Usha Rama College of Engineering and Technology
Electrical and Electronics Engineering
Course Structure (UR23)

FIRST SEMESTER (I-Year)

I- Semester								
S. No	**Course Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Contact Hrs/wk**	**Credits**
1	BS&H	UR23BS101A	Communicative English	2	0	0	2	2
2	BS&H	UR23BS102A	Chemistry	3	0	0	3	3
3	BS&H	UR23BS103	Linear Algebra & Calculus	3	0	0	3	3
4	ES	UR23ES105A	Basic Civil & Mechanical Engineering	3	0	0	3	3
5	ES	UR23ES104A	Introduction to Programming	3	0	0	3	3
6	BS&H	UR23BS111A	Communicative English Lab	0	0	2	2	1
7	BS&H	UR23BS112A	Chemistry Lab	0	0	2	2	1
8	ES	UR23ES113A	Engineering Workshop	0	0	3	3	1.5
9	ES	UR23ES114A	Computer Programming Lab	0	0	3	3	1.5
10	BS&H	UR23BS115A	Health and Wellness, Yoga	-	-	1	1	0.5
Total				**14**	**0**	**11**	**25**	**19.5**

SECOND SEMESTER (I-Year)

II –SEMESTER								
S. No	**Course Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Contact Hrs/wk**	**Credits**
1	BS&H	UR23BS201B	Engineering Physics	3	0	0	3	3
2	BS &H	UR23BS203	Differential Equations & Vector Calculus	3	0	0	3	3
3	ES	UR23BS202B	Basic Electrical and Electronics Engineering	3	0	0	3	3
4	ES	UR23ES205B	Engineering Graphics	1	0	4	5	3
5	ES	UR23ES213B	IT Workshop	0	0	2	2	1
6	PC	UR23PC204B	Electrical Circuit Analysis-I	3	0	0	3	3
7	BS&H	UR23BS211B	Engineering Physics Lab	0	0	2	2	1
8	ES	UR23ES212B	Electrical and Electronics Engineering Workshop	0	0	3	3	1.5
9	PC	UR23BS214B	Electrical Circuits Analysis-I Lab	0	0	3	3	1.5
10	BS&H	UR23BS215B	NSS/NCC/Scouts & Guides/Community Service	-	0	1	1	0.5
TOTAL				13		15	27	18

THIRD SEMESTER (II Year)

S. No	Course Category	Course Code	Course Name	L	T	P	Contact Hrs/wk	C
1	BS	UR23BS301A	Complex Variables& Numerical Methods	3	0	0	3	3
2	HSMC	UR23HS302	Universal human values understanding harmony and Ethical human conduct	2	1	0	2	3
3	ES	UR23ES303A	Electromagnetic Field Theory	3	0	0	3	3
4	PC	UR23PCEE304	Electrical Circuit Analysis-II	3	0	0	3	3
5	PC	UR23PCEE305	DC Machines & Transformers	3	0	0	3	3
6	PC	UR23PCEE311	Electrical Circuit Analysis-II and Simulation Lab	0	0	3	3	1.5
7	PC	UR23PCEE312	DC Machines & Transformers	0	0	3	3	1.5
8	SEC	UR23SEC313A	Data Structures Lab	0	1	2	3	2
TOTAL				13	2	15	27	18
MANDATORY COURSE								
9	Audit Course	UR23MC300	Environmental Science	0	0	0	2	0

FOURTH SEMESTER (II Year)

S. No	Course Category	Course Code	Course Name	L	T	P	Contact Hrs/wk	Credits
1	HSMC	UR23HM401A	Managerial Economics & Financial Analysis	2	0	0	2	2
2	ES	UR23ES402A	Analog Circuits	3	0	0	3	3
3	PC	UR23PCEE403	Power Systems-I	3	0	0	3	3
4	PC	UR23PCEE404	Induction and Synchronous Machines	3	0	0	3	3
5	PC	UR23PCEE405	Control Systems	3	0	0	3	3
6	PC	UR23PCEE411	Induction and Synchronous Machines Lab	0	0	3	3	
7	PC	UR23PCEE412	Control Systems Lab	0	0	3	3	1.5
8	SEC	UR23SEC413A	Python Programming Lab	0	1	2	3	2
9	ES	UR23BS414	Design Thinking	1	0	2	3	2
TOTAL				**15**	**1**	**10**	**26**	**20**
Mandatory Community Service Project Internship Of 8 Weeks Duration During Summer Vacation								

B.Tech – III Semester **COURSE CODE: UR23BS301** **L T P C**
3 0 0 3

COMPLEX VARIABLES & NUMERICAL METHODS

Internal Marks: 30
External Marks:70

Course Objectives:

1. To elucidate the different numerical methods
2. To disseminate the use of different numerical techniques for carrying out numerical integration
3. To familiarize the complex variables
4. To equip the students to solve application problems in their disciplines.

UNIT – I Iterative Methods:
Introduction – Solutions of algebra Secant method – Method of false position method (Simultaneous Equations) **Interpolation:** Newton's forward and backward formulae for interpolation with unequal intervals – Lagrange's interpolation formula

UNIT – II Numerical integration, Solution of ordinary differentials equations by initial conditions:
Trapezoidal rule– Simpson's 1/3 and 3/8th rule-solution of initial value problems by Taylor's series– Picard's method of successive approximations Kutta method (second and fourth order) – Milne's Predictor and Corrector Method

UNIT – III Functions of a complex variable:
Introduction – Continuity – Differentiability Cartesian and polar coordinates Thompson method. Complex integration: Line integral – Generalized integral formula (all without proofs) and problems on above theorems.

UNIT – IV Series expansions and Residue Theorem:
Radius of convergence – Expansion of function in Taylors series, macularian series and Laurent series. Types of Singularities: Isolated – Essential singularities –Pole of order m– Residues –residue theorem (without proof) –evaluation of real integral types $\int_{-\infty}^{\infty} f(x)dx$ and $\int_{c}^{c+2\pi} f(\cos\theta,\sin\theta)d\theta$.

UNIT – V Conformal mapping:
Transformation by e^z , lnz, z^n, sin z , cosz, z+a/z rotation, inversion and bilinear transformation invariance of circles and cross given points .

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics,
2. Micheael Greenberg, Advanced Engineering Mathematics, 2 edition.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10
2. B. V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.
3. Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineering Science, Tata Mc. Graw Hill Education.
4. M. K. Jain, S.R.K. Iyengar Engineering Computation, New Age International Publications.
5. J. W. Brown and R. V. Churchill 9 th edition, Mc-Graw Hill, 2013:

Course Outcomes:

1. Evaluate the approximate different algorithms. A Lagrange's formulae for equal and unequal intervals (L3)
2. Apply numerical integral techniques different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations (L3)
3. Apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic
4. Evaluate the Taylor and Laurent expansions of simple functions, determining the nature of the singularities and calculating residue theorem to evaluate certain integrals (L3)
5. Explain properties of various types of conformal mappings

B.Tech – III Semester **COURSE CODE: UR23HS302** **L T P C**
3 0 0 3

UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT

Internal Marks: 30
External Marks:70

Course Objectives:

1. To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature

Course Topics:

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1 hour duration. Tutorial sessions are used to explore and practice what has been to be proposed during the lecture sessions. The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue

UNIT I Introduction to Value Education
(6 lectures and 3 tutorials for practice session)
Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself
Lecture 3: self-exploration as the Process for Value Education
Lecture4: Continuous Happiness and Prosperity Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity
Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT II Harmony in the Human being
(6 lectures and 3 tutorials for practice session)
Lecture 7: Understanding Human being as the Co body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of needs of self and body.
Lecture 9: The body as an Instrument of the self

Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the bod
Lecture 12: Programme to ensure self-regulation and health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT III Harmony in the Family and Society

(6 lectures and 3 tutorials for practicesession)
Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV Harmony in the Nature/Existence

(4 lectures and 2 tutorials for practice session)
Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co

UNIT V Value based life Implications of the Holistic Understanding

(5lectures and 3 tutorials for practice session)
Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards and processing

Practice Sessions for UNIT I – Introduction to Value Education

PS1 Sharing about Oneself
PS2 Exploring Human Consciousness
PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being

PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self
PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – harmony in the family and society

PS7 Exploring the Feeling of Trust

PS8 Exploring the Feeling of Respect
PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV –Harmony in the Nature/Existence

PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V -Professional Ethics

PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

READINGS: Textbook and Teachers Manual

1.The Textbook R R Gaur, R Asthana, G P Bagaria, Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978

2.The Teacher's Manual R R Gaur, R Asthana, G P Bagaria, Values and Professional Ethics, 978-93-87034-53-2

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharam pal
10. Hind Swaraj or Indian Home Rule- by Mohandas k. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them. Tutorial hours are to be used for practice sessions. While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements. In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-exploration. Scenarios may be used to initiate discussion. The student is encouraged to take up" ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in

performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content Additional content may be offered in separate, higher courses. This course faculty from every teaching department, not exclusively by any one department. Teacher preparation with a minimum exposure to at least one 8 –day faculty Program on Universal Human Values is deemed essential

Online Resources:

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201- Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202- Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203- Harmony%20in%20the%20Family.pdf
4. https://fdpsi.aicteindia.org/UHV%201%20Teaching%20Material/D3- S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDPSI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3- S2A%20Und%20Nature-Existence.pdf
7. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human- values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385

Course Outcomes:

The student will able to understand

1. Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)
2. Identify one's self, and • Apply what they have learnt to their own self in different day real life (L3)
3. Relate human values with human relationship and human society. (L4)
4. Justify the need for universal human values and harmony existence(L5)
5. Develop as socially and ecologically responsible engineers (L3, L6)

B.Tech – III Semester **COURSE CODE: UR23ES303** **L T P C**
3 0 0 3

ELECTROMAGNETIC FIELD THEORY

Internal Marks: 30
External Marks:70

Pre-requisite: Concepts of Differential Equations, Vector Calculus and Electric circuit Analysis.

Course Objectives:

1. To study the production of electric field and potentials due to different configurations of static charges.
2. To study the properties of conductors and dielectrics, calculate the capacitance of different configurations. Understand the concept of conduction and convection current densities.
3. To study the magnetic fields produced by currents in different configurations, application of Ampere's law and the Maxwell's second and third equations.
4. To study the magnetic force and torque through Lorentz force equation in magnetic field environment like conductors and other current loops.
5. To develop the concept of self and mutual inductances and the energy stored.
6. To study time varying and Maxwell's equations in different fourth equation for the induced EMF.

UNIT – I Vector Analysis:
Vector Algebra: Scalars and Vectors, Unit vector, Vector addition and subtraction, Position and distance vectors, Vector multiplication, Components of Coordinate Systems: Rectangular, Cylindrical and Spherical coordinate systems. Vector Calculus: Differential length, Area and Volume. Del operator, Gradient of a scalar, Divergence of a vector and Divergence theorem (definition only). Curl of a v Stroke's theorem (definition only),
Laplacian of a scalar Electrostatics: Coulomb's law and Electric field intensity (EFI) distributions (line and surface charge), Electric flux density, Gauss's law (Maxwell's first equation, $\nabla . D\vec{\iota} = \rho\mu$), Applications of Gauss's law, Electric Potential, Work done moving a point charge in an electrostatic field (second Maxwell's equation for static electric fields,$\nabla \times E\vec{\iota} = 0$), Potential gradient, Laplace's and Poison's equations.

UNIT - II Conductors – Dielectrics and Capacitance:
Behavior of conductor in Electric EFI due to an electric dipole, Torque on an Electric dipole placed in an electric field, Current density-conduction, Ohm's law in point form, Behavior of conductors in an electric field, Polarization, dielectric constant, Boundary conditions between conductor to dielectric, dielectric to dielectric and conductor to free space, Capacitance of parallel plate, coaxial capacitors, Energy stored and density in a static electric field.

UNIT - III Magneto statics, Ampere's Law and Force in magnetic fields:
Biot-Savart's law and its applications viz. Straight current carrying filament, circular, square, rectangle and solenoid current carrying wire Equation ($\nabla . B\vec{\iota} = 0$), Ampere's circuital law and its applications viz. MFI due to an infinite sheet, solenoid, toroidal current carrying conductor, Maxwell's third equation (($\nabla \times \vec{H} = \vec{J}$). Magnetic force, moving charges in a magnetic field current element in a magnetic field, force on a straight and a long current carrying conductor in a magnetic field, force between two straight long, Magnetic dipole, Magnetic torque.

UNIT – IV Self and mutual inductance:
Self and mutual inductance – determination of self-cable and mutual inductance between a straight long wire and a square loop wire in the same plane – Energy stored and energy density in a magnetic field.

UNIT – V Faraday's laws of electromagnetic induction
Maxwell's integral and point forms of Maxwell's equations, statically and dynamically induced EMF, Displacement current, Poynting theorem and Poynting vector.

Textbooks:

1. "Elements of Electromagnetics" by Matthew N O Sadiku, Oxford Publications, 7 th edition, 2018.
2. "Engineering Electromagnetics" by William H. Hayt & John. A. Buck Mc. Graw 7 th Editon.2006.

Reference Books:

1. Introduction to Electro Dynamics" by D J Griffiths, Prentice 2 nd edition.
2. "Electromagnetic Field Theory" by Yaduvir Singh, Pearson India, 1
3. "Fundamentals of Engineering Electromagnetics" by Sunil Bhooshan, Oxford University Press, 2012.
4. Schaum's Outline of Electromagnetics by Joseph A. Edminister, Mahamood Navi, 4 Edition,2014.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/106/108106073/
2. https://nptel.ac.in/courses/117103065

Course Outcomes: At the end of the course, student will be able to,

1. Compute electric fields and potentials using Gauss law/ solve Laplace's or Poisson's equations for various electric charge distributions.
2. Analyse the behavior of conductors in electric fields, electric diploe and the capacitance and energy stored in dielectrics.
3. Calculate the magnetic field intensity due to current c understanding the application of Ampere's law, Maxwell's second and third law.
4. Estimate self and mutual inductances and the energy stored in the magnetic field.

B.Tech – III Semester **COURSE CODE: UR23PCEE30** **L T P C**
3 0 0 3

ELECTRICAL CIRCUIT ANALYSIS-II

Internal Marks: 30
External Marks:70

Pre-requisite: Analysis of DC and Single phase AC Circuits, Concepts of differentiation andintegration.

Course Objectives:

1. To understand three phase circuit
2. To analyse transients in electrical systems
3. To evaluate network parameters of given electrical network
4. To apply Fourier analysis to electrical systems
5. To understand graph theory for circuit analysis and to understand the behavior of filters

UNIT – I Analysis of three phase balanced circuits:
Phase sequence, star and delta connection of sources and loads, relation between line and phase quantities, analysis of balanced three phase circuits, and measurement of active and reactive power.

Analysis of three phase unbalanced circuits:
Loop method, Star-Delta transformation technique, two-wattmeter method for measurement of three phase power.

UNIT – II Laplace transforms :
Definition and Laplace transforms of standard functions– Shifting theorem – Transforms of derivatives and integrals, Inverse Laplace transforms and applications
Transient Analysis: Transient response of R-L, R-C and R-L-C circuits (Series and parallel combinations) for D.C. and sinusoidal excitations – Initial conditions - Solution using differential equation approach and Laplace transform approach.

UNIT – III Network Parameters:
Impedance parameters, Admittance parameters, Hybrid parameters, Transmission (ABCD) parameters, conversion of Parameters from one form to other, Conditions for Reciprocity and Symmetry, Interconnection of Two Port networks in Series, Parallel and Cascaded configurations- problems.

UNIT – IV Analysis of Electric Circuits with Periodic Excitation:
Fourier series and evaluation of Fourier coefficients, Trigonometric and complex Fourier series for periodic waveforms, Application to Electrical Systems – Effective value and average value of non-sinusoidal periodic waveforms, power factor, effect of harmonics

UNIT – V Network synthesis
Introduction, Hurwitz polynomials. Positive real functions, reliazation of RL, RC and LC Functions

Textbooks:

1. Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, 8th Edition McGraw-Hill, 2013
2. Fundamentals of Electric Circuits, Charles K. Alexander, Mathew N. O. Sadiku, 3rd Edition, Tata McGraw-Hill, 2019

Reference Books:

1. Network Analysis, M. E. Van Valkenburg, 3rd Edition, PHI, 2019.
2. Network Theory, N. C. Jagan and C. Lakshminarayana, 1st Edition, B. S. Publications, 2012.
3. Circuits and Networks Analysis and Synthesis, A. Sudhakar, Shyam Mohan S. Palli, 5th Edition, Tata McGraw-Hill, 2017.
4. Engineering Network Analysis and Filter Design (Including Synthesis of One Port Networks)- Durgesh C. Kulshreshtha Gopal G. Bhise, Prem R. Chadha ,Umesh Publications 2012.
5. Circuit Theory: Analysis and Synthesis, A. Chakrabarti, Dhanpat Rai & Co., 2018, 7th Revised Edition.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/117/106/117106108/
2. https://archive.nptel.ac.in/courses/108/105/108105159/

Course Outcomes:

At the end of the course, student will be able to,

1. Analyse the balanced and unbalanced 3 phase circuits for power calculations.
2. Analyse the transient behavior of electrical networks in different domains
3. Estimate various Network parameters.
4. Apply the concept of Fourier series to electrical systems.
5. Analyse the filter circuit for electrical circuits

B.Tech – III Semester **COURSE CODE: UR23PCEE30** **L T P C**
3 0 0 3

DC MACHINES & TRANSFORMERS

Internal Marks:30
External Marks:70

Pre-requisite: Principles of Electromechanical Energy Conversion, Electromagnetic fields and Electrical Circuit Analysis.

Course Objectives:

Students will get exposure to

1. Understand the characteristics and applications of DC Machines.
2. Develop problem solving skills about the starting, speed control and testing of DC Machines.
3. Understand the concepts of efficiency and regulation of a transformer by obtaining equivalent circuit
4. Analyze the performance of single-phase transformers and to understand the connection diagrams of three-phase transformers.

UNIT – I DC Generators

Construction and principle of operation of DC machines – EMF equation for generator – Excitation techniques – characteristics of DC generators –applications of DC Generators, Back-emf and torque equations of DC motor – Armature reaction and commutation

UNIT – II Starting, Speed Control and Testing of DC Machines:

Characteristics of DC motors – losses and efficiency – applications of DC motors. Necessity of a starter – starting by 3-point and 4-point starters – speed control by armature voltage and field current control – testing of DC machines – brake test, Swinburne's test –Hopkinson's test–Field Test.

UNIT – III Single-phase Transformers

Introduction to single-phase Transformers (Construction and principle of operation)– emf equation – operation on no-load and on load –lagging, leading and unity power factors loads –phasor diagrams– equivalent circuit –regulation – losses and efficiency – effect of variation of frequency and supply voltage on losses – all day efficiency.

UNIT –IV Testing of Transformers

Open Circuit and Short Circuit tests – Sumpner's test – separation of losses— Parallel operation with equal and unequal voltage ratios– auto transformer – equivalent circuit – comparison with two winding transformers.

UNIT – V Three-Phase Transformers:

Polyphase connections- Y/Y, Y/Δ, Δ/Y, Δ/Δ, open Δ and Vector groups – third harmonics in phase voltages– Parallel operation–three winding transformers-transients in switching –off load and on load tap changers–Scott connection.

Textbooks:

1. Electrical Machinery by Dr. P S Bimbhra, 7th edition, Khanna Publishers, NewDelhi,1995.
2. Performance and analysis of AC machines by M.G. Say, CBS, 2002.

Reference Books:

1)Electrical Machines by D. P.Kothari, I .J .Nagarth, McGraw Hill Publications, 5th edition

2)Electrical Machinery Fundamentals by Stephen J chapmam McGraw Hill education 2011

3)Generalized of Electrical Machines by Dr.P S Bimbhra ,7th theory edition Khanna Publishers 2021

. **Online Learning Resources:**

1. nptel.ac.in/courses/108/105/108105112
2. nptel.ac.in/courses/108/105/108105155

Course Outcomes:

At the end of the course, the student will be able to,

1. Understand the process of voltage build-up in DC generators and characteristics.
2. Understand the process of torque production, starting and speed control of DC motors and illustrate their characteristics.
3. Obtain the equivalent circuit of single-phase transformer and determine its efficiency & regulation.
4. Analyse various configurations of three-phase transformers

B.Tech – III Semester **COURSE CODE: UR23PCEE311** **L T P C**
0 0 3 1.5

ELECTRICAL CIRCUIT ANALYSIS-II AND SIMULATION LAB

Internal Marks: 30
External Marks:70

Course Objectives:

1. To measure three phase Active and Reactive power
2. To analyze transient behavior of circuits
3. To determine 2-port network parameters
4. To analyze electrical circuits using simulation tools

List of Experiments

Any 10 of the following experiments are to be conducted:

1. Measurement of Active Power and Reactive Power for balanced loads.
2. Measurement of Active Power and Reactive Power for unbalanced loads.
3. Determination of Z and Y parameters.
4. Determination of ABCD and hybrid
5. Verification of Kirchhoff's current law and voltage law using simulation tools.
6. Verification of mesh and nodal analysis using simulation tools.
7. Verification of super position and maximum power transfer theorems using simulation tools.
8. Verification of Reciprocity and Compensation theorems using simulation tools.
9. Verification of Thevenin's and Norton's theorems using simulation tools
10. Verification of series and parallel resonance using simulation tools.
11. Simulation and analysis of transient response of RL, RC and RLC circuits.
12. Verification of self-inductance and mutual inductance by using simulation tools

Course Outcomes:

At the end of the course, student will be able to,

1. Understand the power calculation on three phase circuits.
2. Evaluate the time response of given network.
3. Evaluate two port network parameters.
4. Simulate and Analyse electrical circuits using suitable software.

Note : Minimum 10 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he/she has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

B. Tech – III Semester **COURSE CODE: UR23PCEE312** **L T P C**
0 0 3 1.5

DC MACHINES & TRANSFORMERS LAB

Internal Marks:30
External Marks:70

Course Objectives:

The objectives of this course is

1. To conduct the experiment and plot the characteristics and applications of DC machines.
2. To perform the starting, speed control and testing methods of DC Machines.
3. To determine/Predetermine efficiency and regulation of the transformer through equivalent circuit..

List of Experiments

Any 10 of the following experiments are to be conducted:

1. Speed control of DC shunt motor by Field Current and Armature Voltage Control.
2. Brake test on DC shunt motor- Determination of performance curves.
3. Swinburne's test - Predetermination of efficiencies as DC Generator and Motor.
4. Hopkinson's test on DC shunt Machines.
5. Load test on DC compound generator-Determination of characteristics.
6. Load test on DC shunt generator-Determination of characteristics.
7. Fields test on DC series machines-Determination of efficiency.
8. Brake test on DC compound motor-Determination of performance curves.
9. OC & SC tests on single phase transformer.
10. Sumpner's test on single phase transformer.
11. Scott connection of transformers.
12. Parallel operation of Single-phase Transformers.
13. Separation of core losses of a single-phase transformer.

Online Learning Resources:

1. https://ems-iitr.vlabs.ac.in/List%20of%20experiments.html

Course Outcomes:

At the end of the course, the student will be able to,

1: Demonstrate starting and speed control methods of DC Machines.

2: Apply theoretical concepts in analyzing the performance characteristics of DC Machines

3: Determine the performance characteristics of DC machines using different testingmethods.

4: Determine the performance parameters of single-phase transformer

Note : Minimum 10 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he/she has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted

B.Tech – III Semester **COURSE CODE: UR23SEC313A** **L T P C**
0 1 2 2

DATA STRUCTURES LAB

Internal Marks:30
External Marks:70

Course Objectives:

1. To provide the knowledge of basic data structures and their implementations.
2. To understand importance of data structures in context of writing efficient programs.
3. To develop skills to apply appropriate data structures in problem solving.

UNIT I Introduction to Data Structures:

Definition and importance of Data structures, Abstract data types (ADTs) and its specifications, **Arrays**: Introduction, 1-D, 2-D Arrays, accessing elements of array, Row Major and Column Major storage of Arrays, **Searching Techniques**: Linear & Binary Search, **Sorting Techniques**: Bubble sort, Selection sort, Quick sort.

Sample experiments:

1. Program to find min & max element in an array.
2. Program to implement matrix multiplication.
3. Find an element in given list of sorted elements in an array using Binary search.
4. Implement Selection and Quick sort techniques**.**

UNIT II Linked Lists:

Singly linked lists: representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists.

Sample experiments:

1. Write a program to implement the following operations.
   a. Insert b. Deletion c. Traversal
2. Write a program to store name, roll no, and marks of students in a class using circular double linked list.
3. Write a program to perform addition of given two polynomial expressions using linked list

UNIT III Stacks:

Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list.

Sample experiments:

1. Implement stack operations using
    a. Arrays b. Linked list
2. Convert given infix expression into post fix expression using stacks.
3. Evaluate given post fix expression using stack.
4. Write a program to reverse given linked list using stack.

UNIT IV Queues:

Introduction to queues: properties and operations, Circular queues, implementing queues using arrays and linked lists, Applications of queues scheduling, etc.

Deques: Introduction to deques (double-ended queues), Operations on deques and their applications.

Sample experiments:

1. Implement Queue operations using
    a.Arrays b.Linked list
2. Implement Circular Queue using
    a.Arrays b. Linked list
3. Implement Dequeue using linked list.

UNIT V Trees: Introduction to Trees, Binary trees and traversals, Binary Search Tree – Insertion, Deletion & Traversal

Sample experiments:

Implement binary tree traversals using linked list.

4. Write program to create binary search tree for given list of integers. Perform in-order traversal of the tree. Implement insertion and deletion operations

Textbooks:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, 2008

Reference Books:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders.
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft.
3. Problem Solving with Algorithms and Data Structures by Brad Miller and David Ranum.
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein.
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms" by Robert Sedgewick.

Course Outcomes: At the end of the course, Student will be able to

1. Identify the role of data structures in organizing and accessing data.
2. Design, implement, and apply linked lists for dynamic data storage.
3. Develop applications using stacks and queues
4. Design and implement algorithms for operations on binary trees and trees.
5. Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees

Note1 :

Minimum 10 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he/she has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted

Note 2:

Skill Oriented Course shall carry 100 marks and shall be evaluated through continuous assessments during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity/assignments/viva/mid semester test. The end examination similar to practical examination pattern shall be conducted by the concerned teacher and an expert in the subject nominated by the principal.

B.Tech – III Semester COURSE CODE: UR23MC300 L T P C
0 0 0 0

ENVIRONMENTAL SCIENCE

Internal Marks: 30
End semester marks :70
External Marks: 00

Course Objectives:

1. To make the students to get awareness on environment
2. To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day –day activities of human life
3. To save earth from the inventions by the engineers.

Unit-1 Multidisciplinary Nature of Environmental Studies:
Definition scope and importance- Need for Public Awareness**, Natural Resources** : Renewable and non-renewable resources-natural sources and non associated problems – Forest resources –use and over-studies – explotation, deforestation case studies- Timber extraction – Mining, dams and other effects on forest and tribal people Water resources – Use and over utilization of surface and ground water-flood, drought conflicts over water, dams – benefits and problems –mineral resources exploitation, environmental effects of extracting and using mineral resources, case studies Food resources: World food problems, changes caused by agriculture and overgrazing effects of modern agriculture, fertilizer studies. – pesticide problem ,water logging ,salinity, case studies Energy resources:

UNIT – II Ecosystems:
Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:a.Forest ecosystem.b.Grassland ecosystem c.Desert ecosystem d**.**Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and Its Conservation: Introduction and Definition: genetic, ecosystem diversity – Bio-geographical classification of India – Value of biodiversity consumptive use, Productive use, social, ethical, aesthetic and option values- biodiversity at global, National and local levels- India as a mega-diversity nation-Hot sports of biodiversity- Threats to biodiversity: habitat loss, poaching of wildlife- man wild life conflicts- Endangered and endemic species of India- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

UNIT – III Environmental Pollution:
Definition, Cause, effects and control measures of a**.**Air Pollution b.Water pollution,c. Soil pollution d. Marine pollution e.Noise pollution f.Thermal pollution g.Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution- Pollution case studies, Disaster management-floods, earthquake, cyclone and landslides

UNIT – IV Social Issues and the Environment:

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

UNIT – V Human Population And The Environment:

Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain-

Visit to a local polluted site- Urban/Rural/Industrial/Agricultural- Study of common plants, insects, and birds- river, hill slopes, etc.

Reference Books:

1. Deeksha Dave and E.Sai Baba Reddy, Textbook of Environmental Science,
2. 2/e, Cengage Publications, 2012. 2. M.Anji Reddy, "Textbook of Environmental Sciences and Technology", BS Publication, 2014
3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, 2006. J. Glynn Henry and Gary W. Heinke, Environmental Engineering Sciences and Prentice Hall of India Private limited, 1988

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc23_hs155/preview
2. https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmental-science-part-3-pollution-and resources?index=product&objectID=course-3a6da9f2-d84c-4773-838 -1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science++Part+3%3A+Pollution+and+Resources&source=edX&product_category=courseplacement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental-science
3. http://ecoursesonline.iasri.res.in/Courses/Environmental%20Science- I/Data%20Files/pdf/lec07.pdf

Course Outcomes:

At the end of the course, student will be able to

1. Grasp-multi disciplinary nature of environmental studies and various multi disciplinary nature of environmental studies and various renewable and non-renewable resources.
2. Understand flow and bio geo- chemical cycles and ecological pyramids.
3. Understand various causes of pollution and solid waste management and related preventive measures.
4. Understand the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.
5. Illustrate the causes of population explosion, value education and welfare programs

B.Tech – IV Semester **COURSE CODE: UR23HM401A** **L T P C**
2 0 0 2

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Internal Marks: 30
External Marks:70

Course Objectives:

1. To inculcate the basic knowledge of microeconomics and financial accounting
2. To make the students learn how demand is estimated for different products, input- output relationship for optimizing production and cost
3. To Know the Various types of market structure and pricing methods and strategy
4. To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
5. To provide fundamental skills on accounting and to explain the process of preparing financial statements.

UNIT - I Managerial Economics:

Introduction – Nature, meaning, significance, functions, and advantages. Demand- Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

UNIT – II Production and Cost Analysis:

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least- cost combination– Short run and long run Production Function- Isoquants and Is costs, Cost & Break-Even Analysis - Cost concepts and Cost behaviour- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems).

UNIT – III Business Organizations and Markets:

Introduction – Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Oligopoly-Price-Output Determination - Pricing Methods and Strategies

UNIT - IV Capital budgeting:

Introduction Nature, meaning and significance, types of working capital, Components sources of short term and long term capital-estimating working capital requirements-Capital Budgeting- Features, Proposals, Methods and Evaluation. Projects-pay back method-Accounting Rate of Return(ARR)-net present value(NPV) Internal Rate Return(IRR)Method(sample problems)

UNIT – V Financial Accounting and Analysis:

Introduction – Concepts and Conventions Double-Entry Bookkeeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Introduction to Financial Analysis- Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability

Textbooks:

1. Varshney & Maheswari: Managerial Economics, Sultan Chand.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH.

Reference Books:

1. Ahuja Hl Managerial economics Schand.
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage.

Online Learning Resources:

1. https://www.slideshare.net/123ps/managerial-economics-ppt
2. https://www.slideshare.net/darkyla/business-organizations-19917607
3. https://www.slideshare.net/balarajbl/market-and-classification-of-market
4. https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396
5. https://www.slideshare.net/ashu1983/financial-accounting

Course Outcomes:

1. Define the concepts related to Managerial Economics, financial accounting and management(L2)
2. Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets (L2)
3. Apply the Concept of Production cost and revenues for effective Business decision (L3)
4. Analyze how to invest their capital and maximize returns (L4)
5. Evaluate the capital budgeting techniques. (L5)
6. Develop the accounting statements and evaluate the financial performance of business entity (L5)

B. Tech – IV Semester **COURSE CODE: UR23ES402A** **L T P C**
3 0 0 3

ANALOG CIRCUITS

Internal Marks: 30
External Marks:70

Pre-requisite: Knowledge of electronic components and semiconductor devices, number systems, binary arithmetic, Boolean or switching algebra, and logic gates.

Course Objectives:

1. To acquire the basic knowledge on clippers, clampers & biasing circuits.
2. To determine the h-parameters of a transistor circuit & understand the feedback amplifiers.
3. To know the operation of oscillators and operational amplifier.
4. To understand the applications of operational amplifier.
5. To acquire the knowledge on IC 555 timer and their applications.
6. To know the operation of Analog to Digital Converters and Digital to Analog Converters.

Unit – 1: Diode clipping and clamping circuits:
Diode clippers, clipping at two independent levels, Transfer characteristics of clippers, clamping circuit operation. DC biasing of BJTs: Load lines, Operating Point, Bias Stability, collector to base bias, Self-Bias, Stabilization against variation in V_{BE} and β for the self bias circuit, bias compensation, thermal runway and thermal stability

Unit – II: Small Signals Modelling of BJT:
Analysis of a Transistor Amplifier Circuit using h-parameters, Simplified CE Hybrid Model, Analysis of CE, CC, CB Configuration using Approximate Model, Frequency Response of CE and CC amplifier

Feedback Amplifiers: Classification of Amplifiers, the Feedback Concept, General Characteristics of Negative-Feedback Amplifiers, Effect of Negative Feedback upon Output and input resistances ,voltages –series feedback, current – series feedback, current shunt feedback, voltage shunt feedback

Unit –III : Oscillator Circuits: Barkhausen criterion of oscillation, oscillator operation-C phase shift Oscillator, Wien -Bridge oscillator, Crystal Oscillator

Operational Amplifiers: Introduction, Basic information of Op-Amp, Ideal Operational Amplifier, Block Diagram Representation of Typical Op-Amp, OP-Amps Characteristics: Introduction, DC and AC characteristics, 741 op-amp & its features.

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Unit – IV: OP-AMPS Applications:

Introduction, Basic Op-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I and I to V Converter, Sample and Hold Circuit, Log and Antilog Amplifier, Multiplier and Divider, Differentiator, integrator.

Comparators and Waveform Generators: Introduction, Comparator, Square Wave Generator, Monostable Multivibrator, Triangular Wave Generator, Sine Wave Generators

Unit – V: Timers and Phase Locked Loop:

Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger, PLL block schematic, principles and description of individual blocks, 565 PLL, Applications of VCO (566).

Digital to Analog And Analog to Digital Converters: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A-D Converters – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications

Textbooks:

1. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition, 2003.
2. Electronic Devices and Circuits – David Bell, Oxford, 5thEdition, 2008.
3. Electronic Principles–Malvino, Albert Paul, and David J. Bates, McGraw-Hill/Higher Education, 2007.
4. Operational Amplifiers and Linear Integrated Circuits– Gayakwad R.A, Prentice Hall India, 2002.
5. Operational Amplifiers and Linear Integrated Circuits –Sanjay Sharma, Kataria & Sons, 2ndEdition, 2010.

Online Learning Resources:

1. https://nptel.ac.in/courses/122106025.
2. https://nptel.ac.in/courses/108102112.

Course Outcomes:

At the end of the course, the student will be able to,

1. Analyze diode clipping and clamping circuits. Understand different types of biasing circuits of a transistor.
2. Use small signal modeling for transistor circuit analysis and illustrate the operation of feedback amplifiers.
3. Understand operation of oscillators, operational amplifier and their applications.
4. Use 555 timers in multi-vibrators, Schmitt Trigger and PLL applications.

B.Tech – IV Semester **COURSE CODE:UR23PCEE403** **L T P C**
3 0 0 3

POWER SYSTEMS-I

Internal Marks: 30
External Marks:70

Pre-requisite: Electrical Circuit Analysis

Course Objectives:

1. To study principle of operation of different components of a hydro and thermal power stations.
2. To study principle of operation of different components of a nuclear power stations.
3. To study constructional and operation of different components of an Air and Gas Insulated substations.
4. To study different types of cables and distribution systems.
5. To study different types of load curves and tariffs applicable to consumers.

Unit I:Hydroelectric Power Stations:
Selection of site, general layout of a hydroelectric power plant with brief description of major components and principle of operation

Thermal Power Stations:
Selection of site, general layout of a thermal power plant. Brief description of components: boilers, super heaters, economizers and electrostatic precipitators, steam turbines: impulse and reaction turbines, condensers, feed water circuit, cooling towers and chimney.

Unit II: Nuclear Power Stations:
Location of nuclear power plant, working principle, nuclear fission, nuclear fuels, nuclear chain reaction, nuclear reactor components: moderators, control rods, reflectors and coolants, types of nuclear reactors and brief description of PWR, BWR and FBR. Radiation: radiation hazards and shielding, nuclear waste disposal.

UNIT – III Substations:
Air Insulated Substations – indoor & outdoor substations, substations layouts of 33/11 kV showing the location of all the substation equipment. Bus bar arrangements in the sub- stations: simple arrangements like single bus bar, sectionalized single bus bar, double bus bar with one and two circuit breaker , main and transfer bus bar system with relevant diagrams **Gas Insulated Substations (G S)** – advantages of gas insulated substations, constructional aspects of GIS, comparison of air insulated substations and gas insulated substations.

UNIT – IV underground cables:
Types of cables, construction, types of insulating materials, calculation of insulation resistance, stress in insulation and power factor of cable. Capacitance of single and 3-Core belted Cables. Grading of cables: capacitance grading and intersheath grading.
Distribution Systems: classification of Distribution systems, A.C Distribution, Overhead versus Underground System, connection Schemes of Distribution system ,requirements of distribution systems

UNIT – V Economic Aspects & Tariff:
Economic Aspects – load curve, load duration and integrated load duration curves, discussion on economic aspects: connected load, maximum demand, demand factor, load factor, diversity factor, plant capacity factor and plant use factor, base and peak load plants. Tariff Methods– Costs of generation and their division into fixed, semi-fixed and running costs, desirable characteristics of a tariff method, tariff methods: simple rate, flat rate, block-rate, two-part, three–part, and power factor tariff methods.

Textbooks:

1. S. N. Singh, Electric Power Generation, Transmission and Distribution, PHI Learning Pvt Ltd, New Delhi, 2nd Edition, 2010
2. J.B.Gupta, Transmission and Distribution of Electrical Power, S.K.Kataria and sons,10th Edition, 2012

Reference Books:

1. I.J. Nagarath & D.P. Kothari, Power System Engineering, McGraw-Hill Education, 3rd Edition, 2019.
2. C.L.Wadhwa, Generation, Distribution and Utilization of Electrical Energy, New Age International Publishers, 6th Edition, 2018.
3. V. K. Mehta and Rohit Mehta, Principles of Power , 4th Edition, System, S. Chan 2005.
4. Turan Gonen, Electric Power Distribution System Engineering, McGraw-Hill, 1985.
5. Handbook of switchgear, BHEL, McGraw-Hill Education, 2007.

Online Learning Resources:

1. https://nptel.ac.in/courses/108102047

Course Outcomes: At the end of the course, the student will be able to,

1. Understand the different types of power plants, operation of power plants.
2. Describe the different components of air and gas insulated substations.
3. Discuss the construction of single core and three core cables and describe distribution system configurations.
4. Analyse different economic factors of power generation and tariffs

B.Tech – IV Semester **COURSE CODE: UR23PCEE404** **L T P C**
3 0 0 3

INDUCTION AND SYNCHRONOUS MACHINES

Internal Marks: 30
External Marks: 70

Pre-requisite: Principles of Electromechanical Energy Conversion, Electromagnetic fields and Electrical Circuit Analysis.

Course Objectives:

Students will get exposure to understand the concepts of

1. characteristics, starting and testing methods of Induction Motor
2. torque production and performance of Induction Motor.
3. In determining the performance parameters of Induction Motor.
4. working of synchronous machines

UNIT-I: 3-phase induction motors:
Construction of Squirrel cage and Slipring induction motors– production of rotating magnetic field – principle of operation – rotor EMF and rotor frequency – rotor current and power factor at standstill and during running conditions– rotor power input, rotor copper loss and mechanical power developed and their inter-relationship –equivalent circuit – phasor diagram

UNIT-II: Performance of 3-Phase induction motors:
Torque equation – expressions for maximum torque and starting torque – torque-slip characteristics – double cage and deep bar rotors –No load, Brake test and Blocked rotor tests – circle diagram for predetermination of performance- methods of starting –starting current and torque calculations -speed control of induction motor with V/f control method, rotor resistance control and rotor emf injection technique-crawling and cogging –induction generator operation

UNIT – III: Single Phase Motors:
Single phase induction motors– constructional features – double revolving field theory, Cross field theory – equivalent circuit- starting methods: capacitor start capacitor run, capacitor start induction run, split phase & shaded pole, AC series motor

UNIT – IV: Synchronous Generators
Constructional features of non-salient and salient pole type alternators- armature windings – distributed and concentrated windings – distribution& pitch factors – E.M.F equation – armature reaction – voltage regulation by synchronous impedance method – MMF method and Potier triangle method –two reaction analysis of salient pole machines -methods of synchronization- Slip test – Parallel operation of alternator

UNIT-V: Synchronous Motors:
Synchronous motor principle and theory of operation – Effect of excitation on current and power factor– synchronous condenser –expression for power developed –hunting and its suppression – methods of starting

.

Text Books:

1. Electrical Machinery, Dr. P.S. Bhimbra, Khanna Publishing, 2021, First Edition.
2. Performance and analysis of AC machines by M.G. Say, CBS, 2002.

Reference Books:

1. Electrical machines, D.P. Kothari and I.J. Nagrath, McGraw Hill Education, 2017, Fifth Edition.
2. Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria & Sons, 2007.
3. Electric Machinery, A.E.Fitzgerald, Charles kingsley, Stephen D.Umans, McGraw-Hill, 2020, Seventh edition.

Online Learning Resources:

1. nptel.ac.in/courses/108/105/108105131
2. https://nptel.ac.in/courses/108106072

Course Outcomes:

At the end of the course, the student will be able to,

1. Explain the construction and operation of three-phase induction motor.
2. Analyse the performance of three-phase induction motor.
3. Describe the working of single-phase induction motors.
4. Analyse the performance of Synchronous generators and motors.

B.Tech – IV Semester COURSE CODE: UR23PCEE405 L T P C
3 0 0 3

CONTROL SYSTEMS

Internal Marks: 30
External Marks: 70

Pre-requisite: Basic Engineering Mathematics

Course Objectives:

1. To obtain the mathematical models of physical systems and derive transfer function.
2. To determine the time response of systems and analyse system stability.
3. To analyse system stability using frequency response methods.
4. To design compensators using Bode diagrams.
5. To obtain the mathematical models of physical systems using state space approach and determine the response.

UNIT – I Mathematical Modelling Of Control Systems

Classification of control systems - open loop and closed loop control systems and their differences - Feedback characteristics - transfer function of linear system, differential equations of electrical networks- translational and rotational mechanical systems – transfer function of Armature voltage controlled DC servo motor - block diagram algebra –representation by signal flow graph – reduction using Mason's gain formula.

UNIT – II Time Response Analysis:

Standard test signals – time response of first and second order systems – time domain specifications - steady state errors and error constants - effects of proportional (P) - proportional integral (PI) - proportional derivative (PD) proportional integral derivative (PID) systems **.Stability And Root Locus Technique**: concept of stability – Routh's stability criterion – limitations of Routh's stability, root locus concept – construction of root loci (simple problems) - Effect of addition of Poles and Zeros to the transfer function.

UNIT –III Frequency Response Analysis

Introduction to frequency domain specifications – Bode diagrams – transfer function from the Bode diagram –Polar plots, Nyquist stability criterion- stability analysis using Bode plots (phase margin and gain margin).

UNIT – IV Classical Control Design Techniques

Lag, lead, lag-lead compensators - physical realisation - design of compensators using Bode plots.

UNIT – V State Space Analysis of LTI Systems

Concepts of state - state variables and state model - state space representation of transfer function: Controllable Canonical Form - Observable Canonical Form - Diagonal Canonical Form - diagonalization using linear transformation - solving the time invariant state equations State Transition Matrix and its properties- concepts of controllability and observability.

Text Books:

1. Modern Control Engineering by Kotsuhiko Ogata, Prentice Hall of India, 2010.
2. Automatic control systems by Benjamin C.Kuo, Prentice Hall of India, 2nd Edition.

Reference Books:

1. Control Systems principles and design by M.Gopal, Tata Mc Graw Hill education Pvt Ltd., 4th Edition.
2. Control Systems Engineering by Norman S. Nise, Wiley Publications, 7th edition
3. Control Systems by Manik Dhanesh N, Cengage publications.
4. Control Systems Engineering by I.J.Nagarath and M.Gopal, Newage Publications, 5th Edition.
5. Control Systems Engineering by S.Palani, Tata Mc Graw Hill Publications.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/107/106/107106081/
2. https://archive.nptel.ac.in/courses/108/106/108106098/
3. https://nptelvideos.com/video.php?id=1423&c=14

Course Outcomes:

At the end of the course, the student will be able to,

1. Derive the transfer function of physical systems and determine overall transfer function using block diagram algebra and signal flow graphs.
2. Obtain the time response of first and specifications of second order systems and determine error constants. Analyze the absolute and relative stability of LTI systems using Routh's stability criterion and root locus method.
3. Analyze the stability of LTI systems using frequency response methods.
4. Design Lag, Lead, Lag-Lead compensators to improve system performance using Bode Diagrams.
5. Apply state space analysis concepts to represent physical systems as state models, derive transfer function and determine the response. Understand the concepts of controllability and observability

B.Tech – IV Semester **COURSE CODE: UR23PCEE411**

L	T	P	C
0	0	3	1.5

INDUCTION AND SYNCHRONOUS MACHINES LAB

Internal Marks: 30
External Marks: 70

Course Objectives:

The objectives of this course is

1. To apply the concepts of speed control methods in 3-phase Induction Motor.
2. To experimentally develop circle diagram and obtain equivalent circuit to analyse the performance of 3-phase induction motor
3. To apply the concepts of power factor improvement on single phase Induction Motor
4. To perform various testing methods on alternators for experimentally predetermine the regulation

List of Experiments

Any 10 experiments of the following are required to be conducted

1. Brake test on three phase Induction Motor.
2. Circle diagram of three phase induction motor.
3. Speed control of three phase induction motor by V/f method.
4. Equivalent circuit of single-phase induction motor.
5. Power factor improvement of single-phase induction motor by using capacitors.
6. Load test on single phase induction motor.
7. Regulation of a three -phase alternator by synchronous impedance &MMF methods.
8. Regulation of three-phase alternator by Potier triangle method.
9. V and Inverted V curves of a three-phase synchronous motor.
10. Determination of X_d, X_q& Regulation of a salient pole synchronous generator.
11. Determination of efficiency of three phase alternator by loading with three phase induction motor.
12. Parallel operation of three-phase alternator under no-load and load conditions.
13. Determination of efficiency of a single-phase AC series Motor by conducting Brake test.

Online Learning Resources:

1. https://em-coep.vlabs.ac.in/List%20of%20experiments.html

Course Outcomes:

At the end of the course, the student will be able to,

1. Aanalyse the speed control methods on 3-phase Induction Motor.
2. Evaluate the performance of 3-phase Induction Motor by obtaining the locus diagram and equivalent circuit of 3-phase Induction Motor
3. Adapt the power factor improvement methods for single phase Induction Motor Pre-determine the regulation of 3-phase alternator
4. Determine the synchronous machine reactance of 3-phase alternator

Note :

Minimum 10 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he/she has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted

B.Tech – IV Semester **COURSE CODE:UR23PCEE412**

CONTROL SYSTEMS LAB

L	T	P	C
0	0	3	1.5

Internal Marks: 30
External Marks: 70

Course Objectives:

1. To impart hands on experience to understand the performance of basic control system components such as magnetic amplifiers, D.C. servo motors, A.C. Servo motors and Synchros.
2. To understand time and frequency responses of control systems with and without controllers and compensators.
3. To know the different logic gates and Boolean expressions using PLC.

List of Experiments

Any 10 experiments of the following are required to be conducted

1. Analysis of Second order system in time domain
2. Characteristics of Synchros
3. Effect of P, PD, PI, PID Controller on a second order systems
4. Design of Lag and lead compensation – Magnitude and phase plot
5. Transfer function of DC motor
6. Root locus, Bode Plot and Nyquist Plot for the transfer function of systems up to 5^{th} order using MATLAB.
7. Kalman's test of Controllability and Observability using MAT LAB.
8. Temperature controller using PID
9. Characteristics of magnetic amplifiers
10. Characteristics of AC servo motor
11. Characteristics of DC servo motor
12. Study and verify the truth table of logic gates and simple Boolean expressions using PLC.

Course Outcomes:

At the end of the course, the student will be able to

1. Analyze the performance of magnetic amplifier and DC and AC servo motors and synchro
2. Design of PID controllers and compensators.
3. Evaluate temperature control of an oven using PID controller
4. Determine the transfer function of D.C Motor and examine the truth table of logicgates using PLC.
5. Judge the stability in time and frequency domain and Kalman's test for controllabilityand observability.

Note :

Minimum 10 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he/she has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted

B.Tech – IV Semester **COURSE CODE: UR23SEC413** **L T P C**

0 1 2 2

SKILL ENHANCEMENT COURSE: PYTHON PROGRAMMING LAB

Internal Marks: 30
External Marks: 70

Course Objectives:

The main objectives of the course are to

1. Introduce core programming concepts of Python programming language.
2. Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
3. Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications.

UNIT-I:

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupiter Notebook**.**

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language. **Control Flow Statements**: if statement, if-else statement, if…elif…else, Nested statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
   i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators
5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

UNIT-II: Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments

Sample Experiments:

1. Write a program to define a function with multiple return values.
2. Write a program to define a function using default arguments.
3. Write a program to find the length of the string without using any library functions.

4. Write a program to check if the substring is present in a given string or not.
5. Write a program to perform the given operations on a list:
   i. addition ii. insertion iii. slicing
6. Write a program to perform any 5 built-in functions by taking any list.

UNIT-III:

Dictionaries: Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement. **Tuples and Sets:** Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Dictionaries, Using zip()Function, Sets, Set Methods.

Sample Experiments

7. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
8. Write a program to count the number of vowels in a string (No control flow allowed).
9. Write a program to check if a given key exists in a dictionary or not.
10. Write a program to add a new key-value pair to an existing dictionary.
11. Write a program to sum all the items in a given dictionary.

UNIT-IV:

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os. path Modules**. Object-Oriented Programming:** Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Sample Experiments:

1. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
2. Python program to print each line of a file in reverse order.
3. Python program to compute the number of characters, words and lines in a file.
4. Write a program to create, display, append, insert and reverse the order of the items in the array.
5. Write a program to add, transpose and multiply two matrices.
6. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT-V:

Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:

1. Python program to check whether a JSON string contains complex object or not.
2. Python Program to demonstrate NumPy arrays creation using array () function.
3. Python program to demonstrate use of ndim, shape, size, dtype.
4. Python program to demonstrate basic slicing, integer and Boolean indexing.
5. Python program to find min, max, sum, cumulative sum of array
6. Create a dictionary with at least five keys and each key represent value
7. as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
    a) Apply head () function to the pandas data frame
    b) Perform various data selection operations on Data Frame
8. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

Reference Books:

1.Gowri shankar S, Veena A., Introduction to Python Programming, CRC Press.

2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024

Online Learning Resources/Virtual Labs:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai

Note 1:

Minimum 10 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he/she has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted

Note 2:

Skill Oriented Course shall carry 100 marks and shall be evaluated through continuous assessments during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity/assignments/viva/mid semester test. The end examination similar to practical examination pattern shall be conducted by the concerned teacher and an expert in the subject nominated by the principal.

B.Tech – IV Semester **COURSE CODE: UR23BS414**

L	T	P	C
1	0	2	2

DESIGN THINKING & INNOVATION

Internal Marks: 30
External Marks: 70

Course Objectives: The objectives of the course are to

1. Bring awareness on innovative design and new product development.
2. Explain the basics of design thinking.
3. Familiarize the role of reverse engineering in product development.
4. Train how to identify the needs of society and convert into demand.
5. Introduce product planning and product development process.

UNIT – I Introduction to Design Thinking:

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II Design Thinking Process:

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT-III Innovation:

Art of innovation, Difference between innovation and creativity and innovation in organizations. Creativity to Innovation. Teams of Innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT – IV Product Design:

Problem formation, introduction to product design, Product Strategies, Product value, Product planning, product specifications. Innovation towards product design case studies.

Activity: Importance of modelling, how to set specifications, Explaining their own product design

UNIT – V Design Thinking in Business Process:

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business - Business challenges: Growth, Predictability,

Change, Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.
Activity: How to market our own product, about maintenance, Reliability and plan for startup.

Textbooks:

1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009.

2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.

2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018

3. William lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.

4. Chesbrough.H, The era of open innovation, 2003.

Online Learning Resources:

- https://nptel.ac.in/courses/110/106/110106124/
- https://nptel.ac.in/courses/109/104/109104109/
- https://swayam.gov.in/nd1_noc19_mg60/preview
- https://onlinecourses.nptel.ac.in/noc22_de16/preview

Course Outcomes: At the end of the course, the student will be able to

1. Define the concepts related to design thinking
2. Explain the fundamentals of Design Thinking and innovation.
3. Apply the design thinking techniques for solving problems in various sectors
4. Analyse to work in a multidisciplinary environment
5. Evaluate the value of creativity.

Usha Rama College of Engineering and Technology, Autonomous

Electrical and Electronics Engineering
Course Structure and Syllabus (UR23)

FIRST SEMESTER (I-Year)

I- Semester								
S. No	**Course Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Contact Hrs/wk**	**Credits**
1	BS&H	UR23BS101A	Communicative English	2	0	0	2	2
2	BS&H	UR23BS102A	Chemistry	3	0	0	3	3
3	BS&H	UR23BS103	Linear Algebra & Calculus	3	0	0	3	3
4	ES	UR23ES105A	Basic Civil & Mechanical Engineering	3	0	0	3	3
5	ES	UR23ES104A	Introduction to Programming	3	0	0	3	3
6	BS&H	UR23BS111A	Communicative English Lab	0	0	2	2	1
7	BS&H	UR23BS112A	Chemistry Lab	0	0	2	2	1
8	ES	UR23ES113A	Engineering Workshop	0	0	3	3	1.5
9	ES	UR23ES114A	Computer Programming Lab	0	0	3	3	1.5
10	BS&H	UR23BS115A	Health and Wellness, Yoga	-	-	1	1	0.5
Total				**14**	**0**	**11**	**25**	**19.5**

SECOND SEMESTER (I-Year)

II –SEMESTER								
S. No	**Course Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Contact Hrs/wk**	**Credits**
1	BS&H	UR23BS201B	Engineering Physics	3	0	0	3	3
2	BS &H	UR23BS203	Differential Equations & Vector Calculus	3	0	0	3	3
3	ES	UR23BS202B	Basic Electrical and Electronics Engineering	3	0	0	3	3
4	ES	UR23ES205B	Engineering Graphics	1	0	4	5	3
5	ES	UR23ES213B	IT Workshop	0	0	2	2	1
6	PC	UR23PC204B	Electrical Circuit Analysis-I	3	0	0	3	3
7	BS&H	UR23BS211B	Engineering Physics Lab	0	0	2	2	1
8	ES	UR23ES212B	Electrical and Electronics Engineering Workshop	0	0	3	3	1.5
9	PC	UR23BS214B	Electrical Circuits Analysis-I Lab	0	0	3	3	1.5
10	BS&H	UR23BS215B	NSS/NCC/Scouts & Guides/Community Service	-	0	1	1	0.5
TOTAL				**13**		**15**	**28**	**20.5**

THIRD SEMESTER (II Year)

S. No	Course Category	Course Code	Course Name	L	T	P	Contact Hrs/wk	C
1	BS	UR23BS301A	Complex Variables& Numerical Methods	3	0	0	3	3
2	HSMC	UR23HS302	Universal human values understanding harmony and Ethical human conduct	2	1	0	3	3
3	ES	UR23ES303A	Electromagnetic Field Theory	3	0	0	3	3
4	PC	UR23PCEE304	Electrical Circuit Analysis-II	3	0	0	3	3
5	PC	UR23PCEE305	DC Machines & Transformers	3	0	0	3	3
6	PC	UR23PCEE311	Electrical Circuit Analysis-II and Simulation Lab	0	0	3	3	1.5
7	PC	UR23PCEE312	DC Machines & Transformers	0	0	3	3	1.5
8	SEC	UR23SEC313A	Data Structures Lab	0	1	2	3	2
MANDATORY COURSE								
9	Audit Course	UR23MC300	Environmental Science	0	0	0	2	0
TOTAL				**14**	**2**	**08**	**26**	**20**

FOURTH SEMESTER (II Year)

S. No	Course Category	Course Code	Course Name	L	T	P	Contact Hrs/wk	C
1	HSMC	UR23HM401A	Managerial Economics & Financial Analysis	2	0	0	2	2
2	ES	UR23ES402A	Analog Circuits	3	0	0	3	3
3	PC	UR23PCEE403	Power Systems-I	3	0	0	3	3
4	PC	UR23PCEE404	Induction and Synchronous Machines	3	0	0	3	3
5	PC	UR23PCEE405	Control Systems	3	0	0	3	3
6	PC	UR23PCEE411	Induction and Synchronous Machines Lab	0	0	3	3	1.5
7	PC	UR23PCEE412	Control Systems Lab	0	0	3	3	1.5
8	SEC	UR23SEC413A	Python Programming Lab	0	1	2	3	2
9	ES	UR23BS414	Design Thinking	1	0	2	3	2
TOTAL				**15**	**1**	**10**	**26**	**21**
Mandatory Community Service Project Internship of 8 Weeks Duration During Summer Vacation								

FIFTH SEMESTER (III-Year)

S.No.	Course Category	Course Name	L	T	P	Contact Hrs/wk	C
1	PCC	Power Electronics	3	0	0	3	3
2	PCC	Digital Circuits	3	0	0	3	3
3	PCC	Power Systems-II	3	0	0	3	3
4	PEC	1. Utilization of Electrical Energy 2. Signals and Systems 3. Computer Architecture and Organization	3	0	0	3	3
5	OEC	1. Entrepreneurship Development and Venture Creation 2. Renewable Energy Sources 3.Concepts of Energy Auditing & Management 4.Basics of Control Systems	3	0	0	3	3
6	PCC	Power Electronics Lab	0	0	3	3	1.5
7	PCC	Analog and Digital Circuits Lab	0	0	3	3	1.5
8	SEC	Soft skills	0	1	2	2	2
9	ESC	Tinkering Lab	0	0	2	2	1
10	PROJ	Evaluation of Community Service Internship	-	-	-	2	2
Total			**15**	**1**	**10**	**27**	**23**

SIXTH SEMESTER (III-Year)

S.No.	Course Category	Course Name	L	T	P	Contact Hrs/wk	C
1	PCC	Electrical Measurements and Instrumentation	3	0	0	3	3
2	PCC	Microprocessors and Microcontrollers	3	0	0	3	3
3	PCC	Power System Analysis	3	0	0	3	3
4	PEC	1. Switchgear and Protection 2. Advanced Control Systems 3. Renewable and Distributed Energy Technologies	3	0	0	3	3
5	PEC	1. Electric Drives 2. Digital Signal Processing 3. High Voltage Engineering	3	0	0	3	3
6	OEC	1. Fundamentals of Electric Vehicles 2. Electrical Wiring Estimation and Costing 3. Fundamentals of Utilization of Electrical Energy	3	0	0	3	3
7	PCC	Electrical Measurements and Instrumentation Lab	0	0	3	3	1.5
8	PCC	Microprocessors and Microcontrollers Lab	0	0	3	3	1.5
9	SEC	IoT Applications of Electrical Engineering Lab	0	1	2	2	2
MANDATORY COURSE							
10	MC	Research Methodology	2	0	0	2	-
Total			**20**	**1**	**08**	**28**	**23**

LIST OF OPEN ELECTIVES OFFERED BY THE INSTITUTE

I. Open Electives Offered by EEE department for other branches (Except for EEE branch)

OPEN ELECTIVES

S.No.	Course Category	Title	L	T	P	Contact Hrs/wk	C
1	OEC-I (III-I)	1. Renewable Energy Sources 2. Concepts of Energy Auditing & Management 3. Basics of Control Systems	3	0	0	3	3
2	OEC – II (III-II)	1. Fundamentals of Electric Vehicles 2. Electrical Wiring Estimation and Costing 3. Fundamentals of Utilization of Electrical Energy	3	0	0	3	3
3	OEC – III (IV-I)	1. Battery Management Systems and Charging Stations 2. Concepts of Smart Grid Technologies 3. Electrical Distribution Systems Technology	3	0	0	3	3
4	OEC-IV (IV-I)	1. Concepts of Power Quality 2. Basics of Power Systems Engineering 3. Fundamentals of Electrical Measurements	3	0	0	3	3

II. Open Electives Offered by AI department for other branches (Except for AI branch)

S.No.	Course Category	Title	L	T	P	Contact Hrs/wk	C
1	OEC-I (III-I)	1. Operating Systems 2. Computer Organization and Architecture	3	0	0	3	3
2	OEC – II (III-II)	1. Database Management Systems	3	0	0	3	3
3	OEC – III (IV-I)	1. Object Oriented Programming Through Java	3	0	0	3	3
4	OEC-IV (IV-I)	1. Computer Networks 2. Software Engineering 3. IOT Based Smart System	3	0	0	3	3

III. Open Electives Offered by CSE department for other branches (Except for CSE branch)

OPEN ELECTIVES

S.No.	Course Category	Title	L	T	P	Contact Hrs/wk	C
1	OEC-I (III-I)	1. Principles of Operating Systems 2. Data Structures 3. Computer Organization and Architecture	3	0	0	3	3
2	OEC – II (III-II)	1. Principles of Database Management Systems 2. Python Programming 3. Information Security	3	0	0	3	3
3	OEC – III (IV-I)	1. Object Oriented Programming Through Java 2. AI Tools 3. Data Science	3	0	0	3	3
4	OEC-IV (IV-I)	1. Principles of Software Engineering 2. Computer Networks 3. Machine Learning with Python	3	0	0	3	3

IV. Open Electives Offered by IT department for other branches (Except for IT branch)

OPEN ELECTIVES

S.No.	Course Category	Title	L	T	P	Contact Hrs/wk	C
1	OEC-I (III-I)	1. Principles of Operating Systems 2. Computer Organization and Architecture 3. Python Programming	3	0	0	3	3
2	OEC – II (III-II)	1. Principles of Database Management Systems 2. Web Technologies 3. Advanced Data Structure and Algorithms	3	0	0	3	3
3	OEC – III (IV-I)	1. Object Oriented Programming Through Java 2. Cyber Security 3. Data Science	3	0	0	3	3
4	OEC-IV (IV-I)	1. Principles of Software Engineering 2. Computer Networks 3. Machine Learning	3	0	0	3	3

V. Open Electives Offered by ECE department for other branches (Except for ECE branch)

OPEN ELECTIVES

S.No.	Course Category	Title	L	T	P	Contact Hrs/wk	C
1	OEC-I (III-I)	1. Electronics Devices and Circuits 2. Signals and Systems 3. Probability Theory and Random Variables 4. Consumer Electronics	3	0	0	3	3
2	OEC – II (III-II)	1. Linear and Digital IC Applications 2. Principles of Communications 3. Principles of Signal Processing 4. Microprocessors and Microcontrollers	3	0	0	3	3

VI. Open Electives Offered by ME department for other branches (Except for ME branch)

OPEN ELECTIVES

S.No.	Course Category	Title	L	T	P	Contact Hrs/wk	C
1	OEC-I (III-I)	1. Sustainable Energy Technologies 2. Applied Operations Research 3. Nano Technology 4. Thermal Management of Electronic Systems 5. Industrial Management	3	0	0	3	3
2	OEC – II (III-II)	1. Introduction to Industrial Robotics 2. Entrepreneurship Development and Venture Creation 3. Additive Manufacturing 4. Vehicle Technology 5. Industrial Safety	3	0	0	3	3

B. Tech- V Semester	Course Code:	L T P C
	POWER ELECTRONICS	**3 0 0 3**

Internal Marks: 30
External Marks: 70

Pre-requisite:

Electrical Circuit Analysis, Semiconductor Physics, Control Systems

Course Objectives:

1. To know the characteristics of various power semiconductor devices.
2. To learn the operation of single phase controlled converters and perform harmonic analysis of input current.
3. To learn the operation of three phase controlled converters and AC/AC converters.
4. To learn the operation of different types of DC-DC converters and control techniques.
5. To learn the operation of PWM inverters for voltage control and harmonic mitigation.

UNIT – I

Power Semi-Conductor Devices

Silicon controlled rectifier (SCR) – Two transistor analogy - Static and Dynamic characteristics – Turn ON and Turn OFF Methods - Triggering Methods (R, RC and UJT) – Snubber circuit design. Static and Dynamic Characteristics of Power MOSFET and Power IGBT- Driver Circuit –Line Cmmutstion-Numerical problems.

UNIT – II

Single-phase AC-DC Converters

Single-phase half-wave controlled rectifiers - R and RL loads with and without freewheeling diode - Single-phase fully controlled with R load, RL load and RLE load - Continuous and Discontinuous conduction - Effect of source inductance in Single-phase fully controlled bridge rectifier – Expression for output voltages – Single-phase Semi-Converter with R load-RL load and RLE load – Continuous and Discontinuous conduction - Dual converter and its mode of operation – Effect of source inductance-Numerical Problems.

UNIT – III

Three-phase AC-DC Converters & AC – AC Converters

Three-phase half-wave Rectifier with R and RL load - Three-phase fully controlled rectifier with R and RL load – Continuous conduction operation -Three-phase semi converter with R and RL load - Continuous conduction operation -Expression for Output Voltage - Numerical Problems.

Single-phase AC-AC power control by phase control with R and RL loads - Expression for RMS output voltage – Single-phase step down and step up Cycloconverter - Numerical Problems.

UNIT – IV

DC–DC Converters

Operation of Basic Chopper – Analysis of Buck, Boost and Buck-Boost converters in Continuous Conduction Mode (CCM) and Discontinuous Conduction Modes (DCM) - Output voltage equations using volt-sec balance in CCM & DCM – Expressions for output voltage ripple and inductor current ripple – control techniques – Introduction to PWM control - Numerical Problems.

UNIT – V

DC–AC Converters

Introduction - Single-phase half-bridge and full-bridge inverters with R and RL loads – Phase Displacement Control – PWM with bipolar voltage switching, PWM with unipolar voltage switching - Three-phase square wave inverters - 120^0 conduction and 180^0 conduction modes of operation - Sinusoidal Pulse Width Modulation - Current Source Inverter (CSI) - Numerical Problems.

Text Books:

1. Power Electronics: Converters, Applications and Design by Ned Mohan, Tore M Undeland, William P Robbins, John Wiley & Sons, 2002.
2. Power Electronics: Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2nd edition, 2017.
3. Power Electronics: Essentials & Applications by L.Umanand, Wiley, Pvt. Limited, India, 2009.

Reference Books:

1. Elements of Power Electronics–Philip T.Krein. Oxford University Press; Second edition, 2014.
2. Power Electronics – by P.S.Bhimbra, Khanna Publishers.
3. Thyristorised Power Controllers – by G. K. Dubey, S. R. Doradla, A. Joshi and R. M. K.Sinha, New Age International (P) Limited Publishers, 1996.
4. Power Electronics: by Daniel W.Hart, Mc Graw Hill, 2011.

Online Learning Resources:

1. https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007
2. https://archive.nptel.ac.in/courses/108/101/108101126

Course Outcomes:

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

1. Illustrate the static and dynamic characteristics of SCR, Power-MOSFET and Power-IGBT.
2. Analyse the operation of phase-controlled rectifiers.
3. Analyse the operation of three-phase full–wave converters, AC Voltage Controllers and Cyclo converters.
4. Examine the operation and design of different types of DC-DC converters.
5. Analyse the operation of Square wave inverters and PWM inverters for voltage control.
6. Concept of DC-AC converters

B. Tech- V Semester **Course Code:** **L T P C**

DIGITAL CIRCUITS **3 0 0 3**

Internal Marks: 30
External Marks: 70

Pre-requisite:
Knowledge of electronic components and semiconductor devices, number systems, binary arithmetic, Boolean or switching algebra and logic gates.

Course Objectives:

1. To know the simplification methods of Boolean functions
2. To understand the realization of arithmetic, data routing and memory logic circuits.
3. To know the operation and design of various counters and registers.
4. To understand the analysis and design of synchronous sequential circuits.
5. To understand the basic concepts of digital integrated circuits.

UNIT – I
Combinational Logic Circuits – I
Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, simplification of logic functions using Boolean theorems, NAND and NOR implementations, Karnaugh maps – 3,4,5 variables, Incompletely specified functions (Don‘t care terms), Simplifying Max term equations, Quine-McCluskey minimization technique, General approach to combinational logic design, Look ahead carry adder, Cascading full adders, 4-bit adder-subtractor circuit, BCD adder circuit, Excess 3 adder, Binary comparators.

UNIT – II
Combinational Logic Circuits – II
Decoders, BCD decoders, 7 segment decoder, higher order decoder, multiplexer, higher order multiplexing, de-multiplexers, higher order de-multiplexing, realization of Boolean functions using decoders, multiplexers, encoders, priority encoder, Read only and Read/Write Memories, Programmable ROM, PAL, PLA-Basics structures, programming tables of PROM, PAL, PLA, realization of Boolean functions.

Unit – III
Sequential Logic Circuits
Timing considerations of flip-flops, master-slave flip-flop, edge triggered flip-flops, characteristic equations, flip-flops with reset and clear terminals, excitation tables, conversion from one flip-flop to another flip-flop, design of asynchronous and synchronous counters, design of modulus-N counters, Johnson counter, ring counter, design of registers - buffer register, control buffer register, shift register, bi-directional shift register, universal shift register.

UNIT – IV

Sequential Circuit Design

Mealy and Moore models, State machine notation, Synchronous Sequential circuit analysis, Construction of state diagrams, Analysis of clocked sequential circuits, realization of sequence detector circuit, state reduction and assignments, design procedure.

UNIT – V

Digital Integrated Circuits

Logic levels, propagation delay time, power dissipation, fan-out and fan-in, noise margin, logic families – RTL and DTL Circuits, TTL, Emitter-Coupled Logic, Metal-Oxide Semiconductor, Complementary MOS, CMOS Transmission Gate Circuits.

Text Books:

1. Switching and finite automata theory Zvi. Kohavi, 3rd edition, Cambridge University Press, 2010.
2. M. Morris Mano and M. D. Ciletti, "Digital Design", 4th Edition, Pearson Education,2006.

Reference Books:

1. Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers, 5th Edition, 1992.
2. Switching Theory and Logic Design by A. Anand Kumar,Prentice Hall India Pvt., Limited, Third Edition, 2016.

Online Learning Resources:

1. https://nptel.ac.in/courses/117106086.
2. https://nptel.ac.in/courses/108105113.

Course Outcomes:

At the end of the course, the student will be able to,

1. Use the concepts of Boolean algebra, K-map, tabulation method in minimization of switching functions and able to design the arithmetic combinational circuits.
2. Realize different types of data routing combinational circuits and PLDs.
3. Apply knowledge of flip-flops in designing of registers and counters.
4. Analyze synchronous sequential circuits and apply different methods for the design of synchronous sequential circuits.
5. Understand the logic families in the form of digital integrated circuits.
6. Know the RTL and DTL circuits.

B. Tech- V Semester	Course Code:	L T P C
	POWER SYSTEMS-II	**3 0 0 3**

Internal Marks: 30
External Marks: 70

Pre-requisite:

Power systems-I, Electrical circuit Analysis.

Course Objectives:

1. To understand the concepts of GMD&GMR to compute inductance & capacitance of transmission lines.
2. To distinguish the models of short, medium and long length transmission lines and analyze their performance.
3. To learn the effect of travelling waves on transmission lines with different terminal conditions.
4. To learn the concepts of corona, the factors effecting corona and effects of transmission lines.
5. To design the sag and tension of transmission lines as well as to learn the performance of line insulators.

UNIT–I

Transmission Line Parameters Calculations

Conductor materials – Types of conductors – Calculation of resistance for solid conductors – Calculation of inductance for Single-phase and Three-phase single and double circuit lines– Concept of GMR and GMD–Symmetrical and asymmetrical conductor configuration with and without transposition–Bundled conductors, Skin and Proximity effects.

Calculation of capacitance for 2 wire and 3 wire systems – Effect of ground on capacitance – Capacitance calculations for symmetrical and asymmetrical single and Three-phase single and double circuit lines without and with Bundled conductors.

UNIT–II

Performance Analysis of Transmission Lines

Classification of Transmission Lines – Short, medium, long lines and their model representation –Nominal-T, Nominal-π and A, B, C, D Constants for symmetrical Networks.

Rigorous Solution for long line equations –Representation of Long lines – Equivalent T and Equivalent π network models - Surge Impedance and Surge Impedance Loading of Long Lines - Regulation and efficiency for all types of lines – Ferranti effect.

UNIT – III

Power System Transients

Types of System Transients – Propagation of Surges – Attenuation–Distortion– Reflection and Refraction Coefficients.

Termination of lines with different types of conditions: Open Circuited Line–Short Circuited Line, Line terminated through a resistance and line connected to a cable. Reflection and Refraction at a T-Junction.

UNIT–IV

Corona & Effects of Transmission lines

Description of the phenomenon – Types of Corona - critical voltages and power loss – Advantages and Disadvantages of Corona - Factors affecting corona - Radio Interference.

UNIT–V

Sag and Tension Calculations and Overhead Line Insulators:

Sag and Tension calculations with equal and unequal heights of towers–Effect of Wind and Ice weight on conductor – Stringing chart and sag template and its applications.

Types of Insulators – Voltage distribution in suspension insulators–Calculation of string efficiency and Methods for String efficiency improvement – Capacitance grading and Static Shielding.

Text Books:

1. Electrical Power Systems – by C.L.Wadhwa, New Age International (P) Limited, 1998.
2. Power System Engineering by I.J.Nagarath and D.P.Kothari, Tata McGraw Hill, 3rd Edition, 2019.

Reference Books:

1. Power system Analysis–by John J Grainger William D Stevenson, TMC Companies, 4th edition
2. Power System Analysis and Design by B.R. Gupta, Wheeler Publishing.
3. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S. Bhatnagar A. Chakrabarthy, Dhanpat Rai Co Pvt. Ltd.2016.
4. Electrical Power Systems by P.S.R. Murthy, B.S. Publications, 2017.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/105/108105104
2. https://archive.nptel.ac.in/courses/108/102/108102047

Course Outcomes:

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

1. Calculate parameters of transmission lines for different circuit configurations.
2. Analyze the performance of short, medium and long transmission lines.
3. Analyze the effect of travelling waves on transmission lines.
4. Estimate the effects of corona in transmission lines.
5. Calculate sag and tension of transmission lines and design the line insulators.
6. Modern insulators technology.

B. Tech- V Semester **Course Code:** **L T P C**

3 0 0 3

UTILIZATION OF ELECTRICAL ENERGY

Internal Marks: 30
External Marks: 70

Course Objectives:

1. To understand the operating principles and characteristics of traction motors with respect to speed, temperature, loading conditions.
2. To acquaint with the different types of heating and welding techniques.
3. To study the basic principles of illumination and its measurement.
4. To understand different types of lightning system including design.
5. To understand the basic principle of electric traction including speed–time curves of different traction services.

UNIT – I

Selection of Motors

Choice of motor, type of electric drives, starting and running characteristics–Speed control–Temperature rise–Applications of electric drives–Types of industrial loads–continuous–Intermittent and variable loads–Load equalization.

UNIT – II

Electric Heating

Principle of heating – modes of heat transfer -Advantages and methods of electric heating–Resistance heating- induction heating and dielectric heating – Arc furnaces – Direct and indirect arc furnaces

Electric Welding

Principles of welding – types of welding- Electric welding–Resistance and arc welding–Electric welding equipment–Comparison between AC and DC Welding

UNIT – III

Illumination Fundamentals

Introduction, terms used in illumination–Laws of illumination–Polar curves–Integrating sphere–Lux meter–Discharge lamps, MV and SV lamps – Lumen or flux method of calculation - Sources of light.

UNIT – IV

Various Illumination Methods

Comparison between tungsten filament lamps and fluorescent tubes–Basic principles of light control– Lighting systems – indoor / outdoor lighting Electrical lamps – discharge / arc lamps Sodium Vapour – High Pressure Mercury Vapour lamps- Neon lamps – Fluorescent tubes-Design of lighting and flood lighting–LED lighting Conservation of energy.- illumination calculations.

UNIT – V:

Electric Traction – I

System of electric traction and track electrification– Review of existing electric traction systems in India– Special features of traction motor– Mechanics of train movement–Speed–time curves for different services – Trapezoidal and quadrilateral speed time curves-High speed transportation trains. Modern traction motors.

Electric Traction – II

Calculations of tractive effort– power –Specific energy consumption for given run–Effect of varying acceleration and braking retardation.

Text Books:

1. Utilization of Electric Energy – by E. Openshaw Taylor, Orient Longman.
2. Art & Science of Utilization of electrical Energy – by Partab, Dhanpat Rai & Sons.

Reference Books:

1. Utilization of Electrical Power including Electric drives and Electric traction – by N.V. Suryanarayana, New Age International (P) Limited, Publishers, 1996.
2. Generation, Distribution and Utilization of electrical Energy – by C.L. Wadhwa, New Age International (P) Limited, Publishers, 1997.

Course Outcomes:

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

1. Identify a suitable motor for electric drives and industrial applications
2. Identify most appropriate heating or welding techniques.
3. Understand various level of illuminosity produced by different illuminating sources.
4. Estimate the illumination levels produced by various sources.
5. Determine the speed/time characteristics of different types of tractions.
6. Calculate the tractive effort.

B. Tech- V Semester **Course Code:** **L T P C**

3 0 0 3

SIGNAL AND SYSTEMS

Internal Marks: 30
External Marks: 70

Course Objectives:

1. Know the basics of signals and systems and their classifications.
2. To acquaint use of fourier series and fourier transforms and it's apply. .
3. To study the sampling theorem and solutions.
4. To analyse linear systems and concept of filters.
5. To understand the concept of ROC.

UNIT -I
Introduction to Signals & Systems

Definitions & classifications (continuous/discrete, deterministic/random signals; linear/time-invariant systems). Operations: time- & amplitude-shifting/scaling.

Signal types: complex exponentials, sinusoids, singularity (impulse, step, signum, ramp). Vectors ↔ signals analogy, orthogonal signal spaces, approximation, mean-square error, orthogonal functions.

UNIT -II
Fourier Series & Fourier Transform

Continuous-time periodic signal representation via Fourier series (trigonometric & exponential), Dirichlet's conditions, complex spectrum. Deriving Fourier Transform, transforms of standard/periodic signals, impulse and signum functions. Key properties of Fourier Transform. Introduction to the Hilbert Transform

UNIT- III
Sampling Theorem

Proofs for band-limited signals (graphical & analytical). Sampling types: impulse, natural, flat-top. Reconstruction principles and effects of under-sampling (aliasing). Overview of band-pass sampling.

UNIT -IV
Analysis of Linear Systems

LTI systems: impulse response, convolution (time & frequency domains), transfer function. Filter responses, distortionless conditions, bandwidth analysis, ideal LPF/HPF/BPF. Causality, Poly-Wiener physical realization criterion, bandwidth vs rise-time. Correlation: auto- and

cross-correlation, properties, energy/power spectral density, Parseval's theorem, link between correlation & convolution

UNIT -V

Laplace & Z-Transforms

Review, partial fraction expansion, inverse Laplace, Region of Convergence (ROC) characteristics, transform relationships. **Z-Transform**: discrete-time signal representation, periodicity, definition, ROC, inverse transform, properties, and comparison with Laplace/Fourier domains.

Text Books

1. Signals and Systems By B.P. Lathi, OXFORD
2. Signals and Systems By Oppenheim, Willsky & Nawab, PHI Publisher
3. Signals and Systems By Narayan Iyer & Satya Prasad, CENGAGE Publisher

Reference Books:

1. **Signals & Systems** –by B. Somanathan Nair & S. R. Deepa, S. Chand Publisher

Course Outcomes:

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

1. Understand and classify signals and systems based on key properties.
2. Analyze signals using Fourier series, Fourier and Hilbert transforms.
3. Apply sampling theorem.
4. Analyse linear systems with signals.
5. Use Laplace and Z-transforms for system analysis and stability.
6. Understand the concept of ROC.

B. Tech- V Semester	Course Code:	L	T	P	C
	COMPUTER ARCHITECTURE AND ORGANIZATION	3	0	0	3

Internal Marks: 30
External Marks: 70

Pre-requisite:

Basic knowledge in digital electronics, fundamentals of computers.

Course Objectives:

1. To explain the basic working of a digital computer.
2. To understand the register transfer language and micro operators.
3. To learn various addressing modes supported by the processors.
4. To be familiar with peripheral interfacing with processors.
5. To understand memory hierarchy in computers.

UNIT-I

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input- Output and Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

UNIT-II

Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit. Micro programmed Control: Control Memory, Address Sequencing, Micro program Example, Design of Control Unit.

UNIT-III

Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer(RISC) Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISK Pipeline, Vector Processing, Array Processors.

UNIT-IV

Input/output Organization: Peripheral Devices, I/O interface, Asynchronous data transfer, Modes of transfer, priority Interrupt, Direct memory access, Input-Output

Processor (IOP), Serial Communication.

UNIT-V

Memory Organization: Memory Hierarchy, Main memory, Auxiliary memory, Associate Memory, Cache Memory, and Virtual memory, Memory Management Hardware.

Text Books:

1. Computer System Architecture, M. Morris Mano, Prentice Hall of India Pvt. Ltd., 3rd Edition, Sept. 2008.

References Books:

1. Computer Architecture and Organization, William Stallings, PHI Pvt. Ltd., Eastern Economy Edition, Sixth Edition, 2003.
2. Computer Organization and Architecture, Linda Null, Julia Lobur, Narosa Publications ISBN 81- 7319-609-5
3. Computer System Organization by John. P. Hayes.

Course Outcomes:

At the end of this course, student will be able to:

1. Demonstrate the instruction cycle of a computer.
2. Understand various micro operations and register transfer language.
3. Describe parallel processing and pipelining.
4. Interface different peripherals with processors.
5. Know the advantages of cache and virtual memory.
6. Understand the memory organization techniques.

B. Tech- V Semester **Course Code:** **L T P C**

3 0 0 3

ENTREPRENEURSHIP DEVELOPMENT AND VENTURE CREATION

(OPEN ELECTIVE-I)

Internal Marks: 30
External Marks: 70

Course objective:

1. To develop and strengthen entrepreneurial quality and motivation in students.
2. To impart basic entrepreneurial skills and understandings to run a business efficiently and effectively.

UNIT-I
Entrepreneural Competence
Entrepreneurship concept – Entrepreneurship as a Career – Entrepreneurial Personality - Characteristics of Successful, Entrepreneur – Knowledge and Skills of Entrepreneur.

UNIT-II
Entrepreneural Environment
Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other Support Organisational Services.

UNIT-III
Industrial Polacies
Central and State Government Industrial Policies and Regulations - International Business.

UNIT-IV
Business Plan Preparation
Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product - Ownership - Capital - Budgeting Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria.

UNIT- V
Launching of Small Business
Finance and Human Resource Mobilization Operations Planning - Market and Channel Selection - Growth Strategies - Product Launching – Incubation, Venture capital, IT startups. Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units- Effective Management of small Business.

Text Books:
1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2001.
2. S.S.Khanka, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, 2001.

Reference Books:
1. Mathew Manimala, Entrepreneurship Theory at the Crossroads, Paradigms & Praxis, Biztrantra, 2nd Edition, 2005

2. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill, 1996.
3. P.Saravanavel, Entrepreneurial Development, Ess Pee kay Publishing House, Chennai - 1997.
4. Arya Kumar. Entrepreneurship. Pearson. 2012 5. Donald F Kuratko, T.V Rao. Entrepreneurship: A South Asian perspective. Cengage Learning. 2012

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

1. Encourage Innovation and Creativity
2. Provide Hands-on Learning
3. Impart Skill Development
4. Foster Collaboration and Teamwork
5. Enable Interdisciplinary Learning.
6. Market and Channel Selection.

B. Tech- V Semester **Course Code:** **L T P C**

RENEWABLE ENERGY SOURCES **3 0 0 3**

(OPEN ELECTIVE-I)

Internal Marks: 30
External Marks: 70

Pre-requisite: Basic Electrical Engineering

Course Objectives:

1. To study the solar radiation data, equivalent circuit of PV cell and its I-V & P-V characteristics.
2. To understand the concept of Wind Energy Conversion & its applications.
3. To study the principles of biomass, hydel and geothermal energy.
4. To understand the principles of ocean Thermal Energy Conversion, waves and power associated with it.
5. To study the various chemical energy sources such as fuel cell and hydrogen energy along with their operation and equivalent circuit.

UNIT–I

Solar Energy

Introduction - Renewable Sources - prospects, solar radiation at the Earth Surface - Equivalent circuit of a Photovoltaic (PV) Cell - I-V & P-V Characteristics - Solar Energy Collectors: Flat plate Collectors, concentrating collectors-and Applications: Solar Pond

UNIT–II

Wind Energy

Introduction - basic Principles of Wind Energy Conversion, the nature of Wind - power in the wind - Wind Energy Conversion - basic components of Wind Energy Conversion Systems (WECS) - Classification - Applications.

UNIT–III

Biomass, Hydel and Geothermal Energy

Biomass: Introduction - Biomass conversion technologies- Photosynthesis. Factors affecting Bio digestion.

Hydro plants: Basic working principle – Classification of hydro systems**:** Large, small, micro hydel plants.

Geothermal Energy: Introduction, Geothermal Sources – Applications - operational and Environmental problems.

UNIT–IV

Energy From oceans, Waves & Tides:

Oceans: Introduction - Ocean Thermal Electric Conversion (OTEC) – methods.

Waves: Introduction - Energy and Power from the waves - Wave Energy conversion devices.

Tides: Basic principle of Tide Energy -Components of Tidal Energy.

UNIT–V

Chemical Energy Sources:

Fuel Cells: Introduction - operation of Fuel cell - types of Fuel Cells - Applications.

Hydrogen Energy: Introduction - Methods of Hydrogen production - Storage and Applications

Magneto Hydro Dynamic (MHD) Power generation: Principle of Operation - Types.

Text Books:

1. G.D.Rai, Non-Conventional Energy Sources, Khanna Publications, 2011.
2. John Twidell & Tony Weir, Renewable Energy Sources, Taylor & Francis, 2013.

Reference Books:

1. S.P.Sukhatme & J.K. Nayak, Solar Energy-Principles of Thermal Collection and Storage, TMH, 2011.
2. John Andrews & Nick Jelly, Energy Science- principles, Technologies and Impacts, Oxford, 2nd edition, 2013.
3. Shoba Nath Singh, Non- Conventional Energy Resources, Pearson Publications, 2015.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/103/103/103103206
2. https://archive.nptel.ac.in/courses/103/107/103107157

Course Outcomes:

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

1. Analyze solar radiation data, extra-terrestrial radiation, radiation on earth's surface and solar Energy Storage.
2. Illustrate the components of wind energy systems.
3. Illustrate the working of biomass, hydel plants and Geothermal plants.
4. Demonstrate the principle of Energy production from OTEC, Tidal
5. Evaluate the concept and working of Fuel cells.
6. The concept and working of MHD power generation.

B. Tech- V Semester **Course Code:** **L T P C**

CONCEPTS OF ENERGY AUDITING & MANAGEMENT **3 0 0 3**

(OPEN ELECTIVE-I)

Pre-requisite:

Basics of Conservation of Electrical Energy

Course Objectives:

1. To understand basic concepts of Energy Audit & various Energy conservation schemes.
2. To design energy an energy management program.
3. To understand concept of Energy Efficient Motors and lighting control efficiencies.
4. To estimate/calculate power factor of systems and propose suitable compensation techniques.
5. To calculate life cycle costing analysis and return on investment on energy efficient technologies.

UNIT–I

Basic Principles of Energy Audit

Energy audit- definitions - concept - types of Energy audit - energy index - cost index - pie charts - Sankey diagrams and load profiles - Energy conservation schemes- Energy audit of industries- energy saving potential - energy audit of process industry, thermal power station - building energy audit - Conservation of Energy Building Codes (ECBC-2017)

UNIT–II

Energy Management

Principles of energy management - organizing energy management program - initiating - planning - controlling - promoting - monitoring - reporting. Energy manager - qualities and functions - language - Questionnaire – check list for top management.

UNIT–III

Energy Efficient Motors and Lighting

Energy efficient motors - factors affecting efficiency - loss distribution - constructional details - characteristics – variable speed - RMS - voltage variation-voltage unbalance-over motoring-motor energy audit. lighting system design and practice - lighting control - lighting energy audit.

UNIT–IV

Power Factor Improvement and Energy Instruments

Power factor – methods of improvement - location of capacitors - Power factor with non-linear loads - effect of harmonics on power factor - power factor motor controllers – Energy

Instruments- watt meter - data loggers - thermocouples - pyrometers - lux meters - tongue testers.

UNIT–V

Economic Aspects and their Computation

Economics Analysis depreciation Methods - time value of money - rate of return - present worth method - replacement analysis - lifecycle costing analysis – Energy efficient motors. Calculation of simple payback method - net present value method- Power factor correction - lighting – Applications of life cycle costing analysis - return on investment.

Text Books:

1. Energy management by W.R.Murphy & G.Mckay Butter worth - Heinemann publications - 1982.
2. Energy management hand book by W.CTurner - John wiley and sons - 1982.

Reference Books:

1. Energy efficient electric motors by John.C.Andreas - Marcel Dekker Inc Ltd-2nd edition - 1995
2. Energy management by Paul o' Callaghan - Mc-graw Hill Book company-1st edition - 1998
3. Energy management and good lighting practice : fuel efficiency- booklet12-EEO

Online Learning Resources:

1. https://nptel.ac.in/courses/108106022
2. https://archive.nptel.ac.in/courses/108/106/108106022

Course Outcomes:

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

1. Understand the principles of energy audit along with various Energy related terminologies.
2. Asses the role of Energy Manager and Energy Management program.
3. Design a energy efficient motors and good lighting system.
4. Analyse the methods to improve the power factor and identify the energy instruments for various real time applications.
5. Evaluate the computational techniques with regard to economic aspects.
6. Know computation process.

B Tech -V Semester **URSE CODE:** **L T P C**
3 0 0 3

BASICS OF CONTROL SYSTEMS

Internal Marks: 30
External Marks: 70

Course Objectives:

1. To learn the mathematical modeling of physical systems and to use block diagram algebra and signal flow graph to determine overall transfer function.
2. To analyze the time response of first and second order systems and improvement of performance by proportional plus derivative and proportional plus integral controllers.
3. To investigate the stability of closed loop systems using Routh's stability criterion and the analysis by root locus method.
4. To present the Frequency Response approaches for the analysis of linear time invariant (LTI) systems using Bode plots, polar plots and Nyquist stability criterion.
5. To discuss basic aspects of design and compensation of linear control systems using Bode plots.

UNIT – I
Mathematical Modeling of Control Systems
Open Loop and closed loop control systems and their differences, Classification of control systems, transfer function of linear system, Differential equations of electrical networks, Translational and Rotational mechanical systems, Block diagram algebra – Signal flow graph - Reduction using Mason's gain formula.

UNIT-II
Time Response Analysis
Standard test signals - Time response of first order systems –Time response of second order systems - Time domain specifications - Steady state errors and error constants –PID controllers.
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UNIT – III
Stability and Rootlocus Technique
The concept of stability – Routh's stability criterion –limitations of Routh's stability – The root locus concept - construction of root loci (Simple problems).

UNIT–IV
Frequency Response Analysis
Introduction, Frequency domain specifications-Bode plot diagrams- Phase margin and Gain margin-Stability Analysis from Bode Plots, Polar Plots, Nyquist Stability criterion.

UNIT–V
State Space Analysis of Continuous Systems
Concepts of state, state variables and state model, state space representation of transfer function, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability.

Text Books:
1. Modern Control Engineering, Kotsuhiko Ogata, 4th edition, Prentice Hall of India.
2. Automatic control systems, Benjamin C.Kuo, Prentice Hall of India, 2nd Edition.

3. Control Systems Engineering, Norman S.Nise, 6th edition, Wiley publication.

Reference Books:

1. Control Systems, Manik Dhanesh N, 3rd edition, Cengage publications.
2. Control Systems principles and design, M.Gopal, Tata McGraw Hill education Pvt Ltd., 4th Edition.
3. Control Systems Engineering, S.Palani, 4th edition, Tata McGraw Hill Publications.

Course Outcomes:

1. Ability to derive the transfer function of physical systems and determination of overall transfer function using block diagram algebra and signal flow graphs.
2. Capability to determine time response specifications of second order systems and to determine error constants.
3. Acquires the skill to analyze absolute and relative stability of LTI systems using Routh's stability criterion and the root locus method.
4. Capable to analyze the stability of LTI systems using frequency response methods.
5. Ability to represent physical systems as state models and determine the response. Understanding the concepts of controllability and observability.
6. Understand the state space logic.

B. Tech- V Semester **Course Code:** **L T P C**

POWER ELECTRONICS LAB **0 0 3 1.5**

Internal Marks: 30
External Marks: 70

Course Objectives:

1. To learn the characteristics of various power electronic devices and analyze firing circuits and commutation circuits of SCR.
2. To analyze the performance of single–phase and three–phase full–wave bridge converters with both resistive and inductive loads.
3. To understand the operation of AC voltage regulator with resistive and inductive loads.
4. To understand the working of Buck converter and Boost converter.
5. To understand the working of single-phase & three-phase inverters.

Any 10 of the Following Experiments are to be conducted

1. Characteristics of SCR - Power MOSFET & Power IGBT.
2. R, RC & UJT firing circuits for SCR.
3. Single -Phase semi-converter with R & RL loads.
4. Single -Phase full-converter with R & RL loads.
5. Three- Phase full-converter with R & RL loads.
6. Single-phase dual converter in circulating current & non circulating current mode of operation.
7. Single-Phase AC Voltage Regulator with R & RL Loads.
8. Single-phase step down Cycloconverter with R & RL Loads.
9. Boost converter in Continuous Conduction Mode operation.
10. Buck converter in Continuous Conduction Mode operation.
11. Single -Phase square wave bridge inverter with R & RL Loads.
12. Single - Phase PWM inverter.
13. Three-phase bridge inverter with 120^0 and 180^0 conduction mode.
14. SPWM control of Three-phase bridge inverter

Course outcomes:

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

1. Analyse characteristics of various power electronic devices and design firing circuits for SCR.
2. Analyse the performance of single–phase dual, three–phase full–wave bridge converters and dual converter with both resistive and inductive loads.
3. Examine the operation of Single-phase AC voltage regulator and Cyclo

converter with resistive and inductive loads.

4. Differentiate the working and control of Buck converter and Boost converter.
5. Differentiate the working & control of Square wave inverter and PWM inverter.
6. Three phase bridge inverter.

Note:

Minimum 10 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the students fails to get eligibility for semester end exams in the current semester, he/ she has to take the permission of HOD and complete the required number of experiments and appear for semester end exams as and when conducted.

B. Tech- V Semester **Course Code:** **L T P C**

ANALOG AND DIGITAL CIRCUITS LAB 0 0 3 1.5

Internal Marks: 30
External Marks: 70

Course Objectives:

To impart knowledge on

1. Analysis of transistor amplifiers
2. Analysis of feedback amplifiers and oscillators
3. Realization of digital circuits such data routing, registers and counters.

Any 5 of the Following Experiments are to be conducted from each PART.

PART-A

1. Analysis of clipper and clamper circuits.
2. Analysis of self-bias to a transistor.
3. Analysis of voltage series and current series feedback amplifiers.
4. Analysis of Wien Bridge oscillator and RC-phase shift oscillator.
5. Analysis of Integrator and Differentiator Circuits using IC 741.
6. Analysis of Monostable and Astable multivibrator operation using IC 555 Timer.
7. Analysis of Schmitt Trigger Circuits using IC 741 and IC 555.
8. Verify the PLL characteristics using IC 565.
9. Analysis of 8 bit A to D and D to A circuits

PART-B

1. Design of Full adder and Full Subtractor using logic gates.
2. Realization of parallel adder/subtractor using IC 7483.
3. Implementation of 3 to 8 line decoder using logic gates and IC 7445.
4. Implementation of 8 to 1 multiplexer using logic gates and IC 74151.
5. Verify the operation of master-slave JK flip-flop using IC7476.
6. Realization of the following shift registers using IC7495.
    a) SISO
    b) SIPO
    c) PISO
    d) PIPO
7. Implementation ofMod-10 ripples counter using flip-flops and IC 7490.
8. Implementation of Mod-8 synchronous up/down counters using flip-flops.
9. Implementation of 4 bit Ring Counter and Johnson Counter using D flip-flops/J-K flip-flops.

Course Outcomes:

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

1. Understand Clipper and clamper circuits.
2. Know Wien Bridge oscillator and RC-phase shift oscillator.

3. Design of Full adder and Full Subtractor using logic gates.
4. Implementation of 3 to 8 line decoder using logic gates and IC 7445.
5. Verify the operation of master-slave JK flip-flop using IC7476.
6. Implementation of 4 bit Ring Counter

Note:

Minimum 10 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the students fails to get eligibility for semester end exams in the current semester, he/ she has to take the permission of HOD and complete the required number of experiments and appear for semester end exams as and when conducted.

B. Tech- V Semester **Course Code:** **L T P C**

SOFT SKILLS **0 1 2 2**

(SKILL ENHANCEMENT COURSE)

Internal Marks: 30

External Marks: 70

Course Objectives:

1. To Develop effective communication skills (spoken and written).
2. To Develop effective presentation skills.
3. To make the engineering students aware of the importance, the role and the content of soft skills through instruction, knowledge acquisition, demonstration and practice.

TOPICS:

1. Group Discussion–dynamics of group discussion, Lateral thinking, Brain storming.

2. Interview Skills– concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele and video- conferencing.

3. Meetings-making meeting effective, chairing a meeting, decision-making, Seeking opinions, interrupting and handling interruptions, clarifications, closure, Negotiation skills.

4. Listening comprehension – Achieving ability to comprehend material delivered at relatively fast speed; comprehending spoken material in Standard Indian English, British English, and American English.

5. Cross-Cultural Communication / Non-Verbal Communication, Problems of Language, Lack of Language equivalency/ difficulties in using English.

6. Vocabulary building, Creativity in using Advertisements, Case Studies etc.

7. Personality Development: Decision-Making, Problem Solving, Goal Setting, Time Management & Positive Thinking.

8. Resume writing –structure and presentation, planning, defining the career objective.

9.Writing Skills–Letter writing, Email etiquette; Essays for competitive examinations, Analyzing newspaper articles.

10.Technical Report Writing/Project Proposals–Types of formats and styles, Subject matter–organization, clarity,

11. Coherence and style, planning, data-collection, tools, analysis.-Progress and Project Reports.

Reference Books:

1. M.Ashraf Rizvi, "Effective Technical Communication", Tata McGraw-Hill Publishing Company Ltd.2005.

2. Andrea J.Ruther ford, "Basic Communication Skills for Technology" 2nd Edition, Pearson Education,2007.

3. Meenakshi Raman & Sangeeta Sharma, "Technical Communication", Oxford University Press, 2011.

4. DELTA'skey to the Next Generation TOEFL Test, "Advanced Skill Practice," New Age

Course Outcomes:

Student will be able to:

1. Communicate effectively through verbal/oral communication and improve the listening.
2. Write precise briefs or reports and technical documents.
3. Participate in group discussion / meetings / interviews and prepare and deliver presentations.
4. Become more effective individual through goal/target setting.
5. Become self motivated and practicing creative thinking
6. Learn technical report writing.

Note 1:

Minimum 10 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the students fails to get eligibility for semester end exams in the current semester, he/ she has to take the permission of HOD and complete the required number of experiments and appear for semester end exams as and when conducted.

Note 2:

Skill oriented course shall carry 100 marks and shall be evaluated through continuous assessment during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the class/ laboratory shall be evaluated for 30marks by the concerned teacher based on the regularity/ assignments/ viva/ mid semester test. The end examination similar to practical examination pattern shall be conducted by the concerned teacher and an expert in the subject nominated by the principal.

B. Tech- V Semester	Course Code:	L	T	P	C
	TINKERING LAB	0	0	2	1

(ENGINEERING SCIENCE COURSE)

Internal Marks: 30
External Marks: 70

The aim of tinkering lab for engineering students is to provide a hands-on learning environment where students can explore, experiment, and innovate by building and testing prototypes. These labs are designed to demonstrate practical skills that complement theoretical knowledge.

Course Objectives: To

1. Encourage Innovation and Creativity
2. Provide Hands-on Learning
3. Impart Skill Development
4. Foster Collaboration and Teamwork
5. Enable Interdisciplinary Learning
6. Impart Problem-Solving mind-set
7. Prepare for Industry and Entrepreneurship

These labs bridge the gap between academia and industry, providing students with the practical experience. Some students may also develop entrepreneurial skills, potentially leading to start-ups or innovation-driven careers. Tinkering labs aim to cultivate the next generation of engineers by giving them the tools, space, and mind-set to experiment, innovate, and solve real-world challenges.

List of Experiments:

1) Make your own parallel and series circuits using breadboard for any application of your choice.
2) Demonstrate a traffic light circuit using breadboard.
3) Build and demonstrate automatic Street Light using LDR.
4) Simulate the Arduino LED blinking activity in Tinkercad.
5) Build and demonstrate an Arduino LED blinking activity using Arduino IDE.
6) Interfacing IR Sensor and Servo Motor with Arduino.
7) Blink LED using ESP32.
8) LDR Interfacing with ESP32.
9) Control an LED using Mobile App.
10) Design and 3D print a Walking Robot
11) Design and 3D Print a Rocket.
12) Build a live soil moisture monitoring project, and monitor soil moisture levels of a remote plan in your computer dashboard.
13) Demonstrate all the steps in design thinking to redesign a motor bike.

Students need to refer to the following links:

1) https://aim.gov.in/pdf/equipment-manual-pdf.pdf
2) https://atl.aim.gov.in/ATL-Equipment-Manual/
3) https://aim.gov.in/pdf/Level-1.pdf
4) https://aim.gov.in/pdf/Level-2.pdf
5) https://aim.gov.in/pdf/Level-3.pdf

Course Outcomes:

The students will be able to

1. Experiment real-world challenges.
2. Innovate real-world challenges.
3. Solve the real-world challenges.
4. Explore mini project
5. Practice component connection.
6. Build optimized solution for various technical issues.

Note:

Minimum 10 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the students fails to get eligibility for semester end exams in the current semester, he/ she has to take the permission of HOD and complete the required number of experiments and appear for semester end exams as and when conducted.

B. Tech- V Semester **Course Code:** **L T P C**

EVALUATION OF COMMUNITY SERVICE INTERNSHIP 0 0 0 2

Internal Marks: 00
External Marks: 100

Course Objectives

Community Service Project should be an integral part of the curriculum.

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of the society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

IMPLEMENTATION OF COMMUNITY SERVICE PROJECT

Every student should put in a minimum of 180 hours for the Community Service Project during the summer vacation. Each class/section should be assigned with a mentor. The mentor should be a faculty member.

- 2 Credits to be allocated for Community Service Project within the Choice Based Credit System (CBCS).
- The 180 hours of Community Service Project could be done in different areas.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc.
- A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded.
- The log book has to be countersigned by the concerned mentor/faculty in charge.
- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programmes of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.

- Attendance requirements are as per the norms of the college/ JNTUK University.

EVALUATION METHODOLOGY:

- The faculty member will act as a faculty-mentor for the group and is in-charge for the learning activities of the students and also for the comprehensive and continuous assessment of the students.
- The assessment is to be conducted for 100 marks.
- The number of credits assigned is 2.
- Later as per the present practice the marks are converted into grades and grade points to include finally in the SGPA and CGPA.

  The weightings shall be:
  Project Log 20%
  Project Implementation 30%
  Project report 25%,
  Presentation 25%
- Each student is required to maintain an individual logbook, where he/she is supposed to record day to day activities.
- The project log is assessed on an individual basis, thus allowing for individual members within groups to be assessed this way.
- The assessment will take into consideration the individual student's involvement in the assigned work.

While assessing the student's performance, using the student's project log, the following should be taken into account -

a. The individual student's effort and commitment.
b. The originality and quality of the work produced by the individual student.
c. The student's integration and co-operation with the work assigned.
d. The completeness of the logbook.

The assessment for the Community Service Project implementation shall include the following components and based on the entries of Project Log and Project Report:

a. Orientation to the community development
b. Conducting a baseline assessment of development needs
c. Number and Quality of Awareness Programmes organized on beneficiary programmes and improvement in quality of life, environment and social consciousness, motivation and leadership, personality development, etc.
d. Number and Quality of Intervention Programmes (Prevention or promotion programs that aim to promote behavioural change in defined community contexts to address social problems) organised.
e. Follow-up Programmes suggested (Referral Services, Bringing Community Participation)
f. Developing short and mid-term action plans in consultation with local leadership and local government officers.

The **Project Report** shall be prepared as per the guidelines given in the Model Project Report.
The **Project Presentation** is to be made by the student after he/she reports back to the College.
The components for assessment are –

a. assessing the involvement in the project
b. presentation skills
c. final outcome of the project as evinced by the student.

There shall be no internal marks for Community service Project. A student shall

secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the College. The guidelines for community service project are given separately.

The candidate shall submit the comprehensive report to the department. The report will be evaluated for 100 marks by the Review Committee consisting of Head of the department, community service project coordinator/mentor and one senior faculty member of the department.

B. Tech- VI Semester **Course Code:**

L	T	P	C
3	0	0	3

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

Internal Marks: 30

External Marks: 70

Course Objectives:

1. To understand and analyze the factors that effect the various measuring units.
2. To choose the appropriate meters for measuring of voltage, current, power, power factor and energy qualities and understand the concept of standardization.
3. Describe the operating principle of AC & DC bridges for measurement of resistance, inductance and capacitance.
4. To understand the concept of the transducer and their effectiveness in converting from one form to the other form for the ease of calculating and measuring purposes.
5. To understand the operating principles of basic building blocks of digital systems, record and display units.

UNIT - I

Analog Ammeter and Voltmeters

Classification – deflecting, control and damping torques – PMMC, moving iron type and electrostatic instruments – Construction – Torque equation – Range extension – Errors and compensations – advantages and disadvantages. Instrument transformers: Current Transformer and Potential Transformer – Ratio and phase angle errors–Numerical Problems.

UNIT - II

Analog Wattmeters and Power Factor Meters

Electrodynamometer type wattmeter (LPF and UPF) – Power factor meters: Dynamometer and M.I type (Single phase and Three phase) – Construction – torque equation – advantages and disadvantages. Potentiometers: Principle and operation of D.C Crompton's potentiometer – AC Potentiometer (Polar and coordinate types) - Numerical Problems.

UNIT - III

Measurements of Electrical parameters

DC Bridges: Method of measuring low, medium and high resistance –Wheat stone's bridge for measuring medium resistance– Kelvin's double bridge for measuring low resistance – Loss of charge method for measurement of high resistance – Megger – measurement of earth resistance – Numerical Problems.

AC Bridges: Measurement of inductance and quality factor – Maxwell's bridge –

– Anderson's bridge. Measurement of capacitance and loss angle – Desauty's bridge – Schering Bridge – Wien's bridge –Numerical Problems.

UNIT - IV

Transducers

Definition – Classification – Resistive, Inductive and Capacitive Transducer – LVDT – Strain Gauge – Thermistors – Thermocouples – Piezo electric and Photo Diode Transducers.

UNIT - V

Digital meters

Digital Voltmeters – Successive approximation DVM – Ramp type DVM and Integrating type DVM – Digital frequency meter – Digital multimeter – Digital tachometer – Digital Energy Meter – CRO – measurement of phase difference and Frequency using lissajious patterns.

Text Books:

1. Electrical Measurements and measuring Instruments by E.W. Golding and F.C.Widdis - 5th Edition - Wheeler Publishing.
2. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper - PHI - 5th Edition - 2002.

Reference Books:

1. Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co. Publications - 19th revised edition - 2011.
2. Electrical and Electronic Measurements and instrumentation by R.K.Rajput - S.Chand - 3rd edition.
3. Electrical Measurements by Buckingham and Price - Prentice – Hall
4. Electrical Measurements by Forest K. Harris. John Wiley and Sons

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/105/108105153

Course Outcomes:

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

1. Know the construction and working of various types of analog instruments.
2. Describe the construction and working of wattmeter and power factor meters
3. Know the construction and working various bridges for the measurement resistance inductance and capacitance
4. Know the operational concepts of various transducers.
5. Know the construction and operation digital meters.
6. Understand Successive approximation DVM.

B. Tech- VI Semester **Course Code:**

L	T	P	C
3	0	0	3

MICROPROCESSORS AND MICROCONTROLLERS

Internal Marks: 30
External Marks: 70

Pre-requisite:

Basic knowledge in digital electronics, fundamentals of computers.

Course Objectives:

1. To understand the organization and architecture of Microprocessor
2. To understand addressing modes to access memory
3. To understand 8051 micro controller architecture
4. To understand the programming principles for 8086 and 8051
5. To understand the interfacing of Microprocessor with I/O as well as other devices

UNIT - I

Introduction to Microprocessor Architecture

Introduction and evolution of Microprocessors – Architecture of 8086 – Memory Organization of 8086 – Register Organization of 8086– Introduction to 80286 - 80386 - 80486 and Pentium (brief description about architectural advancements only).

UNIT - II

Minimum and Maximum Mode Operations

Instruction sets of 8086 - Addressing modes – Assembler directives –Simple Programs-General bus operation of 8086 – Minimum and Maximum mode operations of 8086 – 8086 Control signal interfacing – Read and write cycle timing diagrams.

UNIT - III

Microprocessors I/O interfacing

8255 PPI– Architecture of 8255–Modes of operation– Interfacing I/O devices to 8086 using 8255–Interfacing A to D converters– Interfacing D to A converters– Stepper motor interfacing– Static memory interfacing with 8086 – Architecture and interfacing of DMA controller (8257).

UNIT - IV

8051 Microcontroller

Overview of 8051 Microcontroller – Architecture– Memory Organization – Register set – Instruction set – Simple Programs - I/O ports and Interrupts – Timers and Counters – Serial Communication – Interfacing of peripherals.

UNIT - V

PIC Architecture

Block diagram of basic PIC 18 micro controller – registers I/O ports – Programming in C for PIC: Data types - I/O programming - logical operations - data conversion.

Text Books:

1. Ray and Burchandi - "Advanced Microprocessors and Interfacing"- Tata McGraw–Hill - 3rd edition - 2006.
2. Kenneth J Ayala - "The 8051 Microcontroller Architecture- Programming and Applications" - Thomson Publishers - 2nd Edition.
3. PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18 - - Muhammad Ali Mazidi - Rolind D.Mckinay - Danny causey -Pearson Publisher 21st Impression.

Reference Books:

1. Microprocessors and Interfacing - Douglas V Hall - Mc–Graw Hill - 2nd Edition.
2. R.S. Kaler - "A Text book of Microprocessors and Micro Controllers" - I.K. International Publishing House Pvt. Ltd.
3. Ajay V. Deshmukh - "Microcontrollers – Theory and Applications" - Tata McGraw–Hill Companies –2005.
4. Ajit Pal - "Microcontrollers – Principles and Applications" - PHI Learning Pvt Ltd - 2011.

Course Outcomes:

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

1. Know the concepts of the Microprocessor capability in general and explore the evaluation of microprocessors.
2. Analyse the instruction sets - addressing modes - minimum and maximum modes operations of 8086 Microprocessors
3. Analyse the Microcontroller and interfacing capability
4. Describe the architecture and interfacing of 8051 controller
5. Know the concepts of PIC micro controller and its programming.
6. Understand logical operations and data conversion.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/105/108105102
2. https://archive.nptel.ac.in/courses/108/103/108103157
3. https://nptel.ac.in/courses/106108100

B. Tech- VI Semester **Course Code:**

L	T	P	C
3	0	0	3

POWER SYSTEM ANALYSIS

Internal Marks: 30
External Marks: 70

Pre-requisite:
Concepts of electrical circuits and power systems-II.

Course Objectives:

1. To develop the impedance diagram (p.u) and formation of Y_{bus}
2. To learn the different load flow methods.
3. To learn the Z_{bus} building algorithm.
4. To learn short circuit calculation for symmetrical faults
5. To learn the effect of unsymmetrical faults and their effects.

UNIT - I

Circuit Topology

Graph theory definitions – Formation of element node incidence and bus incidence matrices – Primitive network representation – Formation of Y_{bus} matrix by singular transformation and direct inspection methods.

Per Unit Representation

Per Unit Quantities–Single line diagram – Impedance diagram of a power system – Numerical Problems.

UNIT - II

Power Flow Studies

Necessity of power flow studies – Derivation of static power flow equations – Power flow solution using Gauss-Seidel Method – Newton Raphson Method (Rectangular and polar coordinates form) – Decoupled and Fast Decoupled methods – Algorithmic approach – Numerical Problems on 3–bus system only.

UNIT - III

Z-Bus Algorithm

Formation of Z_{bus}**:** Algorithm for the Modification of Z_{bus} Matrix (without mutual impedance) – Numerical Problems.

Symmetrical Fault Analysis

Reactance's of Synchronous Machine – Three Phase Short Circuit Currents - Short circuit MVA calculations for Power Systems – Numerical Problems.

UNIT - IV

Symmetrical Components

Definition of symmetrical components – symmetrical components of unbalanced three phase systems – Power in symmetrical components – Sequence impedances and Sequence networks of Synchronous generator , Transformers and Transmission line-Numerical Problems.

Unsymmetrical Fault analysis

Various types of faults: LG– LL– LLG and LLL on unloaded alternator-Numerical problems.

UNIT - V

Power System Stability Analysis

Elementary concepts of Steady state – Dynamic and Transient Stabilities – Swing equation – Steady state stability – Equal area criterion of stability – Applications of Equal area criterion – Factors affecting transient stability – Methods to improve steady state and transient stability – Numerical problems.

Text Books:

1. Power System Analysis by Grainger and Stevenson - Tata McGraw Hill.2003
2. Modern Power system Analysis – by I.J.Nagrath & D .P.Kothari: Tata McGraw–Hill Publishing Company - 3rd edition - 2007.

Reference Books:

1. Power System Analysis – by A.R.Bergen - Prentice Hall - 2nd edition - 2009.
2. Power System Analysis by HadiSaadat – Tata McGraw–Hill 3rd edition - 2010.
3. Power System Analysis by B.R.Gupta - A H Wheeler Publishing Company Limited - 1998.
4. Power System Analysis and Design by J.Duncan Glover - M.S.Sarma - T.J.Overbye – Cengage Learning publications - 5th edition - 2011.

Course Outcomes:

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

1. Draw impedance diagram for a power system network and calculate per unit quantities.
2. Apply the load flow solution to a power system using different methods.
3. Form Z_{bus} for a power system networks and analyse.
4. Find the sequence components for power system Components.
5. Analyse the stability concepts of a power system.
6. Analyse its effects of unsymmetrical faults.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/117/105/117105140
2. https://archive.nptel.ac.in/courses/108/105/108105104

B. Tech- VI Semester **Course Code:**

L	T	P	C
3	0	0	3

PROFESSIONAL ELECTIVE-II
SWITCHGEAR AND PROTECTION

Internal Marks: 30
External Marks: 70

Pre-requisite:

Basic concepts of Electrical Machines and Power Systems.

Course Objectives:

1. To explain the working principles and applications of circuit breakers in power systems, including MCBs, oil, SF6, and vacuum breakers.
2. To provide an understanding of electromagnetic protection mechanisms, particularly relays used in fault detection and system protection (overcurrent, under-voltage, directional, differential).
3. To analyze protection techniques for generators and transformers, including fault protection schemes like percentage differential protection and Buchholz relays.
4. To explore feeder and busbar protection methods using advanced relay systems such as distance and static relays.
5. To study over-voltage protection systems including lightning arresters and neutral grounding methods to safeguard the power system.

UNIT – I

Circuit Breakers

Miniature Circuit Breaker(MCB)– Elementary principles of arc interruption– Restriking Voltage and Recovery voltages– Restriking phenomenon - RRRV– Average and Max. RRRV– Current chopping and Resistance switching– Concept of oil circuit breakers– Description and operation of Air Blast– Vacuum and SF_6 circuit breakers– Circuit Breaker ratings and specifications– Concept of Auto reclosing.

UNIT – II

Electromagnetic Protection

Relay connection – Balanced beam type attracted armature relay - induction disc and induction cup relays–Torque equation - Relays classification–Instantaneous– DMT and IDMT types– Applications of relays: Over current and under voltage relays– Directional relays– Differential relays and percentage differential relays– Universal torque equation– Distance relays: Impedance– Reactance– Mho and offset mho relays– Characteristics of distance relays and comparison.

UNIT – III

Generator Protection

Protection of generators against stator faults– Rotor faults and abnormal conditions– restricted earth fault and inter turn fault protection– Numerical examples.

Transformer Protection

Percentage differential protection– Design of CT's ratio– Buchholz relay protection– Numerical examples.

UNIT – IV

Feeder and Bus bar Protection & Static Relays:

Over current Protection schemes – PSM - TMS – Numerical examples – Carrier current and three zone distance relay using impedance relays. Protection of bus bars by using Differential protection. Static relays: Introduction – Classification of Static Relays – Basic Components of Static Relays.

UNIT – V

Protection against over voltage and grounding

Generation of over voltages in power systems– Protection against lightning over voltages– Valve type and zinc oxide lighting arresters. Grounded and ungrounded neutral systems – Effects of ungrounded neutral on system performance – Methods of neutral grounding: Solid– resistance–Reactance–Arcing grounds and grounding Practices.

Text Books:

1. Power System Protection and Switchgear by Badri Ram and D.N Viswakarma - Tata McGraw Hill Publications - 2nd edition - 2011.
2. Power system protection- Static Relays with microprocessor applications by T.S. Madhava Rao - Tata McGraw Hill - 2nd edition.

Reference Books:

1. Fundamentals of Power System Protection by Paithankar and S.R.Bhide. - PHI - 2003.
2. Art & Science of Protective Relaying – by C R Mason - Wiley Eastern Ltd.

Course Outcomes: At the end of the course, student will be able to

1. Understand and describe the operation of circuit breakers, including their ratings, principles of arc interruption, and types.
2. Analyze relay-based protection systems, identifying and explaining their roles in overcurrent, undervoltage, and fault detection.
3. Design protection schemes for generators and transformers, addressing faults like restricted earth faults and inter-turn faults.
4. Implement feeder and busbar protection using advanced relays such as distance, impedance, and static relays.
5. Evaluate over-voltage protection strategies, including the use of lightning arresters, and understand various neutral grounding techniques.

6. Understand the arcing grounds and grounding practices.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/107/108107167
2. https://archive.nptel.ac.in/courses/108/105/108105167

B. Tech- VI Semester **Course Code:**

L	T	P	C
3	0	0	3

ADVANCED CONTROL SYSTEMS
(PROFESSIONAL ELECTIVE-II)

Internal Marks: 30
External Marks: 70

Pre-requisite:

Basic concepts of Control Systems.

Course Objectives:

1. To understand the concept of controllability, observability, and their tests for continuous-time systems, as well as the principle of duality in state-space analysis.
2. To understand the state-space methods to assess controllability, observability, and design state feedback controllers via pole placement.
3. To know the stability of nonlinear systems using phase-plane analysis, describing functions, and Lyapunov's stability theorems.
4. To learn optimal control strategies using the calculus of variations, including constrained minimization and the minimum principle.
5. To learn Optimal control and state regulator problems.

UNIT – I

Controllability - Observability and Design of Pole Placement

General concepts of controllability and observability -Tests for controllability and observability for continuous time systems - Principle of duality - Effect of state feedback on controllability and observability - Design of state feedback control through pole placement, full order and reduced order observers.

UNIT – II

Nonlinear Systems

Introduction to nonlinear systems - Types of nonlinearities. Introduction to phase plane analysis, construction of phase trajectories-Analytical and Isocline method, Describing function - Describing functions of on-off nonlinearity, on-off nonlinearity with hysteresis, and relay with dead zone.

UNIT – III

Stability analysis by Lyapunov Method

Stability in the sense of Lyapunov – Lyapunov's stability and Lyapunov's instability theorems – Direct method of Lyapunov for the linear and nonlinear continuous time autonomous systems.

UNIT – IV

Calculus of Variations

Minimization of functionals - functionals of single function – Constrained minimization – Minimum principle – Control variable inequality constraints – Control and state variable inequality constraints.

UNIT –V

Optimal Control

Necessary conditions for optimal control, Formulation of the optimal control problem, minimum time problem, minimum energy problem, minimum fuel problem, state regulator problem, output regulator problem.

Text Books:

1. Modern Control Engineering – by K. Ogata - Prentice Hall of India - 3rd edition - 1998.
2. Automatic Control Systems by B.C. Kuo - Prentice Hall Publication.

Reference Books:

1. Modern Control System Theory – by M. Gopal - New Age International Publishers - 2nd edition – 1996.
2. Optimal control theory: an Introduction by Donald E.Kirk by Dover publications.
3. Control Systems Engineering by I.J. Nagarath and M.Gopal - New Age International (P) Ltd.

Course Outcomes: At the end of the course, student will be able to

1. Explain controllability, observability, and the principle of duality in state-space systems.
2. Apply state-space methods to analyze controllability, observability, and design state feedback controllers.
3. Analyze the stability of nonlinear systems using phase-plane analysis and Lyapunov's stability theorems.
4. Examine the minimization of functional and control variable inequality constraints.
5. Formulate and solve the optimal regulator problems.
6. Understand the state regulator problem

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/103/108103007
2. https://archive.nptel.ac.in/courses/108/107/108107115

B. Tech- VI Semester **Course Code:**

L	T	P	C
3	0	0	3

RENEWABLE AND DISTRIBUTED ENERGY TECHNOLOGIES
(PROFESSIONAL ELECTIVE-II)

Internal Marks: 30
External Marks: 70

Pre-requisite: Power System- I

Course Objectives:

1. To understand the basic concepts on wind energy systems.
2. To understand the various relations between speed, power and energy in the wind systems.
3. To analyze the solar energy systems, various components of solar thermal systems, applications in the relevant fields and design of PV systems.
4. To design the Hydel system components and to get an idea on different other sources like tidal, geothermal and gas based units.
5. To understand the concepts of hybrid renewable energy systems.

UNIT-I

General Introduction

Discuss about in general electric power system, Global energy scenario and Indian Power system. National solar mission, Renewable energy for Rural, Urban, Industrial, Commercial applications.

Introduction to SG, MG, DG, DER

Discuss about Smart Grid, Micro Grid, Distributed Generation, Distributed Energy Resources

UNIT-II

Renewable Energy sources

Solar radiation & Geometry- Solar PV- Solar Thermal- Wind energy- Ocean thermal energy conversion- Wave energy- Tidal Power- Fuel Cell.

UNIT-III

SPV system design

System design of stand alone and grid connected Solar PV system will be covered. Solar PV system types- Typical load types & characteristics- Maximum power point operation- Grid-Connected PV system sizing- Stand-Alone PV System sizing- PV-Powered Water pumping system sizing.

UNIT-IV

Energy Systems Operation

Effect of Renewable generator on system Voltage, Frequency, Inertia and reserve requirement

—Energy System –Energy Vectors, AC Power System, System Operation Issues caused by penetration of DGs, Load flow study, —Demand Side participation, Distribution Tariff.

Unit-V

Energy Economics

Concept of Time value of money, Net present value with Numerical Examples

Hybrid Renewable systems

Requirements of hybrid/combined use of different renewable and distributed sources -Need of energy storage- Use of energy storage and power electronics interfaces for the connection to grid and loads - Design and optimization of size of renewable sources and their storages.

Text Books:

1. Math J. Bollen - Fainan Hassan 'Integration of Distributed Generation in the Power System' - IEEE Press - 2011.
2. G.D.Rai 'Non-Conventional Energy Sources' KHANNA PUBLISHERS.

Reference Books

1. Studies' Craig Anderson and Rudolf I. Howard 'Wind and Hydropower Integration: Concepts - Considerations and Case - Nova Publisher - 2012.
2. Amanda E. Niemi and Cory M. Fincher 'Hydropower from Small and Low-Head Hydro Technologies' - Nova Publisher - 2011.
3. D. YogiGoswami - Frank Kreith and Jan F. Kreider 'Principles of Solar Engineering' - Taylor & Francis 2000.
4. Math J. Bollen - Fainan Hassan 'Integration of Distributed Generation in the Power System' - IEEE Press - 2011.
5. S. Heier and R. Waddington 'Grid Integration of Wind Energy Conversion Systems' – Wiley - 2006.
6. Loi Lei Lai and Tze Fun Chan 'Distributed Generation: Induction and Permanent Magnet Generators' - Wiley-IEEE Press - 2007.
7. G.N. Tiwari 'Solar Energy Technology' - Nova Science Publishers - 2005.

Course Outcomes:

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

1. Illustrate basic concepts of renewable and distributed sources of wind energy.
2. Demonstrate the components of wind energy conversion systems.
3. Model PV systems and analyze MPPT Techniques.

4. Illustrate the concept of Energy Production from Hydro - Tidal and Geothermal.
5. Explain the aspects of hybrid renewable energy systems.
6. Understand the renewable sources and their storages.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/103/103/103103206
2. https://archive.nptel.ac.in/courses/103/107/103107157

B. Tech- VI Semester **Course Code:**

L	T	P	C
3	0	0	3

ELECTRIC DRIVES
(PROFESSIONAL ELECTIVE-III)

Internal Marks: 30
External Marks: 70

Pre-requisite: Electrical Circuit Analysis, Power electronics, Electrical Machines and Control Systems.

Course Objectives:

1. To learn the fundamentals of electric drive and different electric braking methods.
2. To analyze the operation of three phase converter controlled dc motors and four quadrant operation of dc motors using dual converters.
3. To discuss the DC-DC converter control of dc motors.
4. To understand the concept of speed control of induction motor by using AC voltage controllers, voltage source inverters and slip power recovery scheme.
5. To learn the speed control mechanism of synchronous motors.

UNIT - I

Fundamentals of Electric Drives

Electric drive and its components– Fundamental torque equation – Load torque components – Nature and classification of load torques – Steady state stability – Load equalization– Four quadrant operation of drive (hoist control) – Braking methods**:** Dynamic Braking, Plugging and Regenerative Braking –Numerical problems.

UNIT - II

Converter Fed DC Motor Drives

3-phase half and fully-controlled converter fed separately and self-excited DC motor drive – Output voltage and current waveforms – Speed-torque characteristics and expressions – 3-phase Dual converter fed DC motor drives – Numerical problems.

UNIT - III

DC–DC Converter Fed DC Motor Drives

Single quadrant, two quadrant and four quadrant DC-DC converter fed separately excited and self-excited DC motors – Continuous Current Mode of operation - Output voltage and current waveforms – Speed-torque characteristics and expressions – Closed loop operation (qualitative treatment only) – Numerical problems.

UNIT - IV

Control of 3-phase Induction motor Drives

Stator voltage control using 3-phase AC voltage regulators – Waveforms –Speed torque characteristics– Variable Voltage Variable Frequency control of induction motor by PWM voltage source inverter – Closed loop V/f control of induction motor drives (qualitative treatment only). Static rotor resistance control – Slip power recovery schemes – Static Scherbius drive -Numerical problems.

UNIT - V

Control of Synchronous Motor Drives

Separate control of synchronous motor – self-control of synchronous motor employing load commutated thyristor inverter - closed loop control of synchronous motor drive (qualitative treatment only)– PMSM: Basic operation and advantages – Numerical problems.

Text Books:

1. Fundamentals of Electric Drives – G K Dubey - Narosa Publications - 2nd edition – 2002.
2. Power Semiconductor Drives - S.B.Dewan - G.R.Slemon - A.Straughen - Wiley India - 1984.

Reference Books:

1. Electric Motors and Drives Fundamentals - Types and Apllications - by Austin Hughes and Bill Drury - Newnes.4th edition - 2013.
2. Thyristor Control of Electric drives – Vedam Subramanyam Tata McGraw Hill Publications - 1987.
3. Power Electronic Circuits - Devices and applications by M.H.Rashid - PHI - 3rd edition - 2009.

Course Outcomes:

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

1. Explain the fundamentals of electric drive and different electric braking methods.
2. Analyze the operation of three-phase converter fed dc motors and four quadrant operations of dc motors using dual converters.
3. Describe the DC-DC converter fed control of dc motors in various quadrants of operation
4. Know the concept of speed control of induction motor by using AC voltage controllers and voltage source inverters and differentiate the stator side control and rotor side control
5. Learn the concepts of speed control of synchronous motor with different methods.
6. Understand the concept of PMSM method.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/104/108104140
2. https://nptel.ac.in/courses/108104011

B. Tech- VI Semester **Course Code:**

L	T	P	C
3	0	0	3

DIGITAL SIGNAL PROCESSING
(PROFESSIONAL ELECTIVE-III)

Internal Marks: 30
External Marks: 70

Pre-requisite:

Laplace Transforms, Z- Transforms, Fourier series and transforms.

Course Objectives:

1. To explore the basic concepts of digital signal processing.
2. To connect the time domain signal to frequency domain signals using Fourier transform.
3. To understand the basic structures of IRR systems.
4. To understand and design FIR Digital filters.
5. To explore the concepts of multiple sampling rates for DSP.

UNIT - I

Introduction to Digital Signal Processing

Discrete time signals & sequences - Classification of Discrete time systems - stability of LTI systems - Invertability - Response of LTI systems to arbitrary inputs. Solution of Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems. Review of Z-transforms - solution of difference equations using Z-transforms - System function.

UNIT - II

Discrete Fourier Transforms and FFT Algorithms

Discrete Fourier Series representation of periodic sequences -Properties of Discrete Fourier Series - Discrete Fourier transforms: Properties of DFT - linear filtering methods based on DFT - Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms - Inverse FFT.

UNIT - III

Design and Realizations of IIR Digital Filters

Analog filter approximations – Butterworth and Chebyshev filters - Design of IIR Digital filters from analog filters withexamples. Analog and Digital frequency transformations.

Basic structures of IIR systems – Direct-Form Structures - Transposed Structures - Cascade-Form Structures - Parallel-Form Structures Lattice and Lattice-Ladder Structures.

UNIT - IV

Design and Realizations of FIR Digital Filters

Characteristics of FIR Filters with Linear Phase - Frequency Response of Linear Phase FIR

Filters - Design of FIR Digital Filters using Window Techniques and Frequency Sampling technique - Comparison of IIR & FIR filters.
Basic structures of FIR systems – Direct-Form Structure - Cascade-Form Structures Linear Phase Realizations - Lattice structures.

UNIT - V

Multirate Digital Signal Processing

Decimation –Interpolation-Sampling Rate Conversion by a Rational Factor–Implementation of sampling rate converters–Applications of Multirate Signal Processing-Digital Filter Banks.

Text Books:

1. Digital Signal Processing – Principles Algorithms and Applications: John G. Proakis - Dimitris G.Manolakis - 4th Edition - Pearson Education / PHI - 2007.
2. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer - PHI.
3. Digital Signal Processing: A Computer based approach. Sanjit K Mitra - 4th Edition - TMH - 2014.

Reference Books:

1. Digital Signal Processing: Andreas Antoniou - TATA McGraw Hill - 2006.
2. Digital Signal Processing: MH Hayes - Schaum's Outlines - TATA Mc-Graw Hill - 2007.
3. DSP Primer - C. Britton Rorabaugh - Tata McGraw Hill - 2005.
4. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling - Sandra L.Harris - Thomson - 2007.
5. Digital Signal Processing – Alan V. Oppenheim - Ronald W. Schafer - PHI Ed. - 2006.
6. Digital Signal Processing – K Raja Rajeswari - 1st edition - I.K. International Publishing - House - 2014.

Course Outcomes:

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

1. Know the concepts of Digital signal processing - frequency domain representation & Z- transform.
2. Compute discrete Fourier transform and fast Fourier transforms for different sequences.
3. Design IIR filters through analog filter approximation and basic structure of IIR filters.
4. Design FIR filters with window techniques and basic structure of FIR filters.
5. Learn the concepts of Multirate Signal Processing.
6. Understand the digital filter banks.

Online Learning Resources:

1. https://nptel.ac.in/courses/117102060
2. https://archive.nptel.ac.in/courses/108/101/108101174

B. Tech- VI Semester **Course Code:**

L	T	P	C
3	0	0	3

HIGH VOLTAGE ENGINEERING
(PROFESSIONAL ELECTIVE-III)

Internal Marks: 30
External Marks: 70

Pre-requisite:
Material Science, Electromagnetic Fields and Basics of Transient Circuits.

Course Objectives:

1. To understand HV breakdown phenomena in gases.
2. To understand the breakdown phenomenon of liquids and solid dielectrics.
3. To acquaint with the generating principle of operation and design of HVDC, AC voltages.
4. To understand the generating principles of Impulse voltages & currents.
5. To understand various techniques for AC, DC and Impulse measurements of high voltages and currents.

UNIT - I

Break down phenomenon in Gaseous and Vacuum:

Insulating Materials: Types, properties and its applications. Gases as insulating media – Collision process – Ionization process – Townsend's criteria of breakdown in gases and its limitations – Streamers Theory of break down – time lag – Paschen's law- Paschen's curve, Penning Effect. Breakdown mechanisms in Vacuum.

UNIT - II

Break down phenomenon in Liquids:

Liquid as Insulator – Pure and commercial liquids – Breakdown in pure and commercial liquids- Mechanisms.

Break down phenomenon in Solids:

Intrinsic breakdown – Electromechanical breakdown – Thermal breakdown – Breakdown of composite solid dielectrics.

UNIT - III

Generation of High DC voltages:

Voltage Doubler Circuit - Voltage Multiplier Circuit – Vande- Graaff Generator.

Generation of High AC voltages:

Cascaded Transformers – Resonant Transformers –Tesla Coil.

UNIT - IV

Generation of Impulse voltages:

Specifications of impulse wave – Analysis of RLC circuits - Marx Circuit.

Generation of Impulse currents:

Definitions – Circuits for producing Impulse current waves – Wave shape control - Tripping and control of impulse generators.

UNIT - V

Measurement of High DC & AC Voltages:

Resistance potential divider - Generating Voltmeter - Capacitor Voltage Transformer (CVT) - Electrostatic Voltmeters – Sphere Gaps.

Measurement of Impulse Voltages & Currents:

Potential dividers with CRO - Hall Generator - Rogowski Coils.

Text Books:

1. High Voltage Engineering: Fundamentals by E.Kuffel - W.S.Zaengl - J.Kuffel by Elsevier - 2nd Edition.
2. High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications - 3rd Edition.

Reference Books:

1. High Voltage Engineering and Technology by Ryan - IET Publishers - 2nd edition.
2. High Voltage Engineering by C.L.Wadhwa - New Age Internationals (P) Limited – 1997.
3. High Voltage Insulation Engineering by Ravindra Arora - Wolfgang Mosch - New Age International (P) Limited - 1995.

Course Outcomes:

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

1. Recognise the dielectric properties of gaseous materials used in HV equipment.
2. Differentiate the break down phenomenon in liquid and solid dielectric materials.
3. Acquaint with the techniques of generation of high AC and DC voltages
4. Acquaint with the techniques of generation of high Impulse voltages and currents.
5. Getting the knowledge of measurement of high AC- DC- Impulse voltages and currents.
6. Understand the concept of Hall Generator.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/104/108104048
2. https://bharatsrajpurohit.weebly.com/high-voltage-engineering-course.html

B. Tech- VI Semester **Course Code:**

L	T	P	C
3	0	0	3

FUNDAMENTALS OF ELECTRIC VEHICLES
(OPEN ELECTIVE-II)

Internal Marks: 30
External Marks: 70

Pre-requisite:

Basic knowledge in Physics, Chemistry and Basics of Electrical and Electronics.

Course Objectives:

1. To familiarize the students with the need and advantages of electric and hybrid electric vehicles.
2. To understand various power converters used in electric vehicles.
3. To be familiar all the different types of motors suitable for electric vehicles.
4. To know various architecture of hybrid electric vehicles.
5. To have knowledge on latest developments in batteries and other storage systems.

UNIT – I

Introduction

Fundamentals of vehicles – Vehicle model – Calculation road load and tractive force –Components of conventional vehicles – Drawbacks of conventional vehicles – Need for electric vehicles– Advantages and applications of Electric Vehicles – History of Electric Vehicles – EV Market in India and outside India –Types of Electric Vehicles.

UNIT – II

Components of Electric Vehicles

Main components of Electric Vehicles – Electric Traction Motor and Controller – Power Converters – Rectifiers used in EVs – Bidirectional DC–DC Converters – Voltage Source Inverters – PWM inverters used in EVs.

UNIT – III

Motors for Electric Vehicles

Characteristics of traction drive – requirements of electric machines for EVs – Comparison of Different motors for Electric and Hybrid Vehicles – Induction Motors – Synchronous Motors – Permanent Magnetic Synchronous Motors – Brushless DC Motors – Switched Reluctance Motors (Construction details and working only).

UNIT – IV

Hybrid Electric Vehicles

Evolution of Hybrid Electric Vehicles – Advantages and Applications of Hybrid Electric Vehicles – Architecture of HEVs – Series and Parallel HEVs – Complex HEVs – Range extended HEVs – Examples – Merits and Demerits.

UNIT – V

Energy Sources for Electric Vehicles

Batteries– Types of Batteries – Lithium-ion – Nickel-metal hydride – Lead-acid – Comparison of Batteries – Battery Charging – Fast Charging –Battery Management System – Ultra capacitors – Flywheels – Compressed air energy storage (CAES)– Fuel Cell – it's working.

Text Books

1. Iqbal Hussein - Electric and Hybrid Vehicles: Design Fundamentals - CRC Press - 2021.
2. Tom Denton, Hayley Pells - Electric and hybrid vehicles, Third Edition, 2024

Reference Books:

1. Kumar - L. Ashok - and S. Albert Alexander. Power Converters for Electric Vehicles. CRC Press - 2020.
2. Chau - Kwok Tong. Electric vehicle machines and drives: design - analysis and application. John Wiley & Sons - 2015.
3. Berg - Helena. Batteries for electric vehicles: materials and electrochemistry. Cambridge university press - 2015.

Course Outcomes:

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

1. Illustrate the use and advantages of different types of electric vehicles.
2. Use suitable power converters for EV application.
3. Select suitable electric motor for EV power train.
4. Design HEV configuration for a specific application.
5. Analyse various storage systems and battery management system for EVs.
6. Understand the methodology of Compressed air energy storage (CAES).

Online Learning Resources:

1. MOOC at https://www.edx.org/learn/electric-cars
2. https://archive.nptel.ac.in/courses/108/106/108106170

B. Tech- VI Semester **Course Code:**

L	T	P	C
3	0	0	3

ELECTRICAL WIRING ESTIMATION AND COSTING
(OPEN ELECTIVE-II)

Internal Marks: 30
External Marks: 70

Pre-requisite:

Electrical Circuits, Basics of Power Systems and Electrical Machines.

Course Objectives:

1. Introduce the electrical symbols and simple electrical circuits
2. Able to learn the design of electrical installations.
3. Able to learn the design of electrical installation for different types of buildings and small industries.
4. Learn the basic components of electrical substations.
5. Familiarize with the motor control circuits

UNIT - I

Electrical Symbols and Simple Electrical Circuits

Identification of electrical symbols - Electrical wiring Diagrams - Methods of representation of wiring diagrams - introduction to simple light and fan circuits - system of connection of appliances and accessories.

UNIT - II

Design Considerations of Electrical Installations

Electric supply system - Three-phase four wire distribution system - protection of electric installation against overload - short circuit and earth fault - earthing - neutral and earth wire - types of loads - systems of wiring - permissible of voltage drops and sizes of wires - estimating and costing of electrical installations.

UNIT - III

Electrical Installation for Different Types of Buildings and Small Industries

Electrical installations for electrical buildings - estimating and costing of material - simple examples on electrical installation for residential buildings - electrical installations for commercial buildings - electrical installation for small industries-case study.

UNIT - IV

Substations

Introduction - types of substations - outdoor substations-pole mounted type - indoor substations-floor mounted type - simple examples on quantity estimation-case study.

UNIT - V

Motor control circuits

Introduction to AC motors - starting of three phase squirrel cage induction motors - starting of wound rotor motors - starting of synchronous motors - contractor control circuit components - basic control circuits - motor protection – Schematic and wiring diagrams for motor control circuits.

Text Book:

1. Electrical Design and Estimation Costing - K. B. Raina and S.K.Bhattacharya – New Age International Publishers - 2007.

References Books:

1. Electrical wiring estimating and costing – S.L.Uppal and G.C.Garg – Khanna publishers - 6^{th} edition - 1987.
2. A course in electrical installation estimating and costing – J.B.Gupta – Kataria SK & Sons - 2013.

Course Outcomes:

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

1. Demonstrate the various electrical apparatus and their interconnections.
2. Examine various components of electrical installations.
3. Estimate the cost for installation of wiring for different types of building and small industries.
4. Illustrate the components of electrical substations.
5. Design suitable control circuit for starting of three phase induction motor and synchronous motor.
6. Design wiring diagrams for motor control circuits.

Online Learning Resources:

1. https://onlinecourses.swayam2.ac.in/nou25_ec07/preview

B. Tech- VI Semester **Course Code:** **L T P C**

3 0 0 3

FUNDAMENTALS OF UTILIZATION OF ELECTRICAL ENERGY
(OPEN ELECTIVE-II)

Internal Marks: 30
External Marks: 70

Course Objectives:

1. To understand the operating principles and characteristics of traction motors with respect to speed, temperature, loading conditions.
2. To acquaint with the different types of heating and welding techniques.
3. To study the basic principles of illumination and its measurement.
4. To understand different types of lightning system including design.
5. To understand the basic principle of electric traction including speed–time curves of different traction services.

UNIT – I
Selection of Motors

Choice of motor, type of electric drives, starting and running characteristics–Speed control–Temperature rise–Applications of electric drives–Types of industrial loads–continuous–Intermittent and variable loads–Load equalization.

UNIT – II
Electric Heating

Principle of heating – modes of heat transfer Advantages and methods of electric heating–Resistance heating induction heating and dielectric heating – Arc furnaces – Direct and indirect arc furnaces

Electric Welding

Principles of welding – types of welding- Electric welding–Resistance and arc welding–Electric welding equipment–Comparison between AC and DC Welding

UNIT – III
Illumination fundamentals

Introduction, terms used in illumination–Laws of illumination–Polar curves–Integrating sphere–Lux meter–Discharge lamps, MV and SV lamps – Lumen or flux method of calculation - Sources of light.

UNIT – IV
Various Illumination Methods

Comparison between tungsten filament lamps and fluorescent tubes–Basic principles of light control– Lighting systems – indoor / outdoor lighting Electrical lamps – discharge / arc lamps Sodium Vapour – High Pressure Mercury Vapour lamps Neon lamps – Fluorescent tubes-Design of lighting and flood lighting–LED lighting Conservation of energy.- illumination calculations.

UNIT – V

Electric Traction – I

System of electric traction and track electrification– Review of existing electric traction systems in India– Special features of traction motor– Mechanics of train movement–Speed–time curves for different services – Trapezoidal and quadrilateral speed time curves-High speed transportation trains. Modern traction motors.

Electric Traction – II

Calculations of tractive effort– power –Specific energy consumption for given run–Effect of varying acceleration and braking retardation.

Text Books:

1. Utilization of Electric Energy – by E. Openshaw Taylor, Orient Longman.
2. Art & Science of Utilization of electrical Energy – by Partab, Dhanpat Rai & Sons.

Reference Books:

1. Utilization of Electrical Power including Electric drives and Electric traction – by N.V. Suryanarayana, New Age International (P) Limited, Publishers, 1996.
2. Generation, Distribution and Utilization of electrical Energy – by C.L. Wadhwa, New Age International (P) Limited, Publishers, 1997.

Course Outcomes:

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

1. Identify a suitable motor for electric drives and industrial applications
2. Identify most appropriate heating or welding techniques for suitable applications.
3. Understand various level of illuminosity produced by different illuminating sources.
4. Estimate the illumination levels produced by various sources
5. Determine the speed/time characteristics of different types of traction motors.
6. Understand trapezoidal and quadrilateral speed time curves.

B. Tech- VI Semester **Course Code:**

L	T	P	C
0	0	3	1.5

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LAB

Internal Marks: 30

External Marks: 70

Course Objectives:

1. To understand students how different types of meters work and their construction.
2. To make the students understand how to measure resistance, inductance and capacitance by AC & DC bridges.
3. To understand the testing of CT and PT.
4. To Understand and the characteristics of Thermo couples, LVDT, Capacitive transducer, piezoelectric transducer and measurement of strain and choke coil parameters.
5. To study the procedure for standardization and calibration of various methods.

Any 10 of the following experiments are to be conducted

1. Calibration of dynamometer wattmeter using phantom loading
2. Measurement of resistance using Kelvin's double Bridge and Determination of its tolerance.
3. Measurement of Capacitance using Schering Bridge.
4. Measurement of Inductance using Anderson Bridge.
5. Calibration of LPF Wattmeter by direct loading.
6. Measurement of 3 phase reactive power using single wattmeter method for a balanced load.
7. Testing of C.T. using mutual inductor – Measurement of % ratio error and phase angle of given C.T. by Null deflection method.
8. P.T. testing by comparison – V.G as Null detector – Measurement of % ratio error and phase angle of the given P.T.
9. Determination of the characteristics of a Thermocouple.
10. Determination of the characteristics of a LVDT.
11. Determination of the characteristics for a capacitive transducer.
12. Measurement of strain for a bridge strain gauge.
13. Measurement of Choke coil parameters and single-phase power using three voltmeter and three ammeter methods.
14. Calibration of single-phase Induction Type Energy Meter.
15. Calibration of DC ammeter and voltmeter using Crompton DC Potentiometer.
16. AC Potentiometer: Polar Form / Cartesian Form - Calibration of AC voltmeter - Parameters of choke.

Course Outcomes:

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

1. Know about the phantom loading and calibration process.
2. Measure the electrical parameters voltage - current - power- energy and electrical characteristics of resistance - inductance and capacitance.
3. Gain the skill knowledge of various brides and their applications.
4. Learn the usage of CT's - PT's for measurement purpose.
5. Know the characteristics of transducers and measure the strains - frequency and phase difference.
6. Understand the LVDT operation.

Note:

Minimum 10 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the students fails to get eligibility for semester end exams in the current semester, he/ she has to take the permission of HOD and complete the required number of experiments and appear for semester end exams as and when conducted.

B. Tech- VI Semester **Course Code:**

L	T	P	C
0	0	3	1.5

MICROPROCESSORS AND MICROCONTROLLERS LAB

Internal Marks: 30

External Marks: 70

Pre-requisite:

Concepts of Microprocessors and Microcontrollers

Course Objectives:

1. To study programming based on 8086 microprocessor and 8051 microcontroller.
2. To study 8086 microprocessor based ALP using arithmetic, logical and shift operations.
3. To study to interface 8086 with I/O and other devices.
4. To study parallel and serial communication using 8051& PIC 18 micro controllers.

List of experiments

Any 10 of the following experiments are to be conducted:

8086 Microprocessor Programs

1. Arithmetic operations – Two 16-bit numbers and multibyte numbers addition - subtraction - multiplication and division – Signed and unsigned arithmetic operations - ASCII – Arithmetic operations.
2. Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD - BCD to ASCII conversion – BCD numbers addition.
3. Arrange the given array in ascending and descending order
4. Determine the factorial of a given number
5. By using string operation and Instruction prefix**:** Move block - Reverse string Sorting - Inserting - Deleting - Length of the string - String comparison.
6. Find the first and n^{th} number of 'n' natural numbers of a Fibonacci series.
7. Find the number and sum of even and odd numbers of a given array
8. Find the sum of 'n' natural numbers and squares of 'n' natural numbers
9. Arithmetic operations on 8051
10. Conversion of decimal number to hexa equivalent and hexa equivalent to decimal number
11. Find the Sum of elements in an array and also identify the largest & smallest number of a given array using 8051

Programs on Interfacing

12. Interfacing 8255–PPI with 8086.
13. Stepper motor control using 8253/8255.
14. Reading and Writing on a parallel port using 8051
15. Timer in different modes using 8051

16. Serial communication implementation using 8051
17. Understanding three memory areas of 00 – FF Using 8051 external interrupts.
18. Traffic Light Controller using 8051.

Course Outcomes:

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

1. Write assembly language program using 8086 microprocessor based on arithmetic - logical number systems and shift operations.
2. Write assembly language programs for numeric operations and array handling problems.
3. Write a assembly program on string operations.
4. Interface 8086 with I/O and other devices.
5. Do parallel and serial communication using 8051 & PIC 18 micro controllers.
6. Design traffic light controller using 8051.

Note:

Minimum 10 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the students fails to get eligibility for semester end exams in the current semester, he/ she has to take the permission of HOD and complete the required number of experiments and appear for semester end exams as and when conducted.

B. Tech- VI Semester **Course Code:**

L	T	P	C
0	1	2	2

IOT APPLICATIONS OF ELECTRICAL ENGINEERING LAB
(SKILL ENHANCEMENT COURSE)

Internal Marks: 30
External Marks: 70

Course Objectives:

1. To understand the working of Arduino.
2. To learn the programming of Raspberry PI.
3. To know various sensors with Arduino/Raspberry Pi.
4. To interface various displays with Arduino/Raspberry Pi.

Topics to be covered in Tutorials

Module–1: Programming Arduino: (3 hrs)

Arduino - Classification of Arduino Boards - Pin diagrams – Arduino Integrated Development Environment (IDE) – Programming Arduino.

Module–2: Sensors: (5 hrs)

Working of temperature sensor, proximity sensor, IR sensor, Light sensor, ultrasonic sensor, PIR Sensor, Colour sensor, Soil Sensor, Heart Beat Sensor, Fire Alarms etc. Actuators: Stepper Motor, Servo Motor and their integration with Arduino/Raspberry Pi.

Module–3: Raspberry Pi: (2 hrs)

Introduction, Classification of Rasperberry Pi Series - Pin diagrams – Programming Rasperberry Pi.

Module–4: Display: (2 hrs)

Working of LEDs, LED, OLED display, LCDs, Seven Segment Display, Touch Screen etc. Analog Input and Digital Output Converter etc. and their integration with Arduino/Raspberry Pi.

Module–5: Wireless Communication Devices: (4 hrs)

Working of Bluetooth, Wi-Fi, Radio Frequency Identification (RFID), GPRS/GSM Technology, ZigBee, etc and their integration with Arduino/Raspberry Pi. Features of Alexa.

List of experiments

Any 10 of the following experiments are to be conducted:

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. Interfacing of LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3. Interfacing of Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.

4. Interfacing of temperature sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5. Interfacing of Organic Light Emitting Diode (OLED) with Arduino/Raspberry Pi
6. Interfacing of Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
7. Interfacing of Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
8. Write a program on Arduino/Raspberry Pi to upload and retrieve temperature and humidity data to thing speak cloud.
9. Interfacing of 7 Segment Display with Arduino/Raspberry Pi
10. Interfacing of Joystick with Arduino/Raspberry Pi
11. Interfacing of Analog Input & Digital Output with Arduino/Raspberry Pi
12. Night Light Controlled & Monitoring System
13. Interfacing of Fire Alarm Using Arduino/Raspberry Pi
14. IR Remote Control for Home Appliances
15. A Heart Rate Monitoring System
16. Alexa based Home Automation System

Course Outcomes:

At the end of the course - students will be able to:

1. Operate the Arduino Integrated Development Environment with embedded c.
2. Program the embedded Python in Raspberry Pi OS.
3. Interface various sensors with Arduino/Raspberry Pi in the IoT environment.
4. Connect different displays with Arduino/Raspberry Pi
5. Interconnect with wireless communication technologies.
6. Understand operation of IR Remote Control.

Note 1:

Minimum 10 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the students fails to get eligibility for semester end exams in the current semester, he/ she has to take the permission of HOD and complete the required number of experiments and appear for semester end exams as and when conducted.

Note 2:

Skill oriented course shall carry 100 marks and shall be evaluated through continuous assessment during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the class/ laboratory shall be evaluated for 30marks by the concerned teacher based on the regularity/ assignments/ viva/ mid semester test. The end examination similar to practical examination pattern shall be conducted by the concerned teacher and an expert in the subject nominated by the principal.

B. Tech- VI Semester **Course Code:**

L	T	P	C
2	0	0	0

RESEARCH METHODOLOGY

Internal Marks: 30
External Marks: 70
Semester End Exam Marks: 70

Course Objectives:

1. To motivate towards research
2. To know data collection and analyse

UNIT- I

Research Formulation and Design

Motivation and objectives – Research methods vs. Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research. Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review-primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature and research database, development of working hypothesis.

UNIT-II

Data Collection and Analysis

Accepts of method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools,data analysis with statically package (Sigma STAT,SPSS for student t-test, ANOVA, etc.), hypothesis testing.

UNIT- III

Soft Computing

Computer and its role in research, Use of statistical software SPSS, GRETL in research. Introduction to evolutionary algorithms - Fundamentals of Genetic algorithms, Simulated Annealing, Neural Network based optimization, Optimization of fuzzy systems.

UNIT- IV

Research Ethics, Ipr And Scholary Publishing

Ethics-ethical issues, ethical committees (human & animal); IPR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); scholarly publishing- IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability.

UNIT- V

Interpretation and Report Writing

Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports, Conclusions

Text Books:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Publications. 2 volumes.

Reference Books:

1. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
2. Wadehra, B.L. 2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing.

Course Outcomes:

Students will be able to

1. Understand concept of research
2. Understand data collection
3. Understand soft computing
4. Know research ethics.
5. Understand problem identification and solution
6. Develop skill on mechanics of writing a research report.

Minor Engineering Courses Offered by EEE Department for Other Branches

B. Tech- Semester **Course Code:** **L T P C**

3 0 0 3

CONCEPTS OF CONTROL SYSTEMS

Minor Engineering Courses (Except EEE Branch)

Internal Marks: 30
External Marks: 70

Pre-requisite:

Basic Engineering Mathematics

Course Objectives:

1. To learn the mathematical modeling of physical systems and to use block diagram algebra and signal flow graph to determine overall transfer function
2. To analyze the time response of first and second order systems and improvement of performance using PI, PD, PID controllers.
3. To investigate the stability of closed loop systems using Routh's stability criterion and root locus method.
4. To learn Frequency Response approaches for the analysis of LTI systems using Bode plots, polar plots and Nyquist stability criterion.
5. To learn state space approach for analysis of LTI systems and understand the concepts of controllability and observability.

UNIT – I

Mathematical Modelling of Control Systems

Classification of control systems - open loop and closed loop control systems and their differences - transfer function of linear system - differential equations of electrical networks - translational and rotational mechanical systems – block diagram algebra – Feedback characteristics.

UNIT-II

Time Response Analysis

Standard test signals – time response of first and second order systems – time domain specifications - steady state errors and error constants – P, PI, PD &PID Controllers.

UNIT–III

Stability and Root Locus Technique

The concept of stability – Routh-Hurwitz Criteria – limitations of Routh-Hurwitz criterion-Root locus concept – construction of root loci (simple problems).

UNIT–IV

Frequency Response Analysis

Introduction to frequency domain specifications – Bode diagrams – Transfer function from the Bode diagram – phase margin and gain margin.

UNIT–V

State Space Analysis of Linear Time Invariant (LTI) Systems

Concepts of state - state variables and state model - state space representation of transfer function - State Transition Matrix and it's properties.

Text Books:

1. Modern Control Engineering by Kotsuhiko Ogata - Prentice Hall of India.
2. Automatic control systems by Benjamin C.Kuo - Prentice Hall of India - 2nd Edition.

Reference Books:

1. Control Systems principles and design by M.Gopal - Tata Mc Graw Hill education Pvt Ltd. - 4th Edition.
2. Control Systems by Manik Dhanesh N - Cengage publications.
3. Control Systems Engineering by I.J.Nagarath and M.Gopal - Newage International Publications - 5th Edition.
4. Control Systems Engineering by S.Palani - Tata Mc Graw Hill Publications.

Course Outcomes:

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

1. Derive the transfer function of physical systems and determination of overall transfer function using block diagram algebra and signal flow graphs.
2. Determine time response specifications of second order systems and to determine error constants.
3. Analyze absolute and relative stability of LTI systems using Routh's stability criterion and the root locus method.
4. Analyze the stability of LTI systems using frequency response methods.
5. Represent physical systems as state models and determine the response.
6. Understand the State Transition Matrix apply.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/107/106/107106081
2. https://archive.nptel.ac.in/courses/108/106/108106098
3. https://nptelvideos.com/video.php?id=1423&c=14

B. Tech- Semester **Course Code:** **L T P C**

3 0 0 3

FUNDAMENTALS OF ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

Minor Engineering Courses (Except EEE Branch)

Internal Marks: 30
External Marks: 70

Pre-requisite:

Basics of Electrical and Electronics Engineering.

Course Objectives:

1. Interpret the working principles of various analog measuring instruments.
2. Understand the concepts behind power and energy measurement procedures.
3. Calculate resistance, inductance, and capacitance using various bridges.
4. Evaluate the importance of and understand the concepts of various transducers.
5. Comprehend the types of digital meters and their functionalities.

UNIT – I

Fundamentals of Analog Measurement

Analog Ammeter and Voltmeter: Classification of instruments – Deflecting, controlling, and damping torques. Types of Instruments: PMMC and Moving Iron type – Construction, working principle, advantages, and disadvantages. Applications and simple numerical problems.

UNIT – II

Measurement of Power and Energy

Analog Wattmeter: Electrodynamometer type wattmeters – Low Power Factor (LPF) and Unity Power Factor (UPF) designs, advantages, and disadvantages. Energy Meters: Induction type Energy Meter – Construction and working principle Simple numerical problems.

UNIT – III

Measurement of Electrical Parameters

DC Bridges: Measurement of resistance – Low (Kelvin's double bridge), medium (Wheatstone bridge), and high resistance (Loss of charge method).

AC Bridges: Measurement of inductance (Maxwell's Bridge) and capacitance (Schering Bridge), Numerical problems.

UNIT – IV

Transducers and Sensors

Classification of Transducers: Basics and applications. Resistive: Strain Gauge. Inductive:

Linear Variable Differential Transformer (LVDT). Capacitive: Piezoelectric – Applications

UNIT – V

Introduction to Digital Measurement

Digital Instruments: Digital Voltmeters (Successive approximation type), Digital Frequency Meters and Multimeters, Digital Tachometers and Energy Meters, – Overview and applications.

Text Books:

1. Electrical & Electronic Measurement & Instruments by A.K.Sawhney, Dhanpat Rai & Co. Publications – 19th revised edition - 2011.
2. Electronic Instrumentation by H.S.Kalsi - THM.

Reference Books:

1. Electrical Measurements and measuring Instruments by E.W. Golding and F.C.Widdis - 5 th Edition - Wheeler Publishing.
2. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper - PHI - 5th Edition - 2002.
3. Electrical and Electronic Measurements and instrumentation by R.K.Rajput - S.Chand - 3rdedition.

Course Outcomes:

After completing the course, the student will be able to:

1. Choose the appropriate instrument for the measurement of AC and DC voltage and current.
2. Analyse the operation of wattmeters and energy meters.
3. Differentiate between the operations of AC and DC bridges.
4. Describe the working principles of various transducers.
5. Recognize the importance of digital meters and explain their working principles.
6. Understand the Digital Frequency Meters and Multimeters.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/105/108105153

B. Tech- Semester **Course Code:** **L T P C**

3 0 0 3

CONCEPTS OF POWER SYSTEM ENGINEERING

Minor Engineering Courses (Except EEE Branch)

Internal Marks: 30
External Marks: 70

Pre-requisite: Basic Electrical Engineering

Course Objectives:

1. To understand the types of electric power plants and their working principles.
2. To understand the concepts of electric power transmission and distribution.
3. To gain the knowledge of protection and grounding of power system components.
4. To learn the economic aspects of electrical energy.
5. To learn the importance of power factor improvement and voltage control.

UNIT - I

Electrical power Generation Concepts & Types

Sources for Generation of Electrical Energy – working principle and Schematic diagram approaches of Thermal Power Plant – Hydro Power Plant - Nuclear Power Plant – Gas Power Plants – Comparison between Power Plants. Importance of Renewable energy sources.

UNIT - II

Transmission and Distribution Concepts

Types of Conductors Materials – Parameters of Transmission Line – Classification of Overhead Transmission Lines – Performance of Short Transmission Lines – Simple Problems.

Basic concepts of Sub Station – Distribution Systems – Connection Schemes of Distribution Systems – Structure of Cables – Differences between Overhead & Underground systems.

UNIT - III

Protection and Grounding

List of Faults – Basic concepts of fuse – Circuit Breakers – Relays – SF_6 Circuit Breakers – Vacuum Circuit Breakers – Operation of Lightning Arrester –

Grounding and its advantages - Methods of Neutral Grounding: Resistance - Reactance and Resonant Grounding – Numerical Problems.

UNIT - IV

Economic Aspects

Definitions of Load – Load curves& Load Duration Curves - Load Factor - Demand Factor – Utilization Factor – Types of Tariff - Cost of Electrical Energy – Expression for Cost of Electrical Energy – Numerical Problems.

UNIT - V

Power Factor Improvement and Voltage Control

Power Factor – Effects and Causes of low Power Factor- Shunt & Series Capacitor Compensation - Numerical Problems – Need of Voltage Control – Types of Voltage regulating Devices.

Text Book:

1. Principles of Power System, V K Mehta and Rohit Mehta, S.Chand Publishers, 2022.

Reference Book:

1. Electrical Power Systems, C.L. Wadhwa, New Age International Publishers, 2012.

Course Outcomes:

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

1. Know the concepts of power generation by various types of power plants.
2. Learn about short transmission line parameters and distribution systems schemes.
3. Learn about protection equipment and grounding methods of power system.
4. Calculate the tariff by applying the economic aspects of electrical energy.
5. Know the importance of power factor improvement and voltage control in power systems.
6. Understand the Types of Voltage regulating Devices.

Online Learning Resources:

1. https://nptel.ac.in/courses/108102047

B. Tech- Semester **Course Code:** **L T P C**

3 0 0 3

FUNDAMENTALS OF POWER ELECTRONICS

Minor Engineering Courses (Except EEE Branch)

Internal Marks: 30
External Marks: 70

Pre-requisite:

Basic concepts of Electrical and Electronic Circuits and Semiconductor Physics.

Course Objectives:

1. To know the characteristics of various power semiconductor devices.
2. To learn the operation of single phase full–wave converters.
3. To learn the operation of three phase full–wave converters and AC/AC converters.
4. To learn the operation of different types of DC-DC converters.
5. To learn the operation of PWM inverters for voltage control.

UNIT – I

Power Semi-Conductor Devices

Power Diode – Characteristics –Silicon controlled rectifier (SCR) – Two transistor analogy - Static and Dynamic characteristics– Turn-on Methods.

Static and Dynamic Characteristics of Power MOSFET and Power IGBT.

UNIT – II

Single-phase AC-DC Converters

Single-phase half wave-controlled rectifiers - R load and RL load with and without freewheeling diode - Single-phase fully controlled bridge converter with R load and RL load - Continuous conduction - Expression for output voltages – Single-phase Semi-Converter with R load and RL load– Continuous conduction.

UNIT – III

Three-phase AC-DC Converters & AC – AC Converters

Three-phase fully controlled rectifier with R and RL load - Three-phase semi converter with R and RL load - Expression for Output Voltage.

AC power control by phase control with R and RL loads - Expression for rms output voltage.

UNIT – IV

DC–DC Converters

Basic Chopper Operation with R and RL load–Step-up chopper –Classification of

Choppers –Time Ratio Control –Current Limit Control.

UNIT - V

DC–AC Converters

Introduction - Single-phase half bridge and full bridge inverters with R and RL loads – Voltage control of Single-phase inverters –PWM inverters - Sinusoidal Pulse Width Modulation.

Text Books:

1. Power Electronics – by P.S.Bhimbra - Khanna Publishers.
2. Power Electronics: Essentials & Applications by L.Umanand - Wiley - Pvt. Limited - India - 2009.

Reference Books:

1. Power Electronics: Converters - Applications and Design by Ned Mohan - Tore M Undeland - William P Robbins - John Wiley & Sons.
2. Power Electronics: Circuits - Devices and Applications – by M. H. Rashid - Prentice Hall of India - 2nd edition - 1998
3. Power Electronics: by Daniel W.Hart - Mc Graw Hill.

Course Outcomes:

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

1. Illustrate the static and dynamic characteristics SCR - Power MOSFET and Power IGBT.
2. Analyse the operation of phase controlled rectifiers.
3. Analyse the operation of Three-phase full–wave converters - AC Voltage Controllers.
4. Examine the operation and design of different types of DC-DC converters.
5. Analyse the operation of PWM inverters for voltage control.
6. Understand the single-phase half bridge operation.

Online Learning Resources:

1. https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007
2. https://archive.nptel.ac.in/courses/108/101/108101126

B. Tech- Semester **Course Code:** **L T P C**

3 0 0 3

FUNDAMENTALS OF UTILIZATION OF ELECTRICAL ENERGY

Minor Engineering Courses (Except EEE Branch)

Internal Marks: 30
External Marks: 70

Pre Requisites:
Electrical Machines, Power Electronics and Drives and Power Systems –II.

Course Objectives:
To make the students learn about:

1. Able to maintain electric drives used in an industries.
2. Able to identify a heating/ welding scheme for a given application.
3. Able to maintain/ Trouble shoot various lamps and fittings in use.
4. Able to figure-out the different schemes of traction schemes and its main components.
5. Able to design a suitable scheme of speed control for the traction systems.

UNIT – I
Electric Drives
Type of electric drives, choice of motor, starting and running characteristics, speed control, temperature rise – cooling and heating time constant, applications of electric drives, types of industrial loads, continuous, intermittent and variable loads, load equalization.

UNIT – II
Electric Heating and Welding
Advantages and methods of electric heating, resistance heating, induction heating and dielectric heating. Electric welding, resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding.

UNIT – III
Fundamentals of Illumination
Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light. Discharge lamps, MV and SV lamps – comparison between tungsten filament lamps and fluorescent tubes, Basic principles of light control, Types and design of lighting and flood lighting.

UNIT – IV
Electric Traction – I
System of electric traction and track electrification, Review of existing electric traction systems in India, Special features of traction motor, methods of electric braking-plugging, rheostatic braking and regenerative braking.

UNIT – V

Electric Traction –II

Mechanics of train movement. Speed-time curves for different services – trapezoidal and quadrilateral speed time curves. Calculations of tractive effort, power, specific energy consumption for given run, effect of varying acceleration and braking retardation, adhesive weight, braking retardation, and coefficient of adhesion.

Text Books:

1. Utilization of Electric Energy, E. Openshaw Taylor and V. V. L. Rao, Universities Press, 2009.
2. Art & Science of Utilization of electrical Energy, Partab, Dhanpat Rai & Co., 2004.
3. Utilization of Electrical Power including Electric drives and Electric traction – by J.B.Gupta, S.K. Kataria & Sons.

Reference Books:

1. Generation, distribution and utilization of electrical energy, C.L Wadhwa, Wiley Eastern Limited,1993.
2. Electrical Power, S. L. Uppal, Khanna pulishers,1988.

Course Outcomes:

After learning the course, the students should be able to

1. Get knowledge of electric drives used in an industries
2. Get knowledge of principle of electric heating, welding and its applications and design simple resistance furnaces.
3. Design residential illumination schemes.
4. Get knowledge of electric braking methods, control of traction motors
5. Calculate tractive effort, power, acceleration and velocity of traction.
6. Understand the operation of braking retardation

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/104/108104140
2. https://nptel.ac.in/courses/108105060

B. Tech- Semester **Course Code:** **L T P C**

3 0 0 3

BASICS OF ELECTRIC DRIVES AND APPLICATIONS

Minor Engineering Courses (Except EEE Branch)

Internal Marks: 30
External Marks: 70

Pre-requisite:

Electrical Machines, Control Systems and Fundamentals of Power Electronics.

Course Objectives:

To make the students learn about:

1. To learn the fundamentals of electric drive and different electric braking methods.
2. To analyze the operation of single phase converter controlled dc motors and four quadrant operation of dc motors using dual converters.
3. To discuss the DC-DC converter control of dc motors in various quadrants.
4. To understand the concept of speed control of induction motor by using AC voltage controllers and voltage source inverters.
5. To understand the speed control mechanism of synchronous motors

UNIT - I

Fundamentals of Electric Drives

Electric drive and its components– Fundamental torque equation – Load torque components – Classification of load torques –Load equalization– Four quadrant operation of drive (hoist control).

UNIT - II

Controlled Converter Fed DC Motor Drives

1-phase half and fully-controlled converter fed separately and self-excited DC motor drive – Output voltage and current waveforms and their expressions – Speed-torque characteristics.

UNIT - III

DC–DC Converters Fed DC Motor Drives

Single quadrant – Two quadrant and four quadrant DC-DC converter fed separately excited and self-excited DC motors – Continuous current operation -Output voltage and current waveforms – Speed–torque characteristics.

UNIT - IV

Control of 3-phase Induction motor Drives

Stator voltage control using 3-phase AC voltage regulators – Waveforms –Speed torque

characteristics– Variable Voltage Variable Frequency control. Static rotor resistance control– Static Scherbius drive – Static Kramer drive – Performance and speed torque characteristics.

UNIT - V

Control of Synchronous Motor Drives

Separate control of synchronous motor – self-control of synchronous motor employing load commutated thyristor inverter - closed loop control of synchronous motor drive (qualitative treatment only).

Text Books:

1. Fundamentals of Electric Drives, G. K. Dubey, Narosa Publications, 2002.
2. Power Semiconductor Drives, S.B.Dewan, G.R.Slemon, A.Straughen, WileyIndia, 2009.

Reference Books:

1. Electric Motors and Drives Fundamentals- Types and Apllications - by Austin Hughes and Bill Drury - Newnes.4th edition - 2013.
2. Thyristor Control of Electric drives – Vedam Subramanyam Tata McGraw Hill Publications- 1987.
3. Power Electronic Circuits- Devices and applications by M.H.Rashid - PHI - 3rd edition -2009.
4. Power Electronics handbook by Muhammad H.Rashid- Elsevier - 2nd edition - 2010.

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

1. Explain the fundamentals of electric drive and different electric braking methods.
2. Analyze the operation of single-phase converter fed dc motors and four quadrant operations of DC motors using dual converters.
3. Describe the converter control of DC motors in various quadrants of operation
4. Know the concept of speed control of induction motor by using AC voltage controllers.
5. Explains the speed control mechanism of synchronous motors.
6. Understand the operation of closed loop control of synchronous motor drive.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/104/108104140
2. https://nptel.ac.in/courses/108104011