PROGRAM STRUCTURE
AND
SYLLABUS

ELECTRICAL AND ELECTRONICS ENGINEERING

For

B.Tech FOUR YEARS DEGREE PROGRAM

(DR24 Applicable for batches admitted from 2024-2025)

D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

(Approved by AICTE, New Delhi & Affiliated to JNTUK, Kakinada)

(Accredited with A^{++}Grade by NAAC & Accredited by NBA (B.Tech-CSE, ECE & EEE))

BALUSUMUDI, BHIMAVARAM, W.G.Dist., A.P., PIN-534202

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Vision & Mission of the Institute

Vision of the Institution:

To evolve as a Quality Institution in Teaching, Innovative Research, Entrepreneurship and Consultation in Engineering & Technology, empower rural youth globally competent and self-disciplined technocrats.

MissionoftheInstitution:

IM1: Inculcate technical knowledge, soft skills through student centric teaching & learning.

IM2: Strengthen industry institute interaction; provide solutions to the ever-changing requirements.

IM3: Implant entrepreneurial attitude and ethical values.

IM4: Create work culture towards learning, Research &Development.

IM5: Develop a unique practice that in stills responsibility and accountability among the stakeholders

Vision & Mission of the Department

Vision of the Department:

To be a recognized center for Electrical & Electronics Engineering, building ethical technocrats towards societal needs.

Mission of the Department:

DM_1: Impart high quality technical education in a dynamic learning environment

DM_2: Develop Industry collaborations towards holistic development and industry ready.

DM_3: Motivate to practice latest technologies towards innovation, research& development.

Program Educational Objectives (PEOs)

Graduates of the Program will be

PROGRAMEDUCATIONALOBJECTIVES(PEOs)	
PEO-1	Be Successful professionals in multidisciplinary team to solve real life Problems with ethical values.
PEO-2	Demonstrate knowledge, Skills and Competence to identify, comprehend and solve the industrial and societal problems.
PEO-3	Adapt forever changing needs by collaborating with industries and Academia for Professional development, Research and higher studies.

Program Outcomes (POs)

After successful completion of the Program, the graduates will be able to

PROGRAMOUTCOMES(POS)		
1	**Engineering knowledge:**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering Specialization to the solution of complex Engineering problems.
2	**Problem analysis:**	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	**Design/development of solutions:**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural,societal,and Environmental considerations.
4	**Conduct investigations of complex problems:**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid Conclusions.
5	**Modern tool usage:**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an Understanding of the limitations.

6	**The engineer and society:**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent Responsibilities relevant to the professional Engineering practice.
7	**Environment sustainability:**	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the Knowledge of, and need for sustainable development.
8	**Ethics:**	Apply ethical principles and commit to Professional ethics and responsibilities and norms of the engineering practice.
9	**Individual and team work:**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	**Communication:**	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make Effective presentations, and give and receive clear instructions.
11	**Project management and finance:**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in Multidisciplinary environments.
12	**Life long learning**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of Technological change.

Program Specific Outcomes (PSOs)

After successful completion of the Program, the graduates will be able to

PROGRAM SPECIFIC OUTCOMES (PSOS)	
PSO-1	Identify and provide solutions in Drives and Power Systems.
PSO-2	Demonstrate renewable energy technologies for the growing energy demand.

B.Tech.II Year-I Semester

S. No	Category	Course code	Title	L	T	P	C
1	BS	BT24BS2102	Complex Variables & Numerical Methods	3	0	0	3
2	HSMC	BT24HS2101	Universal human values–Understanding harmony and Ethical human conduct	2	1	0	3
3	Engineering Science	BT24EE2101	Electro magnetic Field Theory	3	0	0	3
4	Professional Core	BT24EE2102	Electrical Circuit Analysis-II	3	0	0	3
5	Professional Core	BT24EE2103	DC Machines &Transformers	3	0	0	3
6	Professional Core	BT24EE2104	Electrical Circuit Analysis-II And Simulation Lab	0	0	3	1.5
7	Professional Core	BT24EE2105	DC Machines &Transformers Lab	0	0	3	1.5
8	Skill Enhancement Course	BT24CS2106	Data Structures Lab	0	1	2	2
9	Audit Course	BT24BS2106	Environmental Science	2	0	0	-
		Total		**15**	**2**	**10**	**20**

B.Tech.II Year-II Semester

S. No	Category	Course code	Title	L	T	P	C
1	Management Course-I	BT24HS2201	Managerial Economics& Financial Analysis	2	0	0	2
2	Engineering Science/Basic Science	BT24EC2207	Analog Circuits	3	0	0	3
3	Professional Core	BT24EE2201	Power Systems-I	3	0	0	3
4	Professional Core	BT24EE2202	Induction and Synchronous Machines	3	0	0	3
5	Professional Core	BT24EE2203	Control Systems	3	0	0	3
6	Professional Core	BT24EE2204	Induction and Synchronous Machines Lab	0	0	3	1.5
7	Professional Core	BT24EE2205	Control Systems Lab	0	0	3	1.5
8	Skill Enhancement course	BT24CS2207	Python Programming Lab	0	1	2	2
9	Engineering Science	BT24ME2207	Design Thinking &Innovation	1	0	2	2
		Total		**15**	**1**	**10**	**21**

II Year- I Semester	Course Code: BT24BS2102	L	T	P	C
		3	0	0	3

COMPLEXVARIABLES & NUMERICAL METHODS

Course objectives:

- To elucidate the different numerical methods to solve nonlinear algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration.
- To familiarize the complex variables.
- To equip the students to solve application problems in their disciplines.

Course Outcomes:

1. Apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals
2. Apply numerical integral techniques to different Engineering problems. Apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations
3. Apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous functions analytic
4. Use the concept of conjugate harmonic functions to solve problems related to complex variables.
5. Evaluate the Taylor and Laurent expansions of simple functions, determining the nature of the singularities and calculating residues. Make use of the Cauchy residue theorem to evaluate certain integrals
6. Explain properties of various types of conformal mappings

Mapping of course outcomes with program outcomes

	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	P O10	P O11	P O12
CO1	3	3										
CO2	3	3										
CO3	3	3										
CO4	3	3										
CO5	3	3										
CO6	2	2										

Mapping of course outcomes with program specific outcomes

	PSO1	PSO2
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-
CO5	-	-
CO6	-	-

UNIT–I: Iterative Methods:

Introduction–Solutions of algebraic and transcendental equations: Bisection method– Secant method – Method of false position – General Iteration method – Newton- Raphson method (Simultaneous Equations)

Interpolation: Newton's forward and backward formulae for interpolation–Interpolation with unequal intervals – Lagrange's interpolation formula

UNIT–II: Numerical integration, Solution of ordinary differential equations with initial conditions:

Trapezoidal rule– Simpson's 1/3rdand 3/8thrule– Solution of initial value problems by Taylor's series–Picard's method of successive approximations–Euler's method–Runge- Kutta method (second and fourth order)– Milne's Predictor and Corrector Method.

UNIT–III: Functions of a complex variable and Complex integration:

Introduction – Continuity – Differentiability – Analyticity –Cauchy-Riemann equations in Cartesian and polar coordinates – Harmonic and conjugate harmonic functions – Milne – Thompson method.

Complex integration: Line integral–Cauchy's integral theorem–Cauchy's integral formula – 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 Taylor's series, Maclaurin's series and Laurent series. Types of Singularities: Isolated–Essential singularities–Pole of order m–Residues–Residue theorem (without proof) – Evaluation of real integral of the 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, $\ln z$, z^2, z^n (n positive integer), Sin z, cos z, z + a/z. Translation, rotation, inversion and bilinear transformation–fixed point–cross ratio–properties–invariance of circles and cross ratio–determination of bilinear transformation mapping 3 given points.

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers. Edition
2. Micheael Greenberg, Advanced Engineering Mathematics, 2ndedition, Pearson

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India.
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 and Science, Tata Mc. Graw Hill Education.
4. M. K. Jain, S. R. K. Iyengarand R. K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
5. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 9thedition, Mc-Graw Hill, 2013

II Year I Semester	Course Code : BT24HS2101	L	T	P	C
		2	1	0	3
UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT					

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 high light plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Course Outcomes:

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

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 to be used to explore and practice what has been 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.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	3	3	-	2	-	3
CO2	-	-	-	-	-	-	-	3	2	2	-	3
CO3	-	-	-	-	-	-	-	3	2	-	-	2
CO4	-	-	-	-	-	-	3	3	2	2	-	3
CO5	-	-	-	-	-	-	3	3	-	-	-	3
CO6	-	-	-	-	-	3	3	2	2	-	-	2

Mapping of course outcomes with program specific outcomes.

	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-
CO6	1	-

UNIT I Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about One self
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 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-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
Lecture12: 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 3tutorials for practice session)

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
Lecture18: Vision for the Universal Human Order
Tutorial9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)

Lecture19: Understanding Harmony in the Nature
Lecture 20: Inter connectedness, self-regulation and Mutual Ful filment 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
Lecture22: The Holistic Perception of Harmony in Existence
Tutorial11: Practice Session PS11 Exploring Co-existence in Existence.

UNIT V Implications of the Holistic Understanding –a Look at Professional Ethics (6 lectures 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
Lecture25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture26: Competence in Professional Ethics

Tutorial13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture28: Strategies for Transition towards Value-based Life and Profession

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
PS11Exploring Co-existence in Existence

Practice Sessions for UNITV–Implications of the Holistic Understanding–a Look at Professional Ethics
PS12Exploring Ethical Human Conduct
PS13Exploring Humanistic Models in Education
PS14Exploring Steps of Transition towards Universal Human Order

READINGS:

Text book and Teachers Manual

a. 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

b. The Teacher's Manual

RRGaur, RAsthana, GPBagaria, 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. Jeevan Vidya:Ek Parichaya,ANagaraj,JeevanVidyaPrakashan,Amarkantak,1999.
2. Human Values, A.N.Tripathi, New, New Age Intl.Publishers,New, New Delhi,2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth-by Mohandas Karam chand Gandhi
5. Small is Beautiful-E .F Schumacher.
6. Slow is Beautiful-Cecile Andrews
7. Economy of Permanence-JCK umarappa
8. Bharat Me in Angreji Raj–Pandit Sunderlal
9. Red is covering India-by Dharma pal
10. Hind Swaraj or Indian Home Rule-by Mohan das K.Gandhi
11. India Wins Freedom-Maulana Abdul Kalam Azad
12. Vivekananda-Roma in Roll and (English)
13. Gandhi-Roma in Roll and (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-observation, self-reflection and 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 is to be taught by faculty from every teaching department, not exclusively by any one department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development 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://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
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP- SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte- india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

II Year I Semester	Course Code : BT24EE2101	L	T	P	C
		3	0	0	3
ELECTRO MAGNETIC FIELD THEORY					

Pre-requisite: Concepts of Differential Equations, Vector Calculus and Electrical Circuit Analysis.

Course Objectives:

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

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

CO1: Compute electric fields and potentials using Gauss law.
CO2. Solve Poisson's Laplace's or equations for various electric charge distributions
CO3: Analyse the behavior of conductors in electric fields, electric dipole and the Capacitance and Energy stored in dielectrics.
CO4: Calculate the magnetic field intensity due to current carrying conductor and understanding the application of Ampere's law, Maxwell's second and third law.
CO5: Estimate self and mutual inductances and the energy stored in the magnetic field.
CO6: Understand the concepts of Faraday's laws, Displacement current, Poynting theorem and Poynting vector.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	-	-	-	-	-	-	-	-
CO2	3	1	1	1	-	-	-	-	-	-	-	-
CO3	3	1	1	1	-	-	-	-	-	-	-	-
CO4	3	2	2	2	-	-	-	-	-	-	-	-
CO5	3	2	2	2	-	-	-	-	-	-	-	-
CO6	3	2	2	2	-	-	-	-	-	-	-	-

Mapping of course outcomes with program specific outcomes.

	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-
CO6	1	-

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, Gauss's law (Maxwell's first equation, $\nabla . \bar{D} \rightarrow = \rho_v$), Applications of Gauss's law, Electric Potential, Work done in moving a point charge in an electro static field (second Maxwell's equation for static electric fields, $\nabla \times \bar{E} \rightarrow = 0$), Potential gradient, Laplace's and Poison's equations

UNIT-II

Conductors–Dielectrics and Capacitance:

behavior 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, behavior 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.

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 – Magnetic flux density and Maxwell's second Equation ($\nabla . \bar{B} \rightarrow = 0$), 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 ($\nabla \times \bar{H} \rightarrow = \rightarrow J$). 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 ($\nabla \times \bar{E} \rightarrow = -\frac{\partial B}{\partial T}$), 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

Textbooks:

1. "Elements of Electromagnetic "by Matthew NO Sadiku, Oxford 7th Publications, 7TH edition, 2018.
2. "Engineering Electromagnetic" by William H. Hayt & John. A. Buck Mc. Graw-Hill, 7th Editon.2006.

Reference Books:

1. "Introduction to Electro Dynamics" by DJ 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 Electromagnetic s" by Sunil Bhooshan,Oxford University Press ,2012.
4. Schaum's Outline of Electromagnetic by Joseph A.Edminister, Mahamood Navi, 4th Edition, 2014.

Online Learning Resources:

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

II Year I Semester	Course Code : BT24EE2102	L	T	P	C
		3	0	0	3
ELECTRICALCIRCUITANALYSIS-II					

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

Course Objectives:

- To understand three phase circuits
- To analyse transients in electrical systems
- To evaluate network parameters of given electrical network
- To apply Fourier analysis to electrical systems
- To understand graph theory for circuit analysis and to understand the behavior of filters

Course Outcomes:

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

CO1: Analyse the balanced and unbalanced 3 phase circuits for power calculations.

CO2: Apply the shifting theorem to evaluate Laplace transforms for functions that involve time shifts, both for time shifting and frequency shifting

CO3: Analyse the transient behavior of electrical networks in different domains.

CO4: Estimate various Network parameters.

CO5: Apply the concept of Fourier series to electrical systems.

CO6: Analyse the filter circuit for electrical circuits.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	-	-	-	-	-	-	-	1
CO2	3	2	2	1	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO4	3	2	2	-	-	-	-	-	-	-	-	1
CO5	3	2	2	-	-	-	-	-	-	-	-	1
CO6	3	2	2	-	-	-	-	-	-	-	-	1

Mapping of course outcomes with program specific outcomes.

	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-
CO6	1	-

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, 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

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.

Textbooks:

- Engineering Circuit Analysis, William Hayt andJackE.Kemmerly,8thEdition McGraw-Hill, 2013
- Fundamentals of Electric Circuits,CharlesK.Alexander,MathewN.O.Sadiku,3rd Edition, Tata McGraw-Hill, 2019

Reference Books:

1. Network Analysis, M.E.VanValkenburg, 3rd Edition,PHI,2019.
2. Network Theory, N. C. Jagan and C. Lakshmi narayana, 1st Edition, B. S. Publications, 2012.
3. Circuits and Networks Analysis and Synthesis,A.Sudhakar,Shyam MohanS.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/

II Year I Semester	Course Code : BT24EE2103	L	T	P	C
		3	0	0	3
DC MACHINES & TRANSFORMERS					

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

Course Objectives:

Students will get exposure to

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

Course Outcomes:

At the end of the course, the student should be able to:

CO1. Analyze different excitation techniques used in DC machines and their effects on Performance.

CO2.Analyze and compare the characteristics of separately-excited, shunt, series, and compound DC motors, including their speed-torque curves and applications.

CO3. Operate the DC Motor with different speed control and testing methods.

CO4.Analyze transformer performance under various loads, including lagging, leading, and unity Power factor loads.

CO5. Know about the transformer testing methods for testing of transformer.

CO6.Analyze the different poly phase connections used in transformers.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	-	-	-	-	-	2	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	2	-
CO5	3	2	1	-	-	-	-	-	-	-	1	-
CO6	3	2	2	-	-	-	-	-	-	-	1	-

Mapping of course outcomes with program specific outcomes.

	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-
CO6	1	-

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:

Poly phase 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.PS Bimbhra, 7th edition, Hanna Publishers, New Delhi, 1995.
2. Performance and analysis of AC machines by M.G.Say,CBS, 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 Chapman McGraw Hill education 2011.
3. Generalized Theory of Electrical Machines by Dr.PS Bimbhra,7thEdition, Khanna Publishers, 2021.
4. Theory & Performance of Electrical Machines by J.B. Gupta, Sons, S.K.Kataria & 2007.
5. Electric Machinery by Fitzgerald, A.E., Kingsley, Jr., C., &Umans, S.D, 7th Edition, McGraw-Hill Education, 2014.

Online Learning Resources:

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

II Year I Semester	Course Code : BT24EE2104	L	T	P	C
		0	0	3	1.5
ELECTRICAL CIRCUIT ANALYSIS-II AND SIMULATION LAB					

Course Objectives:

- To measure three phase Active and Reactive power
- To analyse transient behaviour of circuits
- To determine 2-port network parameters
- To analyse electrical circuits using simulation tools

Course Outcomes:

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

CO1: Understand the power calculations in three phase circuits.
CO2: Evaluate the time response of given network.
CO3: Evaluate two port network parameters.
CO4: Apply KCL and KVL to solve real-world electrical circuit problems
CO5: Understand the interrelationship between inductors and their impact on overall circuit behavior.
CO6: Simulate and analyse electrical circuits using suitable software.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	-	-	-	2	-	-	-
CO2	3	2	2	2	2	-	-	-	2	-	-	-
CO3	3	2	2	2	2	-	-	-	2	-	-	-
CO4	3	2	2	2	2	-	-	-	2	-	-	-
CO5	3	2	2	2	2	-	-	-	2	-	-	-
CO6	3	2	2	2	2	-	-	-	2	-	-	-

Mapping of course outcomes with program specific outcomes.

	PSO1	PSO2
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-
CO5	-	-
CO6	-	-

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 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.

II Year I Semester	Course Code : BT24EE2105	L	T	P	C
		0	0	3	1.5
DC MACHINES & TRANSFORMERS LAB					

Course Objectives:

The objectives of this course is

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

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

CO1. Analyze the load characteristics of a DC shunt, series and DC compound generator

CO2. Analyze the factors that influence the efficiency of DC machines and identify ways to improve their overall performance.

CO3. Analyze the obtained data to plot the torque-speed characteristic curve of the motor, illustrating The relationship between torque and speed at different load conditions.

CO4.Evaluate the performance and limitations of DC shunt motors under both field and armature Control methods for specific speed control requirements

CO5. Apply concepts of efficiency and regulation to determine the transformer's performance and Evaluate its energy conversion capabilities under different load conditions.

CO6. Analyze the impact of load on the transformer's performance, including voltage regulation and losses, and identify its operating characteristics under different loading conditions.

Mapping of course outcomes with program out comes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	-	-	-	2	-	-	-
CO2	3	3	2	-	-	-	-	-	2	-	-	-
CO3	3	3	2	-	-	-	-	-	2	-	-	-
CO4	3	3	2	-	-	-	-	-	2	-	-	-
CO5	3	3	2	-	-	-	-	-	2	-	-	-
CO6	3	3	2	-	-	-	-	-	2	-	-	-

Mapping of course outcomes with program specific outcomes.

	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-
CO6	1	-

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-Pre determination of efficiencies as DC Generator and Motor.

4. Hopkinson’s test on DC shunts 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

II Year I Semester	Course Code : BT24CS2106	L	T	P	C
		0	1	2	2
DATA STRUCTURES LAB					

Pre-requisite:

Course Objectives:

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

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

CO1: Identify the role of data structures in organizing and accessing data.
CO2: Design, implement, and apply linked lists for dynamic data storage.
CO3: Develop applications using stacks and queues.
CO4: Design and implement algorithms for operations on binary trees and binary search trees.
CO5: Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees.
CO6: Develop algorithms that incorporate these data structures to solve the given challenges.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	-	-	-	2	-	-	-
CO2	3	2	1	1	1	-	-	-	2	-	-	-
CO3	3	2	1	1	1	-	-	-	2	-	-	-
CO4	3	2	2	2	2	-	-	-	2	-	-	-
CO5	3	2	2	2	2	-	-	-	2	-	-	-
CO6	3	2	2	2	2	-	-	-	2	-	-	-

Mapping of course outcomes with program specific outcomes.

	PSO1	PSO2
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-
CO5	-	-
CO6	-	-

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

UNIT-III

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

Sample experiments:

1. Implement stack operations using
   a. Arrays b. Linked list
2. Convert given in fix 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.

UNITIV

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.

UNITV

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.

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 Tool box by Kurt Mehlhorn and Peter Sanders.
2. C Data Structures and Algorithms by Alfred V .Aho, Jeffrey D. Ullman, and John E. Hop croft.
3. Problem Solving with Algorithms and Data Structures by Brad Miller and David Ranum.
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiser son, Ronald L. Rivest, and Clifford Stein.
5. Algorithms in C, Parts1-5(Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms "by Robert Sedge wick.

II Year- I Semester	Course Code: BT24BS2106	L	T	P	C
		2	0	0	0
Environmental science (COMMON FOR ALL BRANCHES)					

Course Objectives:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future.
- To save earth from the inventions by the engineers.

Course Outcomes:

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.Solid Waste Management: Causes, effects and control measures of urban and industrial Wastes.

CO5.About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation

CO6.Casus of population explosion, value education and welfare programmes

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	-	3	-	-	-	-	1
CO2	2	3	2	-	-	-	2	-	-	-	-	1
CO3	2	2	1	-	-	-	1	-	-	-	-	1
CO4	2	1	2	-	-	-	1	-	-	-	-	1
CO5	3	2	2	-	-	-	1	-	-	-	-	1
CO6	2	2	2	-	-	-	1	-	-	-	-	1

Mapping of course outcomes with program specific outcomes

	PSO1	PSO2
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-
CO5	-	-
CO6	-	-

UNIT – 1: 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:

UNIT – II: Ecosystems:

Concept to 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:

1. Forest ecosystem.
2. Grassl and ecosystem
3. Desert ecosystem
4. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity And Its Conservation: Introduction 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 bio diversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III: Environmental Pollution:

Environmental Pollution: Definition, Cause, effects and control measures of: 1. Air Pollution. 2. Water pollution 3. Soil pollution 4.Marine pollution 5.Noise pollution 6.Thermal pollution 7.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, earth quake, 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, and 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 – Wastel and reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act–Wild life Protection Act–Forest Conservation Act–Issues involved in enforcement of environment allegislation –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, hills lopes, etc..

Text Books:

1. Text book of Environmental Studies for Undergraduate Courses ErachBharucha for University Grants Commission,Universities Press.
2. Palaniswamy, "Environmental Studies ",Pearson education
3. S.AzeemUnnisa,"Environmental Studies"Academic Publishing Company
4. K.RaghavanNambiar,"Text book of Environmental Studies for UndergraduateCourses as per UGC model syllabus", Scitech Publications (India), Pvt.Ltd.

Reference Books:

1. Deeksha Dave and E .Sai Baba Reddy, "Text book of Environmental Science",Cengage Publications.
2. M.AnjiReddy,"Text book of Environmental Sciences and Technology",BSPublication.
3. J.P.Sharma,Comprehensive Environmental studies,Laxmi publicati
4. J.GlynnHenryandGaryW.Heinke,"Environmental Sciences and Engineering",Prentice Hall of India Private limited
5. G.R.Chatwal,"A Text Book of Environmental Studies"Himalaya Publishing House
6. Gilbert M.Masters and WendellP.Ela,"Introduction to Environmental Engineering and Science,Prentice Hall of India Private limited

II Year II Semester	Course Code : BT24HS2201	L	T	P	C
		2	0	0	2
MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS					

Course Objectives:

- To inculcate the basic knowledge of micro economics 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.

Course Outcomes:

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

Mapping of course outcomes with program outcomes and program specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	2	-	-	-	2	3
CO2	-	-	-	-	-	-	2	-	-	-	2	3
CO3	-	-	-	-	-	-	3	-	-	-	2	2
CO4	-	-	-	-	-	-	2	-	-	-	2	3
CO5	-	-	-	3	3	-	2	2	-	-	3	3
CO6	-	-	-	3	3	-	2	2	-	-	3	2

Mapping of course outcomes with program specific outcomes.

	PSO1	PSO2
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-
CO5	-	-
CO6	-	-

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 -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 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. Arya sri : Business Economics and FinancialAnalysis,4/e, MGH.

Reference Books:

1. Ahuja Hl Managerial economics S chand.
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 BusinessEconomics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, C eng age.

Online Learning Resources:

https://www.slideshare.net/123ps/managerial-economics-ppt
https://www.slideshare.net/rossanz/production-and-cost 45827016
https://www.slideshare.net/darkyla/business-organizations-19917607
https://www.slideshare.net/balarajbl/market-and-classification-of-market
https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396
https://www.slideshare.net/ashu1983/financial-accounting

II Year II Semester	Course Code : BT24EC2207	L	T	P	C
		3	0	0	3
ANALOG CIRCUITS					

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

Course Objectives:

- To acquire the basic knowledge on clippers, clampers & biasing circuits.
- To determine the h-parameters of a transistor circuit & understand the feedback Concepts of amplifiers.
- To know the operation of oscillators and operational amplifier.
- To understand the applications of operational amplifier.
- To acquire the knowledge on IC555 timer and their applications.
- To know the operation of Analog to Digital Converters and Digital to Analog Converters.

Course Outcomes:

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

CO1**:** Analyze diode clipping and clamping circuits. Understand different types of biasing circuits of a transistor.

CO2**:** Use small signal modeling for transistor circuit analysis and illustrate the operation of feedback amplifiers.

CO3: Understand operation of oscillators and their applications.

CO4**:** Understand operation of operational amplifier and their applications.

CO5**:** Use 555 timers in multi-vibrators, Schmitt Trigger and PLL applications.

CO6**:** Describe the operation of different ADC's and DAC's.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	-	-	-	-	-	-	1
CO2	3	3	-	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO4	3	2	2	-	-	-	-	-	-	-	-	1
CO5	3	3	2	-	-	-	-	-	-	-	-	1
CO6	3	2	1	-	-	-	-	-	-	-	-	1

Mapping of course outcomes with program specific outcomes

	PSO1	PSO2
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-
CO5	-	-
CO6	-	-

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 Variations in V_{BE} and β for the Self- Bias Circuit, Bias Compensation, Thermal

Runaway, Thermal Stability.

Unit–II:

Small Signals Modeling 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 Multi vibrator, 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. 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. Boylston and Lowis Nashel sky, Pearson Edition, 2021.
2. Electronic Devices and Circuits–G.K.Mithal, Khanna Publisher, 23rd Edition, 2017.
3. Electronic Devices and Circuits–David Bell, Oxford, 5th Edition, 2008.
4. Electronic Principles–Malvino, Albert Paul, and David J. Bates, McGraw-Hill/Higher Education, 2007.
5. Operational Amplifiers and Linear Integrated Circuits– Gaya wad R.A, Prentice Hall India, 2002.
6. Operational Amplifiers and Linear Integrated Circuits –Sanjay Sharma, Kataria & Sons, 2nd Edition, 2010.

Online Learning Resources:

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

II Year II Semester	Course Code : BT24EE2201	L	T	P	C
		3	0	0	3
POWER SYSTEMS-I					

Pre-requisite: Electrical Circuit Analysis

Course Objectives:

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

Course Outcomes:

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

CO1. Identify various types of power generation systems and components of respective power stations.
CO2. Outline the principle of operation of a Nuclear power station.
CO3. Compare AIS and GIS in various aspects
CO4. Apply the knowledge of comparing various bus bar arrangements in substations
CO5. Explain the construction of different types of cables and distribution systems
CO6. Analyze different methods of power generation and tariffs

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	-	2	-	-	-	-	-	-
CO2	3	2	2	2	-	2	-	-	-	-	-	-
CO3	3	2	2	2	-	2	-	-	-	-	-	-
CO4	3	2	2	2	-	2	-	-	-	-	-	-
CO5	3	2	2	2	-	2	-	-	-	-	-	-
CO6	3	2	2	2	-	2	-	-	-	-	-	-

Mapping of course outcomes with program specific outcomes.

	PSO1	PSO2
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2
CO6	2	2

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 (GSI) –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 inter sheath grading

Distribution Systems:

Classification of Distribution systems, A.C Distribution, Overhead versus Underground system, Connection schemes of distribution system, Requirements of Distribution system, requirements of a Distribution system, Design Considerations in Distribution system.

UNITV: 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-fixe 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.

Text Books:

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 .Chan 2005.4th edition ,2005
4. Turan Gonen, Electric Power Distribution System Engineering, McGraw Hill, 1985.
5. Hand book of switchgear, BHEL, McGraw-Hill Education, 2007.

Online Learning Resources:

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

II Year II Semester	Course Code : BT24EE2202	L	T	P	C
		3	0	0	3
INDUCTION AND SYNCHRONOUS MACHINES					

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

Course Objectives:

Students will get exposure to understand the concepts of

- characteristics, starting and testing methods of Induction Motor
- Torque production and performance of Induction Motor.
- In determining the performance parameters of Induction Motor.
- Working of synchronous machines

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

CO1: Explain the construction and operation of three-phase induction motor.

CO2: Analyse the performance of three-phase induction motor.

CO3: Explain the response of a three-phase induction motor

CO4: Describe the working of single-phase induction motors.

CO5: Analyse the construction and performance of Synchronous generators.

CO6: Analyse the performance of Synchronous motors.

Mapping of course outcomes with program outcomes and program specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	2	-	-	-	-	-	-
CO2	3	2	2	2	2	-	-	-	-	-	-	-
CO3	3	2	2	1	-	-	-	-	-	-	-	-
CO4	3	2	2	2	-	-	-	-	-	-	-	-
CO5	3	2	2	2	-	-	-	-	-	-	-	-
CO6	3	2	2	2	-	-	-	-	-	-	-	-

Mapping of course outcomes with program specific outcomes.

	PSO1	PSO2
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2
CO6	2	2

UNIT-I:

3-phase induction motors: Construction of Squirrel cage and Slip ring 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 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 - two reaction analyses 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.

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 king sley, Stephen D. Umans, Mc Graw-Hill, 2020, Seventh edition.

Online Learning Resources:

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

II Year II Semester	Course Code : BT24EE2203	L	T	P	C
		3	0	0	3
CONTROLSYSTEMS					

Pre-requisite: Basic Engineering Mathematics

Course Objectives:

- To obtain the mathematical models of physical systems and derive transfer function.
- To determine the time response of systems and analyse system stability.
- To analyse system stability using frequency response methods.
- To design compensators using Bode diagrams.

Course Outcomes:

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

CO1: Derive the transfer function of physical systems and determine overall transfer function using block diagram algebra and signal flow graphs.

CO2: Obtain the time response of first and specifications of second order systems and determine error constants.

CO3: Analyze the absolute and relative stability of LTI systems using Routh's stability criterion.

CO4: Analyze the absolute and relative stability of LTI systems using root locus method.

CO5: Analyze the stability of LTI systems using frequency response methods.

CO6: Design Lag, Lead, Lag-Lead compensators to improve system performance using Bode Diagrams.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	-	-	-	-	-	-	-	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-
CO3	3	2	2	2	-	-	-	-	-	-	-	-
CO4	3	2	2	2	-	-	-	-	-	-	-	-
CO5	3	2	2	2	-	-	-	-	-	-	-	-
CO6	3	2	2	2	-	-	-	-	-	-	-	-

Mapping of course outcomes with program specific outcomes.

	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-
CO6	1	-

UNIT-1

Mathematical Modeling 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 servomotor-block diagram algebra–Representation by signal flow graph–reduction

using Mason's gain formula.

UNIT-2: 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.

UNIT-3: Stability and Root Locus Technique

The 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-4: 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-5: Classical Control Design Techniques

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

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, 2ndEdition.

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 Mani k Dhanesh N, Cengage publications.
4. Control Systems Engineering by I.J.Nagarath and M.Gopal, New age Publications, International 5th Edition.
5. Control Systems Engineering by S.Palani, Tata McGraw 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

II Year II Semester	Course Code : BT24EE2204	L	T	P	C
		0	0	3	1.5
INDUCTION AND SYNCHRONOUS MACHINES LAB					

Course Objectives:

The objectives of this course is

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

Course Outcomes:

CO1: Analyze the speed control methods on 3-phase Induction Motor.
CO2: Evaluate the performance of 3-phase Induction Motor by obtaining the locus diagram and Equivalent circuit of 3-phase Induction Motor
CO3: Adapt the power factor improvement methods for single phase Induction Motor
CO4: Pre-determineteregulationof3-phasealternator
CO5: Determine the synchronous machine reactance of 3-phase alternator
CO6: Analyze the various operating conditions of synchronous motor.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	-	-	-	2	-	-	-
CO2	3	2	2	2	2	-	-	-	2	-	-	-
CO3	3	2	2	2	2	-	-	-	2	-	-	-
CO4	3	2	2	2	2	-	-	-	2	-	-	-
CO5	3	2	2	2	2	-	-	-	2	-	-	-
CO6	3	2	2	2	2	-	-	-	2	-	-	-

Mapping of course outcomes with program specific outcomes.

	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-
CO6	1	-

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 method.

8. Regulation of a three-phase alternator by MMF 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. 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

II Year II Semester	Course Code : BT24EE2205	L	T	P	C
		0	0	3	1.5
CONTROL SYSTEMS LAB					

Course Objectives:

- 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.
- To understand time and frequency responses of control system with and without Controllers and compensators.
- To know the different logic gates and Boolean expressions using PLC.

Course Outcomes:

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

CO1: Analyze the performance of Magnetic amplifier, D.C and A.C. servomotors and Synchros.
CO2: Design of PID controllers and compensators.
CO3: Evaluate temperature control of an oven using PID controller
CO4: Determine the transfer function of D.C Motor and
CO5. Examine the truth table of logic gates using PLC.
CO6: Judge the stability in time and frequency domain and Kalman's test for controllability and observability.

Mapping of course outcomes with program outcomes and program specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	-	-	-	2	-	-	-
CO2	3	2	2	2	2	-	-	-	2	-	-	-
CO3	3	2	2	2	2	-	-	-	2	-	-	-
CO4	3	2	2	2	2	-	-	-	2	-	-	-
CO5	3	2	2	2	2	-	-	-	2	-	-	-
CO6	3	2	2	2	2	-	-	-	2	-	-	-

Mapping of course outcomes with program specific outcomes.

	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-
CO6	2	-

List of Experiments

Any 10 of the following experiments are 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 MATLAB.
8. Temperature controller using PID
9. Characteristics of magnetic amplifiers
10. Characteristics of AC servo motor
11. Characteristics of DC servo motor
12. Time response of second order system using MATLAB.

Online Learning Resources: **https://ce-dei.vlabs.ac.in/List%20of%20experiments.html**

	D.N.R COLLEGE OF ENGINEERING & TECHNOLOGY **AUTONOMOUS** **ELECTRICAL AND ELECTRONICS ENGINEERING** **(DR24-IInd YEAR II SEM COURSE STRUCTURE & SYLLABUS)**

II Year II Semester	**Course Code : BT24CS2207**	**L**	**T**	**P**	**C**
		0	**1**	**2**	**2**
SKILL ENHANCEMENT COURSE: PYTHON PROGRAMMING LAB					

Course Objectives:

The main objectives of the course are to

- 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

Course outcomes:

CO1. Understand basic Python syntax, data types, operators, and control structures.
CO2.Implement functions with parameters and return values, including recursion.
CO3. Develop data structures like lists, tuples, dictionaries, and sets for efficient data Manipulation.
CO4.Evaluate file input/output operations in Python
CO5.Construct object-oriented programming concepts (classes, objects, inheritance) where Appropriate
CO6. Determine the need of JSON and XML and other file formats.

Mapping of course outcomes with program out comes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	-	-	-	2	-	-	-
CO2	3	2	1	1	1	-	-	-	2	-	-	-
CO3	3	2	1	1	1	-	-	-	2	-	-	-
CO4	3	2	2	2	2	-	-	-	2	-	-	-
CO5	3	2	2	2	2	-	-	-	2	-	-	-
CO6	3	2	2	2	2	-	-	-	2	-	-	-

Mapping of course outcomes with program specific outcomes.

	PSO1	**PSO2**
CO1	3	-
CO2	3	-
CO3	3	-
CO4	3	-
CO5	3	-
CO6	3	-

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 tries 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 with in an interval
3. Write a program to swap two numbers with out 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) Bitwise Operators vi) Ternary Operatory ii) Member ship 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:

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 of in the length of the string with out 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 inTuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Frozen Dictionaries, Using zip () Function, Sets, Set Methods ,set

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 n dim, shape, size, d type.
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 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
7. 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 mat plot lib

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
3. Introduction to Programming Using Python, Y .Daniel Liang, Pearson.

Online Learning Resources/Virtual Labs:

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

II Year II Semester	Course Code : BT24ME2207	L	T	P	C
		1	0	2	2
DESIGN THINKING & INNOVATION					

Course Objectives: The objectives of the course are to

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

Course Outcomes:

CO1 .Define the concepts related to design Thinking.

CO2. Explain the fundamentals of Design Thinking and innovation.

CO3. Apply the design thinking techniques for solving problems in various sectors.

CO4.Analyse to work in a multi disciplinary environment.

CO5.Evaluate the value of creativity.

CO6. Define the product planning and product development process.

Mapping of course outcomes with program outcomes and program specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	2	2	-	2	-	2	3	2	-	2
CO2	3	-	2	2	-	2	-	2	3	2	-	2
CO3	3	-	2	2	-	2	-	2	3	2	-	2
CO4	3	-	2	2	-	2	-	2	3	2	-	2
CO5	3	-	2	2	-	2	-	2	3	2	-	2
CO6	3	-	2	2	-	2	-	2	3	2	-	2

Mapping of course outcomes with program specific outcomes

	PSO1	PSO2
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-
CO5	-	-
CO6	-	-

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, 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 modeling, 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.

Text books:

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 lid well, Kristina Holden,& Jill butter, Universal principles of Design,2/e Rockport Publishers, 2010.
4. Ches brough. H, Theera 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

Website: www.jntuk.edu.in
E-mail: registrar@jntuk.edu.in

Phone: Off. 0884-2300906
Fax: 0884-2300901

PROCEEDINGS OF THE
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
Kakinada-533003, Andhra Pradesh (India)

Proc. No. JNTUK/DAP/Evaluation Procedure for DT&I/Approval/2025 Date: 27.01.2025

Sub: DAP – Academic Planning – Evaluation Procedure for Design Thinking and Innovation (L-T-P-C) (1-0-2-2) - Orders - Issued.

Read: e-Office No. 2690537 approved by Honourable Vice Chancellor dated 27.01.2025

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ORDER:

With reference cited above, the Honorable Vice Chancellor, JNTUK is pleased to approve the recommendations for Evaluation Procedure for Design Thinking and Innovation (L-T-P-C) (1-0-2-2) as follows:

- **Evaluation Procedure for Design Thinking and Innovation (L-T-P-C) (1-0-2-2):**

The performance of a student **for Design Thinking and Innovation** shall be evaluated with a maximum of 100 marks.
A student has to secure not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester and end examination marks taken together.

Assessment Method	Marks
Internal Assessment	30
Semester End Examination	70
Total	**100**

The distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.

a) Internal Evaluation Procedure

i) **Of the internal marks of 30, Day to Day Evaluation in the lab will be given a maximum of 7.5 Marks (25%) and Mid Exam(theory), a maximum of 22.5 Marks (75%).**

ii) During the semester, there shall be two midterm examinations. Each midterm examination shall be evaluated for 30 marks of which 10 marks for objective paper (20 minutes duration), 15 marks for subjective paper (90 minutes duration) and 5 marks for assignment. **30 Marks will be scaled down to 22.5 Marks.**

a. Objective paper shall contain for 05 short answer questions with 2 marks each OR maximum of 20 bits for 10 marks.
b. Subjective paper shall contain 3 questions of internal choice (i.e., either-or type questions of which student has to answer one from each either-or type of questions, each question carries 10 marks. The marks obtained in the subjective paper are condensed to 15 marks.
c. 5 marks for assignment
d. Mid examinations of Design thinking and Innovation to be conducted by the corresponding college.

Note:

- The subjective paper shall contain 3 either-or type questions of equal weightage of 10 marks. Any fraction shall be rounded off to the next higher mark.
- Assignments shall be in the form of problems, mini projects, design problems, slip tests, quizzes etc., depending on the course content. It should be continuous assessment throughout the semester and the average marks shall be considered.

iii) If the student is absent for the mid semester examination, no re-exam shall be conducted and mid semester marks for that examination shall be considered as zero.

iv) First midterm examination shall be conducted for I, II units of syllabus with one either or type question from each unit and third either or type question from both the units. The second midterm examination shall be conducted for III, IV and V units with one either or type question from each unit.

v) Final mid semester marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage given to the better mid exam and 20% to the other.

vi) If the student is absent for any one midterm examination, the final mid semester marks shall be arrived at by considering 80% weightage to the marks secured by the student in the appeared examination and zero to the other.

b) End Examination (Only Practical's) Evaluation:

The end examination shall be evaluated for 70 marks, conducted by the concerned laboratory teacher and a senior expert in the subject from the same department.

- Procedure: 20 marks
- Experimental work & Results: 30 marks
- Viva voce: 20 marks.

REGISTRAR
REGISTRAR
J.N.T. University Kakinada
Kakinada-533003.

To
The Director of Evaluation, JNTUK Kakinada.
Copy to the Director, Academic Planning, JNTUK Kakinada.
Copy to the Secretary to Hon'ble Vice-Chancellor, JNTUK Kakinada.
Copy to the PA to the Registrar, JNTUK Kakinada.