w.e.f. 2024-25

D23

B.Tech.

ELECTRICAL AND ELECTRONICS ENGINEERING

(B.Tech.2nd Year Syllabus)

Department of Electrical and Electronics Engineering

(B.Tech- EEE Program, Accredited by NBA)

DHANEKULA INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Approved by AICTE, Accredited by NBA, Affiliated to JNTUK, Kakinada)

Ganguru, Vijayawada,

Andhra Pradesh- 521139,

INDIA.

www.diet.ac.in

Head of the Department
Electrical & Electronics Engineering
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OF ENGINEERING AND TECHNOLOGY
Ganguru, Vijayawada-521 139

PRINCIPAL
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Ganguru, Vijayawada-521 139

DHANEKULAINSTITUTEOFENGINEERING&TECHNOLOGY
Department of Electrical and Electronics Engineering

VISION –MISSION-PEOs

Institute Vision	Pioneering Professional Education through Quality
Institute Mission	Providing Quality Education through state-of-art infrastructure, laboratories and committed staff. Moulding Students as proficient, competent, and socially responsible engineering personnel with ingenious intellect. Involving faculty members and students in research and development works for betterment of society.
Department Vision	Emerge as Quality Human Resource Provider for Industry and Society in the field of Electrical & Electronics Engineering.
Department Mission	Providing Quality Education through State-of-art resources. To develop innovative, proficient Electrical engineers. Promoting Ethical and moral values among the students so as to make them responsible professionals for the society.
Program Educational Objectives(PEOs)	Graduates of Electrical and Electronics Engineering shall **PEO1**: Have strong foundation in Electrical Engineering along with Mathematics, Sciences and allied Engineering subjects. **PEO2**: Possess good problem solving, design skills, capability to use modern engineering tools, ability to pursue higher education and research. **PEO3**: Seek employment in various engineering or technological positions of their interest and continue to achieve their aspirations through lifelong learning. **PEO4**: Exhibit professional and ethical attitude, effective communication skills, Teamwork and multidisciplinary approach.

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DHANEKULAINSTITUTEOFENGINEERING&TECHNOLOGY
Department of Electrical and Electronics Engineering
POs/PSOs

List of Program Outcomes

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 sustained 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 process 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, andmodernengineeringandITtoolsincludingpredictionandmodelingtocomplex engineering activities with an understanding of the limitations.
6	**The engineer and society:** A pply 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 And 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 a 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 broadest context of technological change.

ListProgramSpecificOutcomes

PSO 1: Ability to design solutions for identified problems by using latest engineering tools like MATLAB, Simulink, PSPICE, plc etc.
PSO2: Able to design and develop the Green Electrical systems

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B.Tech.– II Year I Semester

S.No.	Category	Title	L/D	T	P	Credits
1	BS&H	Complex Variables & Numerical Methods	3	0	0	3
2	HSMC	Universal human values understanding harmony and Ethical human conduct	2	1	0	3
3	Engineering Science	Electromagnetic Field Theory	3	0	0	3
4	Professional Core	Electrical Circuit Analysis- II	3	0	0	3
5	Professional Core	DC Machines & Transformers	3	0	0	3
6	Professional Core	Electrical Circuit Analysis-II and Simulation Lab	0	0	3	1.5
7	Professional Core	DC Machines & Transformers Lab	0	0	3	1.5
8	Skill Enhancement Course	Python Programming Lab	0	1	2	2
9	Audit Course	Environmental Science	2	0	0	-
Total			**16**	**02**	**08**	**20**

B.Tech.– II Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Management Course- I	Managerial Economics & Financial Analysis	2	0	0	2
2	Engineering Science/Basic Science	Analog Circuits	3	0	0	3
3	Professional Core	Power Systems-I	3	0	0	3
4	Professional Core	Induction and Synchronous Machines	3	0	0	3
5	Professional Core	Control Systems	3	0	0	3
6	Professional Core	Induction and Synchronous Machines Lab	0	0	3	1.5
7	Professional Core	Control Systems Lab	0	0	3	1.5
8	Skill Enhancement Course	Data Structures Lab	0	1	2	2
9	Engineering Science	Design Thinking & Innovation	1	0	2	2
Total			15	01	10	21

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II B.TECH. (EEE) – I SEM

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Regulation
D23

Course Code: **D23C201**

Name of the Course: **COMPLEX VARIABLES & NUMERICAL METHODS**

Course Category:	BS&H	Credits : 3	
Course Type:	Theory	Lecture-Tutorial-Practice:	3 0 0
Prerequisites	Calculus, Algebra, and familiarity with complex numbers and basic functions of complex variables.	Continuous Evaluation	30M
		Semester End Evaluation	70M
		Total Marks	100M

Course Outcomes:

After Successful Completion of course, the student will be able to:

CO No:	Course Outcome Description	K - Level
CO1	Apply iterative methods to solve algebraic equation and transcendental equations. Interpolate data using various interpolating techniques	Applying
CO2	Apply numerical techniques to find derivatives/ tofind definite integral /to solve initial value problem of first order-first degree ODE.	Applying
CO3	Apply Cauchy Riemann equations to find derivatives and integrals of complex function	Applying
CO4	Write analytic function in power series and integrate complex function using Residue theorem	Applying
CO5	Explain properties of various types of conformal mappings.	Applying

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (**1**- Low, **2** – Moderate,**3** – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	-

COURSE CONTENT:

UNIT–I: Iterative Methods:

Introduction–Solutionsofalgebraicandtranscendentalequations:Bisectionmethod–Secant method – Method of false position – General Iteration method – Newton-Raphson method(One variable and Simultaneous Equations)

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

UNIT–II: Numericalintegration,Solutionofordinarydifferentialequationswithinitialconditions:

Trapezoidal rule– Simpson's $1/3^{rd}$and $3/8^{th}$ rule– Solution of initial value problems byTaylor'sseries–Picard'smethodofsuccessiveapproximations–Euler'smethod–Runge-Kuttamethod(secondandfourthorder)–Milne'sPredictorandCorrectorMethod.

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UNIT–III: Functions of a complex variable and Complex integration:
Introduction–Continuity–Differentiability–Analyticity–Cauchy-Riemann equation sin Cartesian and polar coordinates–Harmonic and conjugate harmonic functions–Milne–Thompson method.
Complexintegration:Lineintegral–Cauchy'sintegraltheorem–Cauchy'sintegralformula – Generalizedintegralformula(allwithoutproofs)andproblemsonabovetheorems.

UNIT–IV: Series expansions and Residue Theorem:
Radiusofconvergence–Expansionoffunctionin Taylor'sseries,Maclaurin'sseries and Laurent series.
Types of Singularities: Isolated–Essential singularities–Pole of order m–Residues–Residue Theorem (with out proof)–Evaluation of real integral of the types $\int_{-\infty}^{\infty} f(x)\,dx$ and $\int_{c}^{c+2p} f(\cos q, \sin q)\,dq$.

UNIT–V: Conformal mapping:
Transformation by e^z,lnz,z^2, z^n(n positive integer), Sinz, cosz, z+a/z. Translation, rotation, inversion and bilinear transformation–fixed point–cross ratio– properties– invarianceofcirclesandcrossratio–determinationofbilineartransformationmapping3 given points.

Text Books:

1. **B.S.Grewal,** HigherEngineeringMathematics,44th Edition,KhannaPublishers.
2. **Micheael Greenberg,** AdvancedEngineeringMathematics,2nd edition,Pearson edition.

Reference Books:

1. **Erwin Kreyszig,** AdvancedEngineeringMathematics,10th Edition,Wiley-India.
2. **B.V.Ramana,** HigherEngineeringMathematics,2007Edition,TataMc.GrawHillEducation.
3. **StevenC.Chapra,** AppliedNumericalMethodswithMATLABforEngineeringandScience, Tata Mc. Graw Hill Education.
4. **M.K.Jain,S.R.K.IyengarandR.K.Jain,** NumericalMethodsforScientificandEngineeringComputation,NewAgeInternationalPublications.
5. **J.W.BrownandR.V.Churchill,** ComplexVariablesandApplications,9th edition, Mc-Graw Hill,2013.

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Regulation
D23

Course Code: **D23C202**

Name of the Course: **UNIVERSAL HUMAN VALUES UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT**

Course Category:	(HSMC)	Credits : 3			
Course Type:	Theory	Lecture-Tutorial-Practice:	2	1	0
Prerequisites	-	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K – Level
CO1	Aspire continuous happiness and prosperity	2
CO2	Explore harmony in the human being, the co-existence of self and body.	2
CO3	Develop competence and value human-human relationship.	2
CO4	Perceive harmony at all levels of existence.	2
CO5	Validate definitiveness of ethical human conduct	2

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, **2** – Moderate,**3** – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	3	3	3	3	-	-	-	-	-
CO2	-	-	-	-	-	3	3	3	3	-	-	-	-	-
CO3	-	-	-	-	-	3	3	3	3	-	-	-	-	-
CO4	-	-	-	-	-	3	3	3	3	-	-	-	-	-
CO5	-	-	-	-	-	3	3	3	3	-	-	-	-	-

COURSE CONTENT:

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.

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

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself
Lecture 3: self-exploration as the Process for Value Education
Lecture4: Continuous Happiness and Prosperity – 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
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT III Harmony in the Family and Society (6 lectures and 3 tutorials for 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
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)
Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.

UNIT V Implications of the Holistic Understanding – a Look at Professional Ethics (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
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education
PS1 Sharing about Oneself
PS2 Exploring Human Consciousness
PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being
PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self
PS6 Exploring Harmony of self with the body
Practice Sessions for UNIT III – Harmony in the Family and Society
PS7 Exploring the Feeling of Trust
PS8 Exploring the Feeling of Respect
PS9 Exploring Systems to fulfil Human Goal

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Practice Sessions for UNIT IV – Harmony in the Nature (Existence)
PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics
PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

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.

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

Reference Books:

1. JeevanVidya:EkParichaya,ANagaraj,JeevanVidyaPrakashan,Amarkantak,1999.
2. HumanValues,A.N.Tripathi,NewAgeIntl.Publishers,NewDelhi,2004.
3. TheStoryofStuff(Book).
4. TheStoryofMyExperimentswithTruth-byMohandasKaramchandGandhi
5. SmallisBeautiful-E.FSchumacher.
6. SlowisBeautiful-CecileAndrews
7. EconomyofPermanence-JCKumarappa

8. BharatMeinAngrejiRaj–PanditSunderlal
9. RediscoveringIndia-byDharampal
10. HindSwarajorIndianHomeRule-byMohandasK.Gandhi
11. IndiaWinsFreedom-MaulanaAbdulKalamAzad
12. Vivekananda-RomainRolland(English)
13. Gandhi-RomainRolland(English)

E-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

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Regulation
D23

Course Code : **D23C203**

Name of the Course : **ELECTROMAGNETIC FIELD THEORY**

Course Category:	BS/ES/PC/PE/OE/MC/SC	Credits : 3	
Course Type:	Theory / Tutorial /Practical	Lecture-Tutorial-Practice:	3 0 0
Prerequisites	Vector algebra and Engineering Physics	Continuous Evaluation	30M
		Semester End Evaluation	70M
		Total Marks	100M

Course Outcomes:

After Successful Completion of course, the student will be able to:

CO No:	Course Outcome Description	K - Level
D23C203.1	Calculate electric fields and potentials using gauss law or solving Laplace or Poisson's equations	Analysis
D23C203.2	Evaluate the Maxwell's equations in different forms and the boundary conditions for fields across media interfaces	Evaluation
D23C203.3	Calculate magnetic field intensity due to current, the application of amperes law and Maxwell second equation.	Analysis
D23C203.4	Evaluate the magnetic force and dipole moment in magnetic field	Evaluation
D23C203.5	Analyze the Self, Mutual inductances , and energy densities in a magnetic materials	Analysis
D23C203.6	Evaluate Maxwell's equations for time varying fields	Evaluation

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (**1**- Low, **2** – Moderate,**3** – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
D23C203.1	3	3	2									2	2	1
D23C203.2	2	3	2									2	2	1
D23C203.3	3	3	3									2	2	1
D23C203.4	2	3	2									2	2	1
D23C203.5	2	3	2									2	2	1
D23C203.6	3	3	2									2	2	1

COURSE CONTENT:

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.

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

UNIT - II
Conductors – Dielectrics and Capacitance:
Behaviour of conductor in Electric field, Electric dipole and dipole moment –Potential and EFI due to an electric dipole, Torque on an Electric dipole placed in an electric field, Current density-conduction, 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 ($\nabla.\bar{B}= 0$), 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 ($\nabla \times \bar{H}= \bar{J}$) 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.

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

UNIT - V
Time Varying Fields:

Faraday's laws of electromagnetic induction, Maxwell's fourth equation$\left(\nabla \times E=-\frac{\partial B}{\partial t}\right)$, integral and point forms of Maxwell's equations, statically and dynamically induced EMF, Displacement current, Modification of Maxwell's equations for time varying fields.

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

Reference Books:
1. "Introduction to Electro Dynamics" by D J Griffiths, Prentice2nd edition.
2. "Electromagnetic Field Theory" by Yaduvir Singh, Pearson India, 1st edition, 2011.
3. "Fundamentals of Engineering Electromagnetics" by Sunil Bhooshan, Oxford UniversityPress, 2012.
4. Schaum's Outline of Electromagneticsby Joseph A. Edminister, MahamoodNavi,4thEdition,2014.

Online Learning Resources:
a. https://archive.nptel.ac.in/courses/108/106/108106073/
b. https://nptel.ac.in/courses/117103065

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Regulation
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Course Code **D23C204**

Name of the Course **ELECTRICAL CIRCUIT ANALYSIS - II**

Course Category:	**PC (Professional Core)**	Credits : 3			
Course Type:	Theory	Lecture-Tutorial-Practice:	3	0	0
Prerequisites	ECA-I, Mathematics	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:

CO No:	Course Outcome Description	K - Level
CO1	Analyse the balanced and unbalanced 3 phase circuits for power calculations.	Analysis
CO2	Analyse the transient behaviour of electrical networks in different domains.	Analysis
CO3	Estimate various Network parameters.	Analysis
CO4	Apply the concept of Fourier series to electrical systems.	Application
CO5	Analyse the filter circuit for electrical circuits	Analysis

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate, 3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												
CO5	3	3												

COURSE CONTENT:

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 theorem – Transforms of derivatives and integrals Inverse Laplace transforms and applications.

Transient Analysis: Transient response of RL, 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.

Text Books:

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

Reference Books:

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

E-RESOURCES/DIGITAL MATERIAL:

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

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Regulation
D23

Course Code **D23C205**

Name of the Course **DC MACHINES & TRANSFORMERS**

Course Category:	BS/ES/PC/PE/OE/MC/SC	Credits : 3			
Course Type:	Theory / Tutorial /Practical	Lecture-Tutorial-Practice:	3	0	0
Prerequisites	Principles of Electromechanical Energy Conversion, Electromagnetic fields and Electrical Circuit Analysis	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Explain the Principles of electromechanical energy conversion devices, construction and operation of DC machines and its classification.	Understanding
CO2	Discuss the ill-effects of armature reaction, various characteristics and starting methods of DC machines and methods to improve commutation	Analysis
CO3	Demonstrate various speed control methods and testing of DC machines.	Application
CO4	Analyze the performance of single phase transformer and autotransformer	Analysis
CO5	Analyze various connections of three phase transformers	Application

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (**1**- Low, **2** – Moderate, **3** – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2												
CO2	2	3												
CO3		3	2	2										
CO4	2	3	2											
CO5		3	2	2										

COURSE CONTENT:

UNIT – I

DC Machines Fundamentals

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

UNIT-II

Performance 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

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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.

Text Books:

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

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. P S Bimbhra Khanna Publishers, 2021.
4. Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria & Sons,2007.
5. Electric Machinery by edition, McGraw-Hill Education, 2014.

Online Learning Resources:

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

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Regulation
D23

Course Code: **D23C206**

ELECTRICAL CIRCUIT ANALYSIS AND SIMULATION LAB

Course Category:	**PC (Professional Core)**	Credits: 1.5	
Course Type:	Practical	Lecture-Tutorial-Practice:	0 0 3
Prerequisites	Electrical Circuit Analysis	Continuous Evaluation	30M
		Semester End Evaluation	70M
		Total Marks	100M

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Understand the power calculations in three phase circuits.	Evaluation
CO2	Evaluate the time response of given network.	Evaluation
CO3	Evaluate two port network parameters.	Evaluation
CO4	Simulate and analyse electrical circuits using suitable software.	Evaluation

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate, 3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3		3				3	3		3	3	
CO2	3	3	3		3				3	3		3	3	
CO3	3	3	3		3				3	3		3	3	
CO4	3	3	3		3				3	3		3	3	

List of Experiments:

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

Reference Books:

1. Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, 8th Edition McGraw-Hill, 2013
2. Getting started with MATLAB A Quick Introduction for Scientists and Engineers, Rudra Pratap, IndianEdition, OXFORD UNIVERSITY PRESS.

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Course Code: **D23C207**

Name of the Course: **DC MACHINES & TRANSFORMERS LAB**

CourseCategory:	BS/ES/PC/PE/OE/MC/SC	Credits : 1.5	
Course Type:	Theory / Tutorial /Practical	Lecture-Tutorial-Practice:	0 0 3
Prerequisites	DC Machines and Transformers	Continuous Evaluation	30M
		Semester End Evaluation	70M
		Total Marks	100M

Course Outcomes:

After Successful Completion of course,the student will be able to:		
CO No:	Course Outcome Description	K - Level
D23C207.1	Analyze the characteristics and calculate the efficiency of DC shunt machine.	Analysis
D23C207.2	Analyze the performance of a transformer by conducting load and no load tests.	Analysis
D23C207.3	Distinguish the characteristics and examine the efficiency of DC compound and series machines.	Analysis

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (**1**- Low, **2** – Moderate,**3** – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
D23C207.1	1	2	-	3	1	2	-	-	3	-	-	2	2	1
D23C207.2	1	2	-	3	1	2	-	-	3	-	-	2	2	1
D23C207.3	1	2	-	3	1	2	-	-	3	-	-	2	2	1

COURSE CONTENT:

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
3. Swinburne's test - Predetermination of efficiencies as DC Generator and Motor.
4. Hopkinson's test on DC shunt Machines.
5. Load test on DC compound generator
6. Load test on DC shunt generator
7. Fields test on DC series machines
8. Brake test on DC compound motor
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
13. Separation of core losses of a single phase transformer.

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

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Course Code: **D23C208**
Name of the course: **PYTHON PROGRAMMING LAB**

Course Category:	Engineering Science(ES)	Credits: 1.0	
Course Type:	Practical	Lecture-Tutorial-Practice:	0 0 2
Prerequisites	Basic Programming	Continuous Evaluation	30M
		Semester End Evaluation	70M
		Total Marks	100M

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Develop a solid foundation in Python programming, covering essential syntax, semantics, and constructs.	Applying
CO2	Apply skills to handle and manipulate data using Python libraries like Pandas and NumPy	Applying
CO3	Apply problem-solving abilities by implementing various algorithms and datastructures in Python.	Applying
CO4	Build software development skills, including version control, package management, and project documentation	Applying
CO5	Make use of advanced Python topics such as web scraping, API interaction, anddatabase management.	Applying

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (**1**- Low, **2** – Moderate, **3** – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-

Content:

Experiment 1: Introduction to Python

- Objective: Install Python and set up the development environment.

Tasks:

- Install Python and an IDE (e.g., PyCharm, VSCode, or Jupyter Notebook).
- Write and run a simple "Hello, World!" program.
- Understand and demonstrate basic Python syntax and semantics.

Experiment 2: Basic Python Programming

- Objective: Learn basic programming constructs in Python. Tasks:
- Create programs using variables, data types, and operators.
- Implement basic input and output functions.
- Write programs using control structures (if statements, for loops, while loops).

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Experiment 3: Functions and Modules

- Objective: Understand functions and module usage in Python. Tasks:
- Define and call functions with different types of arguments and return values.
- Explore and use built-in Python modules.
- Write a script that imports and utilizes at least two different standard library modules.

Experiment 4: Lists and Tuples

- Objective:Work with Python lists and tuples. Tasks:
- Create, modify, and iterate over lists and tuples.
- Perform list comprehensions to create new lists.
- Demonstrate the immutability of tuples.

Experiment 5: Dictionaries and Sets

- Objective: Explore dictionaries and sets in Python. Tasks:
- Create and manipulate dictionaries.
- Use dictionary comprehension.
- Create and perform operations on sets.

Experiment 6: Strings and File I/O

- Objective: Manipulate strings and perform file I/O operations. Tasks:
- Demonstrate various string methods.
- Write programs to read from and write to text files.
- Work with different file formats, including CSV and JSON.

Experiment 7: Error Handling and Exceptions

- Objective: Implement error handling in Python programs. Tasks:
- Write programs using try, except, else, and finally blocks.
- Handle specific exceptions.
- Create and raise custom exceptions.

Experiment 8:Object-Oriented Programming (OOP)

- Objective: Understand and implement OOP concepts in Python. Tasks:
- Define classes and create objects.
- Demonstrate inheritance and polymorphism.
- Use class and instance variables in programs.

Experiment 9:Libraries and Packages

- Objective: Utilize third-party libraries and create Python packages. Tasks:
- Install and use libraries like NumPy and Pandas.
- Create a simple Python package and distribute it.
- Work with virtual environments to manage dependencies.

Experiment 10: Working with Data

- Objective: Perform data manipulation and visualization. Tasks:
- Use Pandas to load, manipulate, and analyze datasets.
- Create visualizations using Matplotlib and Seaborn.
- Conduct basic data analysis tasks and summarize findings.

Experiment 11: Web Scraping and APIs

- Objective: Extract data from the web and interact with APIs. Tasks:
- Access and parse data from RESTful APIs.
- Process and analyze JSON data from APIs.

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Experiment 12: Databases

- **Objective:** Work with databases in Python.

Tasks:

- Connect to a database using SQLite and SQLAlchemy.
- Perform CRUD operations on the database.
- Write queries to manage and retrieve data.

E-RESOURCES/DIGITAL MATERIAL:

a) https://www.udemy.com/course/python-the-complete-python-developer-course/?matchtype=e&msclkid=0584dfb54dc715f39c0bb9aaf74033be&utm_campaig n=BG-
b) Python_v.PROF_la.EN_cc.INDIA_ti.7380&utm_content=deal4584&utm_medium=udemyad s&utm_source=bing&utm_term=_._ag_1220458320107116_._ad._kw_Python+language_._d e_c_._dm_____._pl ._ti_kwd-76278984197882%3Aloc- 90_._li_116074_._pd ._&couponCode=IND21PM
c) https://www.w3schools.com/python/python_intro.asp
d) https://www.youtube.com/watch?v=eWRfhZUzrAc
e) https://onlinecourses.nptel.ac.in/noc20_cs83/preview
f) https://www.edx.org/learn/python
g) Virtual Labs - https://python-iitk.vlabs.ac.in/
h) Virtual Labs - https://virtual-labs.github.io/exp-arithmetic-operations-iitk/
i) Virtual Labs - https://cse02-iiith.vlabs.ac.in/ https://mlritm.ac.in/assets/cse/cse_lab_manuals/R20_cse_manuals/Python%20Lab%20Manua l.pdf

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Course Code **D23C209**
Name of the Course **ENVIRONMENTAL SCIENCE**

Course Category:	Audit Course	Credits :	
Course Type:	Theory	Lecture-Tutorial-Practice:	2 0 0
Prerequisites	Science	Continuous Evaluation	30M
		Semester End Evaluation	-
		Total Marks	30M

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Understand multi disciplinary nature of environmental studies and various renewable and non-renewable resources	K-2
CO2	Understand flow and bio-geo-chemical cycles and ecological pyramids.	K-2
CO3	Understand various causes of pollution and solid waste management and related preventive measures.	K-2
CO4	Understand the concepts of rain water harvesting, watershed management, ozone layer depletion, and waste land reclamation.	K-2
CO5	Illustrate the causes of population explosion, value education, and welfare programs.	K-3

Note: K-Level is defined From Blooms Taxonomy
Contribution of Course Outcomes mapping with POs & PSOs (**1**- Low, **2** – Moderate, **3** – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	3
CO3	3	-	-	-	-	-	-	-	-	-	-	-	3	3
CO4	-	3	-	-	-	-	-	-	-	-	-	-	3	3
CO5	-	3	-	-	-	-	-	-	-	-	-	-	3	3

COURSE CONTENT:

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, casestudies – Timber extraction – Mining, dams and other effects on forest and tribal people –Water resources – Use andover utilization of surface and groundwater – 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:

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UNIT–2

Ecosystems: Concept to fan ecosystem. –Structure and function of an ecosystem–Producers, consumers, and decomposers– Energy flow in the ecosystem– Ecological succession –Foodchains, foodwebs, and ecological pyramids– Introduction, types, characteristic features, structure, and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity And Its Conservation: Introduction 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-spots of biodiversity –Threats to biodiversity: habitat loss, poaching of wild life, man-wild life conflicts–Endangered and endemic species of India –Conservation of bio diversity: In-situ and Ex-situ conservation of biodiversity.

UNIT–3

Environmental Pollution: Definition, Cause, effects and control measures of:

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

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

UNIT–4

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

UNIT–5

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health –Human Rights–Value Education – HIV/AIDS–Women and Child Welfare –Role of Information Technology in Environment and human health – Case studies. Field Work: Visit to a local area to document environmental assets River / forest grassland / hill/ mountain – Visit to a local polluted site - Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

Textbooks:

1. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, "Environmental Studies", Pearson education
3. S.Azeem Unnisa, "Environmental Studies" Academic Publishing Company
4. K. Raghavan Nambiar, "Textbook of Environmental Studies for Undergraduate Courses as per UGC model syllabus", Scitech Publications (India), Pvt. Ltd.

ReferenceBooks:

1. Deeksha Dave and E.Sai Baba Reddy, "Textbook of Environmental Science", Cengage Publications.
2. M.Anji Reddy, "Textbook of Environmental Sciences and Technology", B S Publication.
3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J.Glynn Henry and Gary W. Heinke, "Environmental Sciences and Engineering", Prentice Hall of India Private limited
5. G.R. Chatwal, "A Text Book of Environmental Studies" Himalaya Publishing House Gilbert M. Masters and Wendell P. Ela, "Introduction to Environmental Engineering and Science, Prentice Hall of India Private limited.

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Regulation
D23

Course Code: **D23C210**

Name of the Course: **MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS**

Course Category:	Management Course- I	Credits : 2	
Course Type:	Theory	Lecture-Tutorial-Practice:	2 0 0
Prerequisites	Basic microeconomics, fundamental financial and management accounting principles.	Continuous Evaluation	30M
		Semester End Evaluation	70M
		Total Marks	100M

Course Outcomes:

After Successful Completion of course, the student will be able to:

CO No:	Course Outcome Description	K - Level
CO1	Understanding the concept of managerial economics, Demand function, and different demand forecasting methods.	2
CO2	Discuss the concepts of production function, economies of scale, optimum size of the firm, and cost & break-even analysis.	2
CO3	Describe market structure and pricing under varied market conditions, Classify the types of business organizations and business cycles.	2
CO4	Evaluate the projects by applying tools and techniques of capital budgeting to accept or reject the new projects in business.	3
CO5	Prepare financial statements for analysis by using accounting tools	3

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate, 3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	3	3	3	3	-	-	-
CO2	-	-	-	-	-	-	-	3	3	3	3	-	-	-
CO3	-	-	-	-	-	-	-	3	3	3	3	-	-	-
CO4	-	-	-	-	-	-	-	3	3	3	3	-	-	-
CO5	-	-	-	-	-	-	-	3	3	3	3	-	-	-

COURSE CONTENT:

UNIT-1:

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-2:

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 Isocosts, MRTS -Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale, Cost & Break-Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) - Determination of BreakEven Point (Simple Problems)-Managerial significance and limitations ofBreak-Even Analysis.

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UNIT-3:

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

UNIT-4:

Capital Budgeting: Introduction – Nature, meaning, significance, functions and advantages. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting–Features, Proposals, Methods, and Evaluation. Projects– Pay Back Method, Accounting Rate of Return(ARR) Net Present Value(NPV)Internal Rate Return(IRR) Method (simple problems)

UNIT-5:

Financial Accounting and Analysis: Introduction – Nature, meaning, significance, functions, and advantages. Concepts and Conventions-Double-Entry Book Keeping, Journal, Ledger, Trial Balance-Final Accounts (Trading Account, Profit and Loss Account, and Balance Sheet with simple adjustments).Financial Analysis-Analysis and Interpretation of Liquidity Ratios, Activity Ratios and Capital Structure Ratios, and Profitability.

Textbooks:

1. Varshney & Maheswari: Managerial Economics, Sultan Chand,2013.

Reference Books:

1. Managerial Economics: Principles and Worldwide Applications, 9E (Adaptation) by Dominick Salvatore and Siddhartha Rastogi.
2. Managerial Economics: Principles and Worldwide Applications by Dominick Salvatore.

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Regulation
D23

Course Code: **D23C211**
Name of the Course **ANALOG CIRCUITS**

Course Category:	Electronic devices and circuits	Credits : 3	
Course Type:	Theory	Lecture-Tutorial-Practice:	3 0 0
Prerequisites	Basics of semiconductor Devices	Continuous Evaluation	30M
		Semester End Evaluation	70M
		Total Marks	100M

Course Outcomes:

After Successful Completion of course, the student will be able to:

CO No:	Course Outcome Description	K - Level
CO1	Analyze diode circuits and biasing methods, Stabilization and Compensation techniques of Transistors.	Analysis
CO2	Design multistage and feedback amplifiers using BJT.	Analysis
CO3	Design RC and LC oscillators using BJT and study the basic concepts of Op-Amp.	Analysis
CO4	Design linear and nonlinear applications of Op-amp.	Evaluation
CO5	Analyze the working principle of IC 555 timer, Phase Locked Loops and their applications and Classify data converters used for real time data conversion.	Analysis

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate, 3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	-			-	-	-	-	-	-	2	3	3
CO2	2	3	2			-	-	-	-	-	-	2	3	3
CO3	2	3	2			-	-	-	-	-	-	2	3	3
CO4	3	2	2			-	-	2	-	-	-	2	3	3
CO5	3	3	1			-	-	2	-	-	-	2	3	3

COURSE CONTENT:

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 Modelling of BJT: Analysis of a Transistor Amplifier Circuit using h- parameters, Simplified CE Hybrid Model, Analysis of CE, CC, CB Configuration using Approximate Model, Frequency Response of CE and CC amplifiers.

Feedback Amplifiers: Classification of Amplifiers, the Feedback Concept, General Characteristics of Negative-Feedback Amplifiers, Effect of Negative Feedback upon Output and Input Resistances, voltage- series Feedback, Current-Series Feedback ,current- shunt feedback, Voltage-Shunt Feedback

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Unit – III: Oscillator Circuits: Bark hausen 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-amps & its features.

Unit – IV:OP-AMPS Applications: Introduction, Basic Op-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I and I to V Converter, Sample and Hold Circuit, Log and Antilog Amplifier, Multiplier and Divider, Differentiator, integrator.
Comparators and Waveform Generators: Introduction, Comparator, Square Wave Generator, Monostable Multivibrator, Triangular Wave Generator, Sine Wave Generators

Unit – V: Timers and Phase Locked Loop: Introduction to 555 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, 2ndEdition, 2010.

2. Linear Integrated Circuits Edition, 2003. D. Roy Choudhury, New Age International (p) Ltd

Reference Books:

1. Electronic Devices and Circuit Theory Pearson Edition, 2021. – Robert L.Boylestad and Lowis Nashelsky,

Circuits

2. Electronic Devices and Circuits Circuits–G.K. Mithal, Khanna Publisher, 23rd Edition, 2017.

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Regulation
D23

Course Code: **D23C212**
Name of the Course **POWER SYSTEMS-I**

Course Category:	PC (Professional Core)	Credits : 3	
Course Type:	Theory	Lecture-Tutorial-Practice:	3 0 0
Prerequisites	Electrical Circuit Analysis	Continuous Evaluation	30M
		Semester End Evaluation	70M
		Total Marks	100M

Course Outcomes:

After Successful Completion of course, the student will be able to:

CO No:	Course Outcome Description	K - Level
CO1	Illustrate components of thermal, Hydro power plants	Understanding
CO2	Illustrate components of Nuclear power plants.	Understanding
CO3	Distinguish the components of gas and air insulated substations.	Analysis
CO4	Analyze the underground cables and Distribution system	Analysis
CO5	Identify the tariff methods and load curves	Analysis

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (**1**- Low, **2** – Moderate, **3** – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3	-											
CO2		3	-											
CO3		3	2											
CO4		-	3											
CO5		3	2											

COURSE CONTENT:

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 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 bus bar, Double bus bar with one and two circuit breakers, main and transfer bus bar system with relevant diagrams.

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Gas Insulated Substations (GIS) – advantages of gas insulated substations, constructional aspects of GIS, comparison of air insulated substations and gas insulated substations.

Unit IV:

Underground Cables:

Types of cables, construction, types of insulating materials, calculation of insulation resistance, stress in insulation and power factor of cable. Capacitance of single and 3-Core belted cables. Grading of cables: capacitance grading and intersheath grading.

Distribution Systems:

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

UNIT V:

Economic Aspects & Tariff:

Economic Aspects – load curve, load duration and integrated load duration curves, discussion on economic aspects: connected load, maximum demand, demand factor, load factor, diversity factor, plant capacity factor and plant use factor, base and peak load plants.

Tariff Methods – Costs of generation and their division into fixed, semi-fixed, 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. Chand, 4th Edition 2005.
4. Turan Gonen, Electric Power Distribution System Engineering, McGraw Hill, 1985.
5. Handbook of switchgear, BHEL, McGraw-Hill Education, 2007.

E-RESOURCES/DIGITAL MATERIAL:

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

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Regulation
D23

Course Code: **D23C213**

Name of the Course **INDUCTION & SYNCHRONOUS MACHINES**

Course Category:	BS/ES/PC/PE/OE/MC/SC	Credits : 3	
Course Type:	Theory / Tutorial /Practical	Lecture-Tutorial-Practice:	3 0 0
Prerequisites	Principles of Electromechanical Energy Conversion, Electromagnetic fields and Electrical Circuit Analysis	Continuous Evaluation	30M
		Semester End Evaluation	70M
		Total Marks	100M

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Understand the principle of operation and constructional features of 3-phase induction motor.	Understanding
CO2	Analyse the performance of three- phase induction motor in terms of Torque and slip and as induction generator.	Analysis
CO3	Describe the working of single- phase induction motors.	Understanding
CO4	Analyze the performance of synchronous generators	Analysis
CO5	Analyze the performance and starting methods of synchronous motors.	Analysis

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate, 3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3												
CO2	2	3	2	2									2	
CO3	3	3												
CO4	2	3	2	2									2	
CO5	2	3	2	2									2	

COURSE CONTENT:

UNIT - I :3-phase induction motors

Construction details of squirrel cage and slip ring induction motors – production of rotating magnetic field – principle of operation -rotor emf and rotor frequency – rotor current and pf at standstill and during running conditions – rotor power input, rotor copper loss and mechanical power developed and their interrelationship, –equivalent circuit – phasor diagram.

UNIT - II : Performance of 3-Phase induction motors:

Torque equation – expressions for maximum torque and starting torque – torque slip characteristic – 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

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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 and Potier triangle method– two reaction analysis of salient pole machines -methods of synchronization- Slip test – Parallel operation of alternators.

UNIT - V

Synchronous motor

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

Text Books:

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

Reference Books:

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

E-RESOURCES/DIGITAL MATERIAL:

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

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Regulation
D23

Course Code **D23C214**

Name of the Course **CONTROL SYSTEMS**

Course Category:	BS/ES/PC/PE/OE/MC/SC	Credits : 3			
Course Type:	Theory / Tutorial /Practical	Lecture-Tutorial-Practice:	3	0	0
Prerequisites	Basic Engineering Mathematics	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Calculate the transfer function of physical systems	Analysis
CO2	Determine time response specifications of second order systems and error constants of linear systems and Analyze stability of Liner time invariant systems using time domain analysis methods such as Rouths stability criterion and the root locus method.	Analysis
CO3	Analyze the stability of Liner time invariant systems using frequency response methods such as Nyquist, Bode and polar plots	Analysis
CO4	Design Lag, Lead, Lag-Lead compensators to improve system performance by using Bode Diagrams	Application
CO5	Develop the state model equations and identify the controllability and observability of a physical System	Analysis

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (**1**- Low, **2** – Moderate, **3** – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3												
CO2	2	3											2	
CO3	2	3											2	
CO4		2	3										2	
CO5	2	3			2								2	

COURSE CONTENT:

UNIT-I : Mathematical Modelling Of Control Systems

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

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UNIT-II : Time Response Analysis

Standard test signals – time response of first and second order systems – time domain specifications - steady state errors and error constants - effects of proportional (P) - proportional integral (PI) - proportional derivative (PD) proportional integral derivative (PID) systems.

Stability And Root Locus Technique

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-III : Frequency Response Analysis

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

UNIT-IV : Classical Control Design Techniques

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

UNIT-V : State Space Analysis of LTI Systems

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

Text Books:

1.Modern Control Engineering by Kotsuhiko Ogata, Prentice Hall of India, 2010.

2.Automatic control systems by Benjamin C.Kuo, Prentice Hall of India, 2nd Edition

Reference Books:

1. Control Systems by Manik Dhanesh N, Cengage publications
2. Control Systems Engineering by I.J.Nagarath and M.Gopal, Newage International Publications, 5th Edition
3. Control Systems Engineering by S.Palani, Tata Mc Graw Hill Publications

E-RESOURCES/DIGITAL MATERIAL:

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

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Regulation
D23

Course Code: **D23C215**

Name of the Course: **INDUCTION &SYNCHRONOUS MACHINES LAB**

CourseCategory:	BS/ES/PC/PE/OE/MC/SC	Credits : 1.5			
Course Type:	Theory / Tutorial /Practical	Lecture-Tutorial-Practice:	0	0	3
Prerequisites	AC Machines	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
D23C215.1	Examine the performance characteristics of three phase Induction machines.	Analysis
D23C215.2	Distinguish various characteristics and test the efficiency and regulation of synchronous machines	Analysis
D23C215.3	Determine the performance of a single phase induction motors	Analysis

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (**1**- Low, **2** – Moderate,**3** – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
D23C215.1	1	2	2	3	1	1	-	2	3	2	1	2	1	1
D23C215.2	1	2	2	3	-	1	-	2	3	2	1	2	-	1
D23C215.3	1	2	2	3	1	1	-	2	3	2	1	2	1	1

COURSE CONTENT:

Any 10 of the following experiments are to be conducted:

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

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

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Regulation
D23

Course Code: **D23C216**
Name of the course: **CONTROL SYSTEMS LAB**

Course Category:	PC (Professional Core)	Credits: 1.5			
Course Type:	Practical	Lecture-Tutorial-Practice:	0	0	3
Prerequisites	Control Systems	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Analysis of P,PI,PID controllers with and without temperature effect	Analysis
CO2	Examine different logic gates and Boolean expressions using PLC.	Evaluating
CO3	Analyze the Characteristics of synchros, magnetic amplifiers, AC and DC Servomotors	Analysis
CO4	Calculate time domain specifications of Second order system for step input	Evaluating
CO5	Test the controllability and Observability and Judge the stability in time and frequency domain	Evaluating

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (**1**- Low, **2** – Moderate, **3** – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	3	2					2	3	2				
CO2	1	2	3		3			2	3	2				
CO3	1	3						2	3	2				
CO4	1	3			2			2	3	2			2	
CO5	1	2			3			2	3	2			3	

Content:

List of Experiments:

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 5th order using MATLAB.
7. Kalman's test of Controllability and Observability using MAT LAB.
8. Temperature controller using PID
9. Characteristics of magnetic amplifiers
10. Characteristics of AC servo motor
11. Characteristics of DC servo motor
12. Study and verify the truth table of logic gates and simple Boolean expressions using PLC.

Reference Books:

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

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Regulation
D23

Course Code: **D23C217**

Name of the Course: **DATA STRUCTURES LAB**

Course Category:	Skill Enhancement Course	Credits : 2	
Course Type:	Tutorial & Practical	Lecture-Tutorial-Practice:	0 1 2
Prerequisites	Basic Programming	Continuous Evaluation	30M
		Semester End Evaluation	70M
		Total Marks	100M

Course Outcomes:

After Successful Completion of course,the student will be able to:

CO No:	Course Outcome Description	K - Level
CO1	Apply sorting and searching operations on linear data structures Arrays.	Applying
CO2	Apply operations on linked lists for dynamic data storage, demonstrating understanding of memory allocation.	Applying
CO3	Apply operations on stacks to handle recursive algorithms, manage program states, and solve related problems.	Applying
CO4	Apply operations on queues and implement circular queues, Dequeues	Applying
CO5	Apply operations on Tree with Traversal techniques	Applying

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (**1**- Low, **2** – Moderate,**3** – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-

COURSE CONTENT:

UNIT I

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

Sample experiments:

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

UNIT II

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

Sample experiments:

1. Write a program to implement the following operations.

a. Insert b. Deletion c. Traversal

2. Write a program to store name, roll no, and marks of students in a class using circular double linked list.
3. Write a program to perform addition of given two polynomial expressions using linked list.

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UNIT III

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

Sample experiments:

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

UNIT IV

Queues: Introduction to queues: properties and operations, Circular queues, implementing queues using arrays and linked lists, Applications of queues scheduling, etc. Deques: Introduction to deques (double-ended queues), Operations on deques and their applications.

Sample experiments:

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

UNIT V

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

Sample experiments:

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

TEXT BOOKS:

1. Data Structures and algorithm analysis in C, 2nd Edition, Mark Allen Weiss, Pearson, 2002
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Freed, Silicon Press, 2008

REFERENCE BOOKS:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders. 2008
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft., 2002

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Regulation
D23

Course Code: **D23C218**

Name of the course: **DESIGN THINKING & INNOVATION**

Course Category:	Engineering Science (ES)	Credits: 2			
Course Type:	Practical	Lecture-Tutorial-Practice:	1	0	2
Prerequisites	-	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Define the concepts related to design thinking.	1
CO2	Explain the fundamentals of Design Thinking and innovation.	2
CO3	Apply the design thinking techniques for solving problems in various sectors.	3
CO4	Analyse to work in a multidisciplinary environment.	4
CO5	Evaluate the value of creativity.	5

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate, 3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	-	-	2	2	-	2	-	-
CO2	3	3	3	3	3	2	-	-	2	2	-	2	-	-
CO3	3	3	3	3	3	2	-	-	2	2	-	2	-	-
CO4	3	3	3	3	3	2	-	-	2	2	-	2	-	-
CO5	3	3	3	3	3	2	-	-	2	2	-	2	-	-

Content:

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 lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4) Chesbrough.H, The era of open innovation, 2003.

E-RESOURCES/DIGITAL MATERIAL:

a) https://nptel.ac.in/courses/110/106/110106124/
b) https://nptel.ac.in/courses/109/104/109104109/
c) https://swayam.gov.in/nd1_noc19_mg60/preview
d) https://onlinecourses.nptel.ac.in/noc22_de16/preview

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