JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOUMS)
KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA.
B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

II YEAR COURSE STRUCTURE & SYLLABI

B. Tech II Year-I Semester

S. No.	Category	Title	L/D	T	P	Credits
1	23ABS10	Complex Variables & NumericalMethods	3	0	0	3
2	23AHS04	Universal Human Values-Understanding Harmony	2	1	0	3
3	23AEE02	Electromagnetic Field Theory	3	0	0	3
4	23AEE03T	Electrical Circuit Analysis-II	3	0	0	3
5	23AEE04T	DC Machines & Transformers	3	0	0	3
6	23AEE03P	Electrical Circuit Analysis-II and Simulation Lab	0	0	3	1.5
7	23AEE04P	DC Machines & Transformers Lab	0	0	3	1.5
8	23ACS08	**Skill oriented course – I** Data Structures	0	1	2	2
9	23AHS03	Environmental Science	2	0	0	-
Total			**16**	**2**	**8**	**20**

B. Tech II Year-II Semester

S. No.	Category	Title	L/D	T	P	Credits
1	23AHS05a 23AHS05b 23AHS05c	Managerial Economics and FinancialAnalysis Organizational Behavior Business Environment	2	0	0	2
2	23AEE05	Analog Circuits	3	0	0	3
3	23AEE06	Power Systems-I	3	0	0	3
4	23AEE07T	Induction and Synchronous Machines	3	0	0	3
5	23AEE08T	Control Systems	3	0	0	3
6	23AEE07P	Induction and Synchronous Machines Lab	0	0	3	1.5
7	23AEE08P	Control Systems Lab	0	0	3	1.5
8	23ACS07	**Skill oriented course – II** Python Programming	0	1	2	2
9	23AME11	Design Thinking & Innovation	1	0	2	2
Total			**15**	**1**	**10**	**21**

Mandatory Community Service Project of 08 weeks duration during summer vacation

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B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	COMPLEX VARIABLES & NUMERICAL METHODS	L	T	P	C
23ABS10		3	0	0	3
Semester	**II B. Tech I Semester**				

Course Objectives:

- To expose to the field of complex variables and numerical methods, and their applications in electrical engineering.

CO1: Analyze the behavior of a complex function and understand Cauchy-Riemann equations in testing the analytic functions. (L2, L3).

CO2: Understand the Cauchy integral theorem and use the Cauchy integral formula in evaluating the complex integrals. Expand the complex functions in series and able to find residues and evaluate complex integrals using the residue theorem. (L3, L5).

CO3: Apply numerical methods to solve algebraic and transcendental equations and estimate the predictions through interpolation. (L3).

CO4: Apply the concept of numerical differentiation and integration in solving the related problems. (L2, L3).

CO5: Solve the initial value problems of a single variable. (L3, L5).

Course Outcomes (CO): Student will be able to

Unit - I	**COMPLEX VARIABLE – DIFFERENTIATION**

Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method.

Unit - II	**COMPLEX VARIABLE – INTEGRATION**

Line integral, Cauchy's integral theorem (Simple Case), Cauchy Integral formula. Power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series.

Unit - III	**SOLUTION OF ALGEBRAIC, TRANSCENDENTAL EQUATIONS & INTERPOLATION**

Introduction-Bisection Method-Iterative method, Regula-falsi method and Newton Raphson method, Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae

Unit - IV	**NUMERICAL DIFFERENTIATION, INTEGRATION AND CURVE FITTING**

Numerical differentiation and integration: Numerical differentiation based on Newton's interpolation, Trapezoidal rule, Simpson's 1/3 rule and Simpson's 3/8 rule.
Curve fitting: Fitting of straight line, second-degree and Exponential curve by method of least squares.

Unit - V	**SOLUTION OF INITIAL VALUE PROBLEMS TO ORDINARY DIFFERENTIAL EQUATIONS**

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's and modified Euler's methods-Runge-Kutta methods (second and fourth order).

Learning Resources:

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers,2017, New Delhi.
2. S. S. Sastry, Introductory Methods of Numerical Analysis, 4/e, PHI, 2006, New Delhi.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.
2. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill, 2006, New Delhi.
3. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science International Ltd., 2002.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ma14/preview
2. https://onlinecourses.nptel.ac.in/noc20_ma50/preview
3. http://nptel.ac.in/courses/111105090

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B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	UNIVERSAL HUMAN VALUES- UNDERSTANDING HARMONY (Common to All Branches)	L	T	P	C
23AHS04		2	1	0	3
Semester	**II B. Tech I Semester**				

Course Objectives:

- 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.
- 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.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

CO1: Define the terms like Natural Acceptance, Happiness and Prosperity. L1, L2
CO2: Identify one's self, and one's surroundings (family, society nature). L1, L2
CO3: Apply what they have learnt to their own self in different day-to-day settings in real life. L3
CO4: Relate human values with human relationship and human society. L4
CO5: Justify the need for universal human values and harmonious existence. L5
CO6: Develop as socially and ecologically responsible engineers. L3, L6

Course Outcomes (CO): Student will be able to

Unit - I **INTRODUCTION TO VALUE EDUCATION**

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 – the Basic Human Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfil the Basic Human Aspirations
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

Unit - II **HARMONY IN THE HUMAN BEING**

Lecture 7: Understanding Human being as the Co-existence of the self and the 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 body
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**

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**
Lecture 19: Understanding Harmony in the Nature Lecture 20: Interconnectedness, self-regulation and Mutual fulfilment among the Four Orders of Nature Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature Lecture 21: Realizing Existence as Co-existence at All Levels Lecture 22: The Holistic Perception of Harmony in Existence Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence	
Unit - V	**IMPLICATIONS OF THE HOLISTIC UNDERSTANDING – A LOOK AT PROFESSIONAL ETHICS**
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 Models in Education Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies Lecture 28: Strategies for Transition towards Value-based Life and Profession Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order	
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 – Implications of the Holistic Understanding – a Look at Professional Ethics PS12 Exploring Ethical Human Conduct PS13 Exploring Humanistic Models in Education PS14 Exploring Steps of Transition towards Universal Human Order	
Learning Resources:	

Textbooks:

1. The Textbook R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. The Teacher's Manual R R Gaur, R Asthana, G P Bagaria,Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 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 - by Mohandas Karamchand Gandhi
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 – PanditSunderlal
9. Rediscovering India - by Dharampal
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)

Web 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://fdp-si.aicte-india.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

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B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	ELECTROMAGNETIC FIELD THEORY	L	T	P	C
23AEE02		3	0	0	3
Semester	**II B. Tech I Semester**				

Course Objectives:

- To understand the basic principles of electrostatics
- To understand the basic principles of magneto statics for time invariant and time varying fields
- To understand the principles of dielectrics, conductors and magnetic potentials

Course Outcomes (CO): Student will be able to

CO1: Remember the concepts of vector algebra, vector calculus, various fundamental laws, self and mutual inductance (L1)
CO2: Understand the concepts of electrostatics, conductors, dielectrics, capacitance, magneto statics, magnetic fields, time varying fields, self and mutual inductances (L2)
CO3: Apply vector calculus, Coulomb's law, Gauss's law, Ohm's law in point form, Biot-Savart's law, Ampere's circuital law, Maxwell's third equation, self and mutual inductances, Faraday's laws, Maxwell's fourth equation, Poynting theorem to solve various numerical problems (L3)
CO4: Analyze vector calculus, electrostatic fields, behaviour of conductor in electric filed, Biot-Savart's law and its applications (L4)
CO5: Analyze magnetic force, moving charges in a magnetic field, self-inductance of different cables, mutual inductance between different wires and time varying fields (L5)

Unit - I **VECTOR ANALYSIS:**

Vector Algebra: Scalars and Vectors, Unit vector, Vector addition and subtraction, Position and distance vectors, Vector multiplication, Components of a vector.
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 vector and Stoke's theorem (definition only), Laplacian of a scalar.
Electrostatics:
Coulomb's law and Electric field intensity (EFI) – EFI due to Continuous charge distributions (line and surface charge), Electric flux density, $\nabla . \vec{D} = \rho_v$), Gauss's law (Maxwell's first equation, Applications of Gauss's law, Electric Potential, Work done in moving a point charge in an electrostatic field $\nabla \times \vec{E} = 0$), (second Maxwell's equation for static electric fields, Potential gradient, Laplace's and Poison's equations.

Unit - II **CONDUCTORS – DIELECTRICS AND CAPACITANCE:**

Behaviour of conductor in Electric field, Electric dipole and dipole moment – Potential and EFI due to an electric dipole, Torque on an Electric dipole placed in an electric field, Current density-conduction and convection current densities, Ohm's law in point form, Behaviour of conductors in an electric field, Polarization, dielectric constant and strength, Continuity equation and relaxation time, Boundary conditions between conductor to dielectric, dielectric to dielectric and conductor to free space, Capacitance of parallel plate, coaxial and spherical capacitors, Energy stored and density in a static electric field, Coupled and decoupled capacitors.

Unit - III **MAGNETO STATICS, AMPERE'S LAW AND FORCE IN MAGNETIC FIELDS:**

Biot-Savart's law and its applications viz. Straight current $(\nabla \times \vec{H} = \vec{J})$. carrying filament, circular, square, rectangle and solenoid current carrying wire – Magnetic flux $(\nabla . \vec{B} = 0)$. density and Maxwell's second Equation Ampere's circuital law and its applications viz. MFI due to an infinite sheet, long filament, solenoid, toroidal current carrying conductor, point form of Ampere's circuital law, Maxwell's third equation Magnetic force, moving charges in a magnetic field – Lorentz force equation, force on a 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 and parallel current carrying conductors, Magnetic dipole, Magnetic torque, and moment.

Unit - IV	**SELF AND MUTUAL INDUCTANCE:**

Self and mutual inductance – determination of self-inductance of a solenoid, toroid, coaxial 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	**TIME VARYING FIELDS:**

Faraday's laws of electromagnetic induction, Maxwell's fourth equation $\left(\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}\right)$.

integral and point forms of Maxwell's equations, statically and dynamically induced EMF, Displacement current, Modification of Maxwell's equations for time varying fields, Poynting theorem and Poynting vector.

Learning Resources:

Textbooks:

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

Reference Books:

1. "Introduction to Electro Dynamics" by D J Griffiths, Prentice-Hall of India Pvt. Ltd, 2nd edition.
2. "Electromagnetic Field Theory" by Yaduvir Singh, Pearson India, 1st edition, 2011.
3. "Fundamentals of Engineering Electromagnetics" by Sunil Bhooshan, Oxford University Press, 2012.
4. Schaum's Outline of Electromagnetics by Joseph A. Edminister, MahamoodNavi, 4th Edition,2014.

Web Resources:

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

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B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	ELECTRICAL CIRCUIT ANALYSIS-II	L	T	P	C
23AEE03T		3	0	0	3
Semester	**II B. Tech I Semester**				

Course Objectives:

- To distinguish between balanced and unbalanced circuits
- To know about phasor relationships of voltage, current, power in star and delta connected balanced and unbalanced loads
- To know about measurement of active, reactive powers in balanced circuits
- To understand about analysis of unbalanced circuits and power calculations

Course Outcomes (CO): Student will be able to

CO1: Remember the concepts of Laplace transforms, formulation of various circuit topologies (R, L and C components) and basic filters (L1)
CO2: Understand three phase balanced and unbalanced circuits, different circuit configurations and it's mathematical modelling, network parameters and various filters (L2)
CO3: Apply Laplace transforms to solve various electrical network topologies and filter design concepts (L3)
CO4: Analyze three phase circuits, transient response of various network topologies, electric circuits with periodic excitations and filter characteristics (L4)
CO5: Design suitable electrical circuits and various filters for different applications (L5)

Unit - I	**ANALYSIS OF THREE PHASE BALANCED UNBALANCED CIRCUITS:**

Analysis of three phase unbalanced circuits:
Phase sequence, star and delta connection of sources and loads, relation between line and phase quantities, analysis of balanced three phase circuits, 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 & TRANSIENT ANALYSIS**

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**

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**

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	FILTERS

Filters: Classification of filters-Low pass, High pass, Band pass and Band Elimination filters, Constant-k filters -Low pass and High Pass, Design of Filters.

Learning Resources:

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

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. KulshreshthaGopal G. Bhise, Prem R. Chadha, Umesh Publications 2012.
5. Circuit Theory: Analysis and Synthesis, A. Chakrabarti, DhanpatRai& Co., 2018, 7th Revised Edition

Web Resources:

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

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B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	DC MACHINES & TRANSFORMERS	L	T	P	C
23AEE04T		3	0	0	3
Semester	**II B. Tech I Semester**				

Course Objectives:

Student will be able to
- Study magnetic materials, electromechanical energy conversions, principle and operation of DC machines and transformers and starters.
- understand the constructional details of DC machines and Transformers
- Analyze the performance characteristics of DC machines and transformer
- Evaluate efficiency, regulation and load sharing of DC machines and transformers Design Equivalent circuit of transformer

Course Outcomes (CO): Student will be able to

CO1: Understand the process of voltage build-up in DC generators and characteristics. (L2)
CO2: Understand the process of torque production, starting and speed control of DC motors and illustrate their characteristics. (L2)
CO3: Obtain the equivalent circuit of single-phase transformer, auto transformer and determine its efficiency & regulation. (L3)
CO4: Apply various testing methods for transformers and speed control of DC motors (L3)
CO5: Analyze various configurations of three-phase transformers. (L4)

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, Applications.

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, Applications.

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.

Learning Resources:
Textbooks: 1. Electrical Machinery by Dr. P S Bimbhra, 7th edition, Khanna Publishers, New Delhi,1995. 2. Performance and analysis of AC machines by M.G. Say, CBS, 2002.
1. Electrical Machines by D. P.Kothari, I .J .Nagarth, McGraw Hill Publications, 5th edition 2. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2011. 3. Generalized Theory of Electrical Machines by Dr. P S Bimbhra, 7th Edition, Khanna Publishers, 2021. 4. Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria& Sons,2007. 5.Electric Machinery by Fitzgerald, A.E.,Kingsley, Jr.,C.,&Umans, S. D, 7th edition, McGraw-Hill Education, 2014.
Web Resources: 1. nptel.ac.in/courses/108/105/108105112 2. nptel.ac.in/courses/108/105/108105155

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B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	ELECTRICAL CIRCUIT ANALYSIS-II AND SIMULATION LAB	L	T	P	C
23AEE03P		0	0	3	1.5
Semester	**II B. Tech I Semester**				

Course Objectives:

To impart hands on experience in verification of circuit laws and theorems, measurement of circuit parameters, study of circuit characteristics. It also gives practical exposure to the usage of different circuits with different conditions.

Course Outcomes (CO): By the end of the course, the student will be able to:

CO1: Understand the power calculations in three phase circuits. (L2)
CO2: Analyze the time response of given network. (L4)
CO3: Determination of two port network parameters. (L4)
CO4: Simulate and analyze electrical circuits using software tools (L4)
CO5: Apply various theorems to solve different electrical networks using simulation tools (L3)

List of Experiments:

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 parameters
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.

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B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	DC MECHANICS & TRANSFORMERS LAB	L	T	P	C
23AEE04P		0	0	3	1.5
Semester	**II B. Tech I Semester**				

Course Objectives:

To conduct various experiments on
- DC motors and DC Generators
- The speed control techniques of DC motors.
- To conduct various experiments for testing on 1-phase transformers

Course Outcomes (CO): By the end of the course, the student will be able to:

CO1: Able to conduct and analyze load test on DC shunt generator
CO2: Able to understand and analyze magnetization characteristics of DC shunt generator
CO3: Able to understand and analyze speed control techniques and efficiency of DC machines
CO4: Able to understand to predetermine efficiency and regulation of single-phase Transformers

List of Experiments:

All the following ten experiments are required 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.

Learning Resources:

Reference Books:

D. P. Kothari and B. S. Umre, Laboratory Manual for Electrical Machines, I.K International Publishing House Pvt. Ltd., 2017

Web Resources:

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

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KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA.
B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	Skill oriented course – I DATA STRUCTURES	L	T	P	C
23ACS08		0	1	2	2
Semester	**II B. Tech I Semester**				

Course Objectives:

➢

CO1: Understand the role of data structures in organizing and accessing data (L2).
CO2: Design, implement and apply linked lists for dynamic data storage (L3).
CO3: Develop applications using stacks and queues (L5).
CO4: Design and implement algorithms for operations on binary trees and binary search trees (L5).
CO5: Design novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees (L5).

Course Outcomes (CO): Student will be able to

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 etc.

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:

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

Learning Resources:

Textbooks:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2. Fundamentals of data structures in C, Ellis Horowitz, SartajSahni, Susan AndersonFreed, 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

Web Resources:

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B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	ENVIRONMENTAL SCIENCE (Common to All Branches)	L	T	P	C
23AHS03		2	0	0	0
Semester	**II B. Tech I Semester**				

Course Objectives:

- To make the students to get awareness on environment.
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life.
- To save earth from the inventions by the engineers.
- To understand the problems related to social issues and Wild life protection acts.
- To know the importance of value education and welfare programs.

CO1: Grasp multidisciplinary nature of environmental studies and various renewable and non-renewable resources.

CO2: Understand flow and bio-geo chemical cycles and ecological pyramids.

CO3: Understand various causes of pollution and solid waste management and related preventive measures.

CO4: About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.

CO5: Cause of population explosion, value education and welfare programs.

Course Outcomes (CO): Student will be able to

Unit - I

Multidisciplinary Nature of Environmental Studies: — Definition, Scope and Importance — Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources — Natural resources and associated problems — Forest resources — Use and over — exploitation, 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 — Floods, drought, conflicts over water, dams — benefits and problems — Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies — Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. — Energy resources:

Learning outcomes:

At the end of this unit, the students will be able to

• To know the importance of public awareness

• Explain how natural resources should be used.

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 0 Definition: genetic, species and 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-wildlife conflicts — Endangered and endemic species of India — Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Learning outcomes:

At the end of this unit, the students will be able to

- To get a clear picture of echo systems and their characteristics.
- To get awareness about land degradation, soil erosion and desertification.

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.

Learning outcomes:

At the end of this unit, the students will be able

- To understand the causes, effects and preventive measures of various pollution.
- To understand the various sources of solid waste and preventive measures.
- To know about the different types of disasters and their managerial measures.

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.

Learning outcomes:

At the end of this unit, the students will be able to

- To know about the social issues related to environment and their protection acts.
- To know about the various sources of conservation of natural resources.

Unit - V	

Human Population and The Environment: Population growth, variation among nations. Population explosion — Family Welfare Programs. — 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...

Learning outcomes:

At the end of this unit, the students will be able

• To understand population explosion and family welfare programs.

To identify the natural assets and related case studies.

Learning Resources:

Textbooks:

1. Text book of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press, 2nd Edition, 2013.
2. Palaniswamy, "Environmental Studies", Pearson education, 2nd Edition. 2014.
3. K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", Scitech Publications (India), Pvt. Ltd., 2010.

Reference Books:

1. Deeksha Dave and E.Sai Baba Reddy, "Textbook of Environmental Science", Cengage Publications, Revised Edition, 2023.
2. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications, 3rd Edition, 2009.
3. J. G. Henry and G. W. Heinke, "Environmental Sciences and Engineering", Prentice hall of India Private limited, 2nd Edition 2007.
4. G.R. Chatwa1, "A Text Book of Environmental Studies" Himalaya Publishing House, 1st edition, 2004.
5. G. M. Masters and W. P. Ela, "Introduction to Environmental Engineering and Science, Prentice hall of India Private limited, 3rd Edition, 2008.

Web Resources:

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B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (Common to All Branches)	L	T	P	C
23AHS05a		2	0	0	2
Semester	**II B. Tech II Semester**				

Course Objectives:

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

CO1: Define the concepts related to Managerial Economics, financial accounting and management(L2)
CO2: Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets (L2).
CO3: Apply the Concept of Production cost and revenues for effective Business decision (L3).
CO4: Analyze how to invest their capital and maximize returns (L4).
CO5: Evaluate the capital budgeting techniques (L5).
CO6: Develop the accounting statements and evaluate the financial performance of business entity (L5).

Course Outcomes (CO): Student will be able to

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- ISO-quant's and ISO-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 Competition– Oligopoly-Price-Output Determination - Pricing Methods and Strategies

Unit - IV	CAPITAL BUDGETING

Introduction – Nature, meaning, 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.	
Learning Resources:	
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.	
Web Resources:	

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B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	ORGANIZATIONAL BEHAVIOUR (Common to All Branches)	L	T	P	C
23AHS05b		2	0	0	2
Semester	**II B. Tech II Semester**				

Course Objectives:
- To enable student's comprehension of organizational behaviour.
- To offer knowledge to students on self-motivation, leadership and management.
- To facilitate them to become powerful leaders.
- To Impart knowledge about group dynamics.
- To make them understand the importance of change and development.

CO1: Define the Organizational Behaviour, its nature and scope (L2).
CO2: Understand the nature and concept of Organizational behaviour (L2).
CO3: Apply theories of motivation to analyse the performance problems (L3).
CO4: Analyse the different theories of leadership (L4).
CO5: Evaluate group dynamics (L5).
CO6: Develop as powerful leader (L5).

Course Outcomes (CO): Student will be able to

Unit - I	**INTRODUCTION TO ORGANIZATIONAL BEHAVIOUR**

Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective - Understanding Individual Behaviour –Attitude -Perception - Learning – Personality.

Unit - II	**MOTIVATION AND LEADING**

Theories of Motivation- Maslow's Hierarchy of Needs - Hertzberg's Two Factor Theory - Vroom's theory of expectancy – Mc Cleland's theory of needs–Mc Gregor's theory X and theory Y– Adam's equity theory.

Unit - III	**ORGANIZATIONAL CULTURE**

Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership - Traits Theory– Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Conflict Management -Evaluating Leader.

Unit - IV	**GROUP DYNAMICS**

Introduction – Meaning, scope, definition, Nature- Types of groups - Determinants of group Behaviour - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building - Conflict in the organization– Conflict resolution

Unit - V	**ORGANIZATIONAL CHANGE AND DEVELOPMENT**

Introduction –Nature, Meaning, scope, definition and functions- Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development

Learning Resources:

Textbooks:
1. Luthans, Fred, OrganisationalBehaviour, McGraw-Hill, 12 Th edition
2. P Subba Ran, OrganisationalBehaviour, Himalya Publishing House.

Reference Books:
1. McShane, Organizational Behaviour, TMH
2. Nelson, OrganisationalBehaviour, Thomson.
3. Robbins, P. Stephen, Timothy A. Judge, OrganisationalBehaviour, Pearson.
4. Aswathappa, OrganisationalBehaviour, Himalaya.

Web Resources:

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B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	BUSINESS ENVIRONMENT (Common to All Branches)	L	T	P	C
23AHS05c		2	0	0	2
Semester	**II B. Tech II Semester**				

Course Objectives:
- To make the student to understand about the business environment.
- To enable them in knowing the importance of fiscal and monitory policy.
- To facilitate them in understanding the export policy of the country.
- To Impart knowledge about the functioning and role of WTO.
- To Encourage the student in knowing the structure of stock markets.

CO1: Define Business Environment and its Importance (L2).
CO2: Understand various types of business environment (L2).
CO3: Apply the knowledge of Money markets in future investment (L3).
CO4: Analyze India's Trade Policy (L4).
CO5: Evaluate fiscal and monitory policy (L5).
CO6: Develop a personal synthesis and approach for identifying business opportunities (L5).

Course Outcomes (CO): Student will be able to

Unit - I	**OVERVIEW OF BUSINESS ENVIRONMENT**

Introduction – meaning Nature, Scope, significance, functions and advantages. Types- Internal &External, Micro and Macro. Competitive structure of industries -Environmental analysis- advantages & limitations of environmental analysis.

Unit - II	**FISCAL & MONETARY POLICY**

Introduction – Nature, meaning, significance, functions and advantages. Public Revenues - Public Expenditure - Evaluation of recent fiscal policy of GOI. Highlights of Budget- Monetary Policy - Demand and Supply of Money –RBI -Objectives of monetary and credit policy - Recent trends- Role of Finance Commission.

Unit - III	**INDIA'S TRADE POLICY**

Introduction – Nature, meaning, significance, functions and advantages. Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank - Balance of Payments– Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.

Unit - IV	**WORLD TRADE ORGANIZATION**

Introduction – Nature, Significance, Functions and Advantages. Organization And Structure - Role And Functions Of WTO In Promoting World Trade - GATT -Agreements In The Uruguay Round –TRIPS, TRIMS - Disputes Settlement Mechanism - Dumping And Anti-Dumping Measures.

Unit - V	**MONEY MARKETS AND CAPITAL MARKETS**

Introduction – Nature, meaning, significance, functions and advantages. Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI – Stock Exchanges- Investor protection and role of SEBI, Introduction to international finance.

Learning Resources:

Textbooks:

1. Francis Cherunilam, International Business: Text and Cases, Prentice Hall of India.
2. K. Aswathappa, Essentials of Business Environment: Texts and Cases & Exercises 13th Revised Edition.HPH

Reference Books:

1. K. V. Sivayya, V. B. M Das, Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
2. Sundaram, Black, International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.
3. Chari. S. N, International Business, Wiley India.
4. E. Bhattacharya, International Business, Excel Publications, New Delhi.

Web Resources:

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B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	ANALOG CIRCUITS	L	T	P	C
23AEE05		3	0	0	3
Semester	**II B. Tech II Semester**				

Course Objectives:
- Learn the concept of load line analysis and biasing techniques.
- To familiarize the concept of feedback amplifiers so as to differentiate positive and negative feedback.
- To introduce the basic building blocks of linear integrated circuits.
- Study about the concept of multivibrators.

CO1: Understand the concepts of diode clipping and clamping circuits, different amplifier configurations, operation of oscillator circuits, operational amplifiers, timers, ADC and DAC.

CO2: Apply the above concepts for different circuit design.

CO3: Analyze various circuit characteristics by using Amplifiers, Transistors, Comparators, Wave form generators, ADC and DAC.

CO4: Analyze various circuit characteristics by using timers, Phase locked loops and operational amplifiers.

CO5: Evaluate different system configurations by using various amplifier, transistor and waveform generators.

Course Outcomes (CO): Student will be able to

Unit - I

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 Variations in VBE and β for the Self-Bias Circuit, Bias Compensation, Thermal Runaway, 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 amplifiers.

Feedback Amplifiers: Classification of Amplifiers, the Feedback Concept, General Characteristics of Negative-Feedback Amplifiers, Effect of Negative Feedback upon Output and Input Resistances, Voltage-Series Feedback, Current-Series Feedback, Current-Shunt Feedback, Voltage-Shunt Feedback.

Unit - III

Oscillator Circuits: Barkhausen Criterion of oscillation, Oscillator operation, R-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.

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 timers, 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.

Learning Resources:

Textbooks:

1. Electronic Devices and Circuits- J. Millman, C.Halkias, Tata Mc-Graw Hill, 2nd Edition, 2010.
2. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition, 2003.

Reference Books:

1. Electronic Devices and Circuit Theory – Robert L.Boylestad and Lowis Nashelsky, Pearson Edition, 2021.
2. Electronic Devices and Circuits–G.K. Mithal, Khanna Publisher, 23rd Edition, 2017.
3. Electronic Devices and Circuits – David Bell, Oxford, 5thEdition, 2008.
4. Electronic Principles–Malvino, Albert Paul, and David J. Bates, McGraw-Hill/Higher Education, 2007.
5. Operational Amplifiers and Linear Integrated Circuits– Gayakwad R.A, Prentice Hall India, 2002.
6. Operational Amplifiers and Linear Integrated Circuits –Sanjay Sharma, Kataria & Sons, 2nd Edition,2010.
7. Design of Analog CMOS Integrated Circuits - Behzad Razavi

Web Resources:

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

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B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	POWER SYSTEMS-I	L	T	P	C
23AEE06		3	0	0	3
Semester	**II B. Tech II Semester**				

Course Objectives:

Student will be able to
- Operation of Conventional Power generating systems and their components.
- Evaluate efficiency, regulation and load sharing of substations.
- understand of distribution systems & underground cables
- Evaluate economic aspects & tariff of distribution systems

Course Outcomes (CO): Student will be able to

CO1: Understand the different types of power plants, operation of power plants. (L2)
CO2: Understand the concepts of distribution systems, underground cables, economic aspects and tariff. (L2)
CO3: Understand various substations that are located in distribution systems. (L2)
CO4: Apply the above concepts to illustrate different power generation layouts (L3)
CO5: Analyze various economic aspects related to power generation and distribution. (L4)

Unit - I	**HYDROELECTRIC & THERMAL POWER STATIONS**

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 breakers, main and transfer bus bar system with relevant diagrams.
Gas Insulated Substations (GIS) – advantages of gas insulated substations, constructional aspects of GIS, comparison of air insulated substations and gas insulated substations.

Unit - IV	**DISTRIBUTION SYSTEMS & UNDERGROUND CABLES**

Classification of Distribution systems, A.C Distribution, Overhead versus Underground system, Connection schemes of Distribution system, Requirements of Distribution system, Design considerations in Distribution system.

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 inters heath grading.

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, Time of Day (ToD) tariff and Time of Use (ToU) tariff.

Learning Resources:

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 System, S. Chand, 4th Edition, 2005.
4. Turan Gonen, Electric Power Distribution System Engineering, McGraw-Hill, 1985.
5. Handbook of switchgear, BHEL, McGraw-Hill Education, 2007.

Web Resources:

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

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B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	INDUCTION AND SYNCHRONOUS MACHINES	L	T	P	C
23AEE07T		3	0	0	3
Semester	**II B. Tech II Semester**				

Course Objectives:

- understand and performance of the 3-phase induction motors.
- constructional details and Evaluate efficiency, regulation of 1-Phase motors.
- understand and performance of the Synchronous Generator and Motor.

Course Outcomes (CO): Student will be able to

CO1: Understand the construction, principle and operation of single phase and three phase induction motors. (L2)
CO2: Understand the construction, principle and operation of synchronous generator and synchronous motor. (L2)
CO3: Understand various applications of various alternating machines. (L2)
CO4: Apply the above concepts to solve various mathematical and complex problems (L3)
CO5: Analyze the characteristics of induction motor, synchronous motor and synchronous generators. (L4)

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, Applications.

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, Applications.

Unit - IV	**SYNCHRONOUS GENERATOR**

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 alternators.

Unit - V	**SYNCHRONOUS MOTOR**

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, Applications.

Learning Resources:
Textbooks: 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.
Web Resources: 1. https://nptel.ac.in/courses/108/105/108105131 2. https://nptel.ac.in/courses/108106072

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B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	CONTROL SYSTEMS	L	T	P	C
23AEE08T		3	0	0	3
Semester	**II B. Tech II Semester**				

Course Objectives:

- Merits and demerits of open loop and closed loop systems; the effect of feedback.
- The use of block diagram algebra and Mason's gain formula to find the overall transfer function.
- Transient and steady state response, time domain specifications and the concept of Root loci.
- Frequency domain specifications, Bode diagrams and Nyquist plots.
- State space modelling of Control system.

Course Outcomes (CO): Student will be able to

CO1: Understand the concepts of various mathematical representations of control systems, Time response of first order and second order systems, stability, frequency response and fundamentals of modern control systems. (L2)
CO2: Apply Block diagram reduction, Signal flow graph, Routh criterion, Root locus, Bode, Polar, Nyquist concepts for solving various numerical problems. (L3)
CO3: Analyze time response characteristics, frequency response characteristics, stability analysis of various control systems. (L4)
CO4: Design various compensators and controllers for different control systems by using design procedures (L5)
CO5: Create suitable control systems for various real time applications. (L5)

Unit - I	**CONTROL SYSTEMS CONCEPTS**

Open loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feedback characteristics, Effects of positive and negative feedback, Mathematical models – Differential equations of translational and rotational mechanical systems and electrical systems, Analogous Systems, Block diagram reduction methods – Signal flow graphs - Reduction using Mason's gain formula. Principle of operation of DC and AC Servo motor, Transfer function of DC servo motor - AC servo motor, Synchros.

Unit - II	**TIME RESPONSE ANALYSIS**

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants, P, PI, PID Controllers.

Unit - III	**STABILITY ANALYSIS IN TIME DOMAIN**

The concept of stability – Routh's stability criterion – Stability and conditional stability – limitations of Routh's stability. The Root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

Unit - IV	**FREQUENCY RESPONSE ANALYSIS**

Introduction, Frequency domain Specifications-Bode Diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots- Phase margin and Gain Margin-Stability Analysis. Compensation techniques – Lag, Lead, Lag-Lead Compensator design in frequency Domain.

Unit - V	STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS

Concepts of state, state variables and state model, state models - differential equations & Transfer function models - Block diagrams. Diagonalization, transfer function from state model, Solving the Time invariant state Equations- State Transition Matrix and its Properties. System response through State Space models. The concepts of controllability and observability, Duality between controllability and observability.

Learning Resources:

Textbooks:

1. Modern Control Engineering by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5th edition, 2010.

2. Control Systems Engineering by I. J. Nagrath and M. Gopal, New Age International (P) Limited Publishers, 5th edition, 2007.

Reference Books:

1. Control Systems Principles & Design by M.Gopal, 4th Edition, Mc Graw Hill Education, 2012.

2. Automatic Control Systems by B. C. Kuo and Farid Golnaraghi, John wiley and sons, 8th edition, 2003.

3. Feedback and Control Systems, Joseph J Distefano III, Allen R Stubberud & Ivan J Williams, 2nd Edition, Schaum's outlines, Mc Graw Hill Education, 2013.

4. Control System Design by Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado, Pearson, 2000.

5. Feedback Control of Dynamic Systems by Gene F. Franklin, J.D. Powell and Abbas Emami-Naeini, 6th Edition, Pearson, 2010.

Web Resources:

1. https://nptel.ac.in/courses/108102043
2. https://nptel.ac.in/courses/108106098.

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B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	INDUCTION AND SYNCHRONOUS MACHINES LAB	L	T	P	C
23AEE07P		0	0	3	1.5
Semester	**II B. Tech II Semester**				

Course Objectives:

To conduct various experiments on
- Single Phase and Three Phase Induction motors
- Synchronous generator and motor

Course Outcomes (CO): By the end of the course, the student will be able to:

CO1: Analyze various performance characteristics of 3-phase and 1-phase induction motors (L4)
CO2: Evaluate the performance of 3-phase Induction Motor by obtaining the circle diagram and equivalent circuit of 3-phase Induction Motor and single phase induction motor (L4)
CO3: Adapt the power factor improvement methods for single phase Induction Motor (L3)
CO4: Pre-determine the regulation of 3-phase alternator (L3)
CO5: Determine the synchronous machine reactance of 3-phase alternator (L3)

List of Experiments:

All the following Ten experiments 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 Xd, Xq& 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.

Learning Resources:

Reference Books:

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

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B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	CONTROL SYSTEMS LAB	L	T	P	C
23AEE08P		0	0	3	1.5
Semester	**II B. Tech II Semester**				

Course Objectives:

- Determination of transfer functions of various systems and control of it by different methodologies.
- To provide knowledge in the analysis and design of controllers and compensators.
- The characteristics of servo mechanisms which are helpful in automatic control systems.
- To know the stability analysis using MATLAB.

CO1: Understand how to use feedback control system to determine transfer function of DC servo motor and any other given circuit with R, L and C components. (L2).
CO2: Model the systems and able to design the controllers and compensators. (L3).
CO3: Get the knowledge about the effect of poles and zeros location on transient and steady state behaviour of second order systems and implement through software tools. (L4).
CO4: Determine the performance and time domain specifications of first and second order systems. (L4).
CO5: Understand the stability analysis (L2).

Course Outcomes (CO): Student will be able to

List of Experiments:

1. Time response of Second order system
2. Characteristics of Synchros
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor.
4. Effect of feedback on DC servo motor
5. Transfer function of DC Machine
6. Effect of P, PD, PI, PID Controller on a second order system
7. Lag and lead compensation – Magnitude and phase plot
8. Temperature controller using PID
9. Characteristics of magnetic amplifiers
10. Characteristics of AC servo motor
11. Linear system analysis (Time domain analysis, Error analysis) using MATLAB.
12. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using MATLAB
13. State space model for classical transfer function using MATLAB – Verification.

Learning Resources:

Textbooks:

Reference Books:

Web Resources:

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B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	PYTHON PROGRAMMING (Common to All Branches)	L	T	P	C
23ACS07		0	0	2	1
Semester	**II B. Tech II Semester**				

Course Objectives:

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

CO1: Showcase adept command of Python syntax, deftly utilizing variables, data types, control structures, functions, modules, and exception handling to engineer robust and efficient code solutions. (L4).
CO2: Apply Python programming concepts to solve a variety of computational problems (L3).
CO3: Understand the principles of object-oriented programming (OOP) in Python, including classes, objects, inheritance, polymorphism, and encapsulation, and apply them to design and implement Python programs (L3).
CO4: Proficient in using commonly used Python libraries and frameworks such as JSON, XML, NumPy, pandas (L2)
CO5: Exhibit competence in implementing and manipulating fundamental data structures such as lists, tuples, sets, dictionaries (L3).

Course Outcomes (CO): Student will be able to

Unit - I

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter 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 if 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. Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String

Methods, Formatting Strings. Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:

7. Write a program to define a function with multiple return values.
8. Write a program to define a function using default arguments.
9. Write a program to find the length of the string without using any library functions.
10. Write a program to check if the substring is present in a given string or not.
11. Write a program to perform the given operations on a list:
    i. additionii. insertioniii. slicing
12. 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 Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Sample Experiments:

13. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
14. Write a program to count the number of vowels in a string (No control flow allowed).
15. Write a program to check if a given key exists in a dictionary or not.
16. Write a program to add a new key-value pair to an existing dictionary.
17. 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:

18. 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.
19. Python program to print each line of a file in reverse order.
20. Python program to compute the number of characters, words and lines in a file.
21. Write a program to create, display, append, insert and reverse the order of the items in the array.
22. Write a program to add, transpose and multiply two matrices.
23. 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, NumssssPy with Python, Pandas.

Sample Experiments:

24. Python program to check whether a JSON string contains complex object or not.
25. Python Program to demonstrate NumPy arrays creation using array () function.
26. Python program to demonstrate use of ndim, shape, size, dtype.
27. Python program to demonstrate basic slicing, integer and Boolean indexing.

28. Python program to find min, max, sum, cumulative sum of array
29. Create a dictionary with at least five keys and each key represent value 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
30. 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

Learning Resources:

Textbooks:

Reference Books:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

Web Resources:

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B.TECH.-ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	DESIGN THINKING & INNOVATION (Common to All Branches)	L	T	P	C
23AME11		2	0	0	2
Semester	**II B. Tech II Semester**				

Course Objectives:

- The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

CO1: Define the concepts related to design thinking. L1, l2
CO2: Explain the fundamentals of Design Thinking and innovation. L1, L2
CO3: Apply the design thinking techniques for solving problems in various sectors. L3
CO4: Analyze to work in a multidisciplinary environment. L4
CO5: Evaluate the value of creativity. L5
CO6: Formulate specific problem statements of real time issues. L3, L6

Course Outcomes (CO): Student will be able to

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, brain storming, 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, role of creativity and innovation in organizations- Creativity to Innovation- Teams for 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 PROCESSES

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining 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.

Learning Resources:
Textbooks: 1. Tim Brown, Change by design, Harper Bollins (2009) 2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.
Reference Books: 1. David Lee, Design Thinking in the Classroom, Ulysses press 2. Shrutin N Shetty, Design the Future, Norton Press 3. William Lidwell,Universal Principles of Design- Kritinaholden, Jill Butter. 4. Chesbrough.H, The Era of Open Innovation – 2013
Web Resources: 1. https://nptel.ac.in/courses/110/106/110106124/ 2. https://nptel.ac.in/courses/109/104/109104109/ 3. https://swayam.gov.in/nd1_noc19_mg60/preview