B.TECH ELECTRICAL & COMPUTER ENGINEERING

DEPT OF ELECTRICAL ENGINEERING

FACULTY OF ENGINEERING & TECHNOLOGY

JAMIA MILLIA ISLAMIA

NEW DELHI

https://jmi.ac.in/electrical

CURRICULUM AND SYLLABI

VISION OF THE DEPARTMENT

To produce comprehensively trained socially responsible, innovative electrical engineers and researchers of highest quality to contribute to the nation's imprint on the world stage.

MISSION OF THE DEPARTMENT

M1. Department is committed to provide world class teaching, mentoring with intellectual stimulation.

M2. Department is committed to industry collaboration and state of the art research.

M3. Department is committed to outreach program to address societal and industrial needs.

CURRICULUM & SYLLABI

2024-2025

BACHELORS OF TECHNOLOGY (B.TECH)

IN

ELECTRICAL AND COMPUTER ENGINEERING

DEPARTMENT OF ELECTRICAL ENGINEERING
FACULTY OF ENGINEERING AND TECHNOLOGY
JAMIA MILLIA ISLAMIA
NEW DELHI-110025

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PROPOSED COURSE STRUCTURE AS PER NEP-2020

Program **B. Tech. in Electrical & Computer Engineering with Honours Degree OR Minor Specialization**

Duration **4 years**

Effective from July 2024

S. No.	Courses	Credits								Total	No. of Courses
		1st Year		2nd Year		3rd Year		4th Year			
		1st Sem.	2nd Sem.	3rd Sem.	4th Sem.	5th Sem.	6th Sem.	7th Sem.	8th Sem.		
1	Basic Science Course **(BSC)**	9	9	3						21	7
2	Basic Science- Laboratory Course (**BSC-L**)	4	1							5	4
3	Engineering Science Course (**ESC**)	6	9							15	5
4	Engineering Science-Laboratory Course (**ESC-L**)	1	3		2					6	4
5	Humanities, Social Sciences including Management Courses (**HSMC**)	2			6					8	3
6	Humanities, Social Sciences including Management Courses (**HSMC-L**)	1								1	1
7	Professional core courses (**PCC**)			12	9	15	12			48	16
8	Professional core courses- Laboratory Course (**PCC-L**)			4	3	4	4			15	15
9	Professional Electives courses (**PEC**)					3	3	12		18	6
10	Open Electives courses (**OEC**)							3	6	9	3
11	Seminar/ Internship/ Minor Project/ Major Project (**PROJ**)						1	2+3	6	12	4
12	Mandatory Course (**MC**)		0	3	2					5	3
	Total	23	22	22	22	22	20	20	12	163	71

Abbreviations

L Lecture
T Tutorial
P Practical
C Credits
CCA Continuous Class Assessment
MSE Mid Semester Evaluation
ESE End Semester Evaluation

B. TECH. ELECTRICAL & COMPUTER ENGINEERING – I YEAR

FIRST SEMESTER

S. No	COURSE CODE	COURSE NAME	COURSE TYPE		Credits	L	T	P	HRS
1.	AST-101	Communication Skills	Theory	HSMC	2	2	0	0	2
2.	ASB-101	Engineering Physics I	Theory	BSC	3	3	0	0	3
3.	ASB-102	Engineering Chemistry	Theory	BSC	3	3	0	0	3
4.	ASB-103	Engineering Mathematics I	Theory	BSC	3	3	0	0	3
5.	EES-101	Basics of Electrical Engineering	Theory	ESC	3	3	0	0	3
6.	CSS-101	Fundamentals of Computing	Theory	ESC	3	3	0	0	3
i.	ASL-101	Language Laboratory	Lab	HSMC-L	1	0	0	2	2
ii.	ASL-102	Engineering Physics Laboratory I	Lab	BSC-L	1	0	0	2	2
iii.	ASL-103	Engineering Chemistry Laboratory	Lab	BSC-L	1	0	0	2	2
iv.	MEL-101	Engineering Graphics & Design	Lab	BSC-L	2	0	0	4	4
v.	ASL-104	Design Thinking & Idea Lab	Lab	ESC-L	1	0	0	2	2
				Total	**23**	**17**	**0**	**12**	**29**

SECOND SEMESTER

S. No	COURSE CODE	COURSE NAME	COURSE TYPE		Credits	L	T	P	HRS
1.	ASB-201	Engineering Physics II	Theory	BSC	3	3	0	0	3
2.	ASB-202	Engineering Mathematics II	Theory	BSC	3	3	0	0	3
3.	ASB-203	Biology for Engineers	Theory	BSC	3	3	0	0	3
4.	ECS-201	Basics of Electronics & Communication Engineering	Theory	ESC	3	3	0	0	3
5.	MES-201	Basics of Mechanical Engineering	Theory	ESC	3	3	0	0	3
6.	CES-201	Basics of Civil Engineering	Theory	ESC	3	3	0	0	3
7.	ASM-201	Constitution of India	Theory	MC-I	0	2	0	0	2
i.	ASL-201	Engineering Physics Laboratory II	Lab	BSC-L	1	0	0	2	2
ii.	MEL-201	Workshop Practice	Lab	ESC-L	2	0	0	4	4
iii.	MEL-202	Engineering Mechanics Laboratory	Lab	ESC-L	1	0	0	2	2
				Total	**22**	**20**	**0**	**8**	**28**

B. TECH. ELECTRICAL & COMPUTER ENGINEERING – II YEAR

THIRD SEMESTER

S. No	COURSE CODE	COURSE NAME	COURSE TYPE		Credits	L	T	P	HRS
1.	ASM-301	Mandatory Course : Universal Human Values	Theory	MC-II	3	3	-	-	3
2.	ASM-302	Mandatory Course: Essence of Indian Traditional Knowledge	Theory	MC-IV	0	2	-	-	2
3.	ASB-301	Engineering Mathematics- III (Probability and Statistics)	Theory	BSC	3	3	-	-	3
4.	EEC-302	Network Analysis	Theory	PCC	3	3	-	-	3
5.	EEC-303	Signals and System	Theory	PCC	3	3	-	-	3
6.	EEC-305	Data Structures and Algorithms	Theory	PCC	3	3	-	-	3
7.	EEC-306	Electric Machines & Power System	Theory	PCC	3	3	-	-	3
i.	EEL-302	Network Analysis Lab.	Lab	PCC-L	1	-	-	2	2
ii.	EEL-303	Signals and System Lab	Lab	PCC-L	1	-	-	2	2
iii.	EEL-305	Data Structures and Algorithms Lab	Lab	PCC-L	1	-	-	2	2
iv.	EEL-306	Electric Machines & Power System Lab	Lab	PCC-L	1	-	-	2	2
				Total	**22**	**20**	**-**	**8**	**28**

FOURTH SEMESTER

S. No	COURSE CODE	COURSE NAME	COURSE TYPE		Credits	L	T	P	HRS
1.	ASM-401	Mandatory Course: Environmental Science	Theory	MC-III	2	2	-	-	2
2.	AST-401	OE-I (Operations Research)	Theory	HSMC	3	3	-	-	3
3.	AST-402	OE-II (Engg. Economics)	Theory	HSMC	3	3	-	-	3
4.	EEC-403	Power Electronics	Theory	PCC	3	3	-	-	3
5.	EEC-404	Analog and Digital Electronics	Theory	PCC	3	3	-	-	3
6.	EEC-405	Object Oriented Programming	Theory	PCC	3	3	-	-	3
i.	EEL-403	Power Electronics Lab	Lab	PCC-L	1	-	-	2	2
ii.	EEL-404	Analog and Digital Electronics Lab.	Lab	PCC-L	1	-	-	2	2
iii.	EEL-405	Object Oriented Programming Lab	Lab	PCC-L	1	-	-	2	2
iv.	ASL-401	Numeric & Scientific Computing Lab	Lab	ECS-L	2	-	-	4	4
				Total	**22**	**19**	**0**	**10**	**29**

B. TECH. ELECTRICAL & COMPUTER ENGINEERING –III YEAR

FIFTH SEMESTER

S. No	COURSE CODE	COURSE NAME	COURSE TYPE		Credits	L	T	P	HRS
1.	EEC-501	Control Systems	Theory	PCC	3	3	-	-	3
2.	EEC-506	Measurement and Instrumentation	Theory	PCC	3	3	-	-	3
3.	EEC-507	Data Communications & Computer Networks	Theory	PCC	3	3	-	-	3
4.	EEC-508	Computer Architecture	Theory	PCC	3	3	-	-	3
5.	EEC-509	Artificial Intelligence & Machine Learning	Theory	PCC	3	3	-	-	3
6.		**Professional Elective Courses-I** EEC-502 Switchgear & Protection/ EEE-510 Digital Signal Processing/ EEE-511 Introduction to Robotics/ EEE-512 Database Management Systems	Theory	PEC	3	3	-	-	3
i.	EEL-501	Control Systems Lab.	Lab	PCC-L	1	-	-	2	2
ii.	EEL-506	Measurement & Instrumentation Lab	Lab	PCC-L	1	-	-	2	2
iii.	EEL-507	Data Communications and Computer Network Lab.	Lab	PCC-L	1	-	-	2	2
iv.	EEL-509	Artificial Intelligence and Machine Learning Lab.	Lab	PCC-L	1	-	-	2	2
				Total	**22**	**18**	**-**	**8**	**26**

SIXTH SEMESTER

S. No	COURSE CODE	COURSE NAME	COURSE TYPE		Credits	L	T	P	HRS
1.	EEC-603	Power Systems Analysis	Theory	PCC	3	3	-	-	3
2.	EEC-604	SCADA & Smart Grid Technologies	Theory	PCC	3	3	-	-	3
3.	EEC-605	Microprocessors & Microcontrollers	Theory	PCC	3	3	-	-	3
4.	EEC-606	Operating Systems	Theory	PCC	3	3	-	-	3
5.		**Professional Elective Courses-II** EEE-602 HVDC Transmission/ EEE-603 Electrical Power Gen./ EEE-604 Intro to Cyber Security/ EEE-605 Theory of Computation/ EEE-606 Data Mining	Theory	PEC	3	3	-	-	3
i.	EEL-603	Power Sys Analysis(MATLAB-based)	Lab	PCC-L	1	-	-	2	2
ii.	EEL-604	SCADA & Smart Grid Technologies Lab	Lab	PCC-L	1	-	-	2	2
iii.	EEL-605	Microprocessors & Microcontrollers L	Lab	PCC-L	1	-	-	2	2
iv.	EEL-606	Operating Systems Lab.	Lab	PCC-L	1	-	-	2	2
v.	EEP-601	Seminar (Literature Review)	Lab	PROJ-I	1	-	-	2	2
				Total	**20**	**15**	**-**	**8**	**24**

B. TECH. ELECTRICAL & COMPUTER ENGINEERING –IV YEAR

SEVENTH SEMESTER

S. NO	COURSE CODE	COURSE NAME	COURSE TYPE		CREDITS	L	T	P	HRS
1.		**Professional Electives Courses-III** EEE-702 Embedded Systems/ EEE-703 Power System Op. & Control/ EEE-711 Compiler Design	Theory	PEC	3	3	-	-	3
2.		**Professional Electives Courses-IV** EEO-702 Robotics & Automation / EEE-705 Adv. Protective Relays/ EEE-712 Big Data Analytics	Theory	PEC	3	3	-	-	3
3.		**Professional Electives courses-V** EEE 709 VLSI Design / EEE 713 Cloud Computing / EEE 714 Electric Drives	Theory	PEC	3	3	-	-	3
4.		**Professional Electives Courses-VI** EEE 710 Adv. Power Electronics/ EEE 715 Deep Learning/ EEE 716 GPU Computing	Theory	PEC	3	3	-	-	3
5.		**Open Elective-III** EEO 703 Software Engg. / EEO 704 Power System Automation/ EEO 705 Cyber Physical Systems	Theory	OEC	3	3	-	-	3
i.	EEP-701	Summer Internship	Internship	PROJ-II	2	-	-	4	4
ii.	EEP-702	Minor Project	Project	PROJ-III	3	-	-	6	6
		702		**Total**	**20**	**15**	**0**	**10**	**25**

* During last summer vacation (Minimum 6-8 weeks)

B. TECH. ELECTRICAL & COMPUTER ENGINEERING –IV YEAR

EIGHTH SEMESTER

S. NO	COURSE CODE	COURSE NAME	COURSE TYPE		CREDITS	L	T	P	HRS
1.		**Open Elective-IV (SWAYAM NPTEL/ MOOCs)** EEO 803 Grid Protection & Control/ EEO 806 Computing & Sustainability/ EEO 807 Adv Cybersecurity/ EEO 808 NLP	Theory	OEC	3	3	-	-	3
2.		**Open Elective-V (SWAYAM NPTEL/ MOOCs)** EEO 805 Electricity Markets/ EEO 809 Evolutionary Optimization Tech/ EEO 810 Blockchain Tech/ EEO 811 Image Processing & Computer Vision	Theory	OEC	3	3	-	-	3
i.	EEP-801	Major Project	Project	PROJ-IV	6	-	-	12	12
				Total	**12**	**06**	**0**	**12**	**18**

*If semester-long project work is done in the industry/internship, the OECs in VIII sem may be offered in online mode/NPTEL on SWAYAM.

Total Semester-wise Credit Breakdown

	Semesters								
Total	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**Total Credits**
	23	22	24	22	21	19	20	12	**163**

HONOURS DEGREE IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

S. No	COURSE CODE	COURSE NAME	COURSE TYPE		Credits	L	T	P	HRS
		FOURTH SEMESTER							
1.	EEH-414	Mathematics for AI & ML	Theory	PCC	3	3	0	0	3
		FIFTH SEMESTER							
2.	EEH-514	Data Analytics	Theory	PCC	3	3	0	0	3
		SIXTH SEMESTER							
3.	EEH-614	Deep Learning	Theory	PCC	3	3	0	0	3
i	EEL-624	Deep Learning Lab	Lab	PCC-L	1	0	0	2	2
		SEVENTH SEMESTER							
4.	EEH-714	Generative AI and LLMs	Theory	PCC	3	3	0	0	3
ii	EEP-724	Generative AI Project	Project	PROJ-V	2	0	0	4	4
		EIGHTH SEMESTER							
5.	EEH-814	Special Topics in AI and ML **(SWAYAM NPTEL/ MOOCs)** NLP/Computer Vision/Artificial Intelligence for Economics/Machine Learning for Earth System Sciences/Machine Learning in Agriculture/Responsible & Safe AI Systems	Theory	PCC	3	3	0	0	3
				Total	**18**	**15**	**0**	**6**	**21**

AST-101: COMMUNICATION SKILLS

Credits	Hours/week	Lecture	Tutorial	Practical	End-Sem Exam	Internal Assessment
2	2	2 hours	0 hours	0 hours	30 Marks	20 Marks

Course Outcomes

CO1 Gaining proficiency in English.
CO2 Developing personality, communication fluency & accuracy.
CO3 Inculcating ideation and exposition skills.
CO4 Honing the interpretative, logical, creative and imaginative skills.
CO5 Creating human sensibilities and forge convergences of technology with larger humanity.

UNIT-I: COMMUNICATION SKILLS AND ITS VARIOUS ASPECTS

Communication Skills: theoretical perspectives. Reading, Writing, Listening, Speaking and Pragmatics, Identification of Communication Barriers and ways to overcome them, Technology, Humanities & Communication

UNIT-II: GRAMMAR

Subject-verb agreement, Use of tense & sequence of tenses, Use of verbs, repositions & articles, Use of idioms & phrases, Discourse markers, Word vocabulary- synonym, antonym, homonym & one word substitution

UNIT-III: WRITING

Formal & informal letters & Email correspondences, Report, Resume, Reviews (Book & Scientific) & Expansion, Essay & Article writing

UNIT-IV: ENGLISH PHONETICS

Speech Mechanism, Organs of Speech, Vowels & Consonants, Place of Articulations, Manner of Articulation, Vowel diagram, IPA symbols, Phonetic Transcription, Word , tress (Primary Accent)

UNIT-V: LITERATURE

Road Not Taken (Poem by Robert Frost), The Express (Poem by Stephan Spender), Of Studies (Essay by Francis Bacon), Pygmalion (by George Barnard Shaw)

Text Books

1. The Joy of Reading: Orient Blackswan Pvt. Ltd, New Delhi
2. Fluency in English: Macmillan Publishers, New Delhi
3. Intermediate Grammar Usage and Composition : M.L.Tikoo and Subramanian , Orient Blackswan Pvt. Ltd, New Delhi
4. A Text Book of English Phonetics for Indian Students: T. Balasubramanian,
5. Macmillan Publishers, New Delhi.
6. Practical English Usage: Michael Swan, Oxford University Press.

References Books

1. The Oxford Guide to effective Writing and Speaking Skills: John Seely, Oxford University Press
2. English Pronouncing Dictionary: Daniel Jones, Cambridge University Press.
3. Technical communication Principles and Practice: Meenakshi Raman and Sangeeta Sharma, Oxford.

ASB-101: ENGINEERING PHYSICS – I

Credits	Hours/week	Lecture	Tutorial	Practical	End-Sem Exam	Internal Assessment
3	3	2 hours	1 hours	0 hours	45 Marks	30 Marks

Course Outcomes

CO1 Introducing the basic theories of Mechanics and Kinematics.
CO2 Describing the concepts of coordinate systems and their transformation. Understanding the concept and applications of electric field intensity.
CO3 Describing the basic laws of magnetism, analysis and their practical applications.
CO4 Discussing the transition from classical to quantum mechanics, explaining quantum mechanics & related applications.
CO5 Recalling the basics of semiconductors, explaining various electrical parameters of semiconductors and different laws of distribution of particles. Introducing the concept of free electron theory, its success and failure.

UNIT- I: CLASSICAL MECHANICS

Review of Newtonian Mechanics in rectilinear Coordinate system, Rigid body, Translational and Rotational motion, Moment of Inertia, Radius of Gyration, Kinematics of rotational motion about fixed axis (Parallel axis theorem Perpendicular axis theorem), Simple harmonic motion (SHM), phaser representation of SHM, Simple Pendulum and Compound Pendulum, Damped harmonic oscillator- heavy, critical and light damping, energy decay in damped harmonic oscillator, quality factor.

UNIT–II: ELECTROSTATICS

Coordinate Systems: Cartesian, Cylindrical and Spherical, Transformation of coordinate systems, Gradient of a scalar, divergence and curl of a vector; line integral, surface integral and volume integral, Gauss Divergence Theorem and its applications, Stokes Theorem and its applications, Charge distribution along line, across surface and over volume, Gauss's law and its applications, Electric field due to uniformly charged infinitely long wire, Electric field due to thin infinite plane sheet, Electric field due to infinite parallel sheets, Electric field due to uniformly distributed charged spherical shell, Electric field due to non-conducting charged solid sphere, Working and principle of Potentiometer, Wheatstone bridge.

UNIT-III: MAGNETOSTATICS

Biot-Savart law and its application, Magnetic field due to current carrying conductor, Magnetic field at the centre and at the axis of circular coil carrying current, Magnetic flux, Gauss's law in magnetostatics, Ampere's circuital law and its application, Magnetic induction due to long linear conductor, Magnetic field due to long circular cylinder, Equation of Continuity, Concept of Displacement current, Modified Ampere circuital law.

UNIT-IV: QUANTUM IDEAS

Prerequisite of Quantum theory, Concept of Black body radiation, Wein`s displacement law, Rayleigh Jeans Planck's hypothesis, wave particle duality; Photoelectric effect; de-Broglie hypothesis; Experimental evidence of matter waves (Davisson-Germer experiment), Compton effect, Uncertainty principle and its applications.

UNIT-V: SOLID STATE PHYSICS

Basic of semiconductors, Concept of doping in semiconductors, Intrinsic and Extrinsic semiconductors, p-type and n-type semiconductors. Effective mass and law of mass action, Carrier concentration, Electrical conductivity and mobility of charge carriers in intrinsic and extrinsic semiconductors.Classical free electron theory of metals and its failure, Explanation of electrical conductivity, thermal conductivity of metals, Weidmann Franz Law, Bose Einstein and Fermi Dirac statistical distribution function, Fermi energy of free electron in metal, concept of average energy and total energy of free electrons, relation between average energy and Fermi energy.

Textbooks

1. Fundamentals of Physics: Halliday and Resnick
2. Introduction to Electrodynamics: David J. Griffiths
3. Optics: Ajoy Ghatak
4. Concepts of Modern Physics: Arthur Beiser

Reference Books

1. Elements of Electrodynamics, Mathew N. O. Sadiku
2. Electricity, magnetism and Light, W. Saslow
3. Fundamentals of Optics, Jenkins and White

ASB-102: ENGINEERING CHEMISTRY

Credits	Hours/week	Lecture	Tutorial	Practical	End-Sem Exam	Internal Assessment
3	3	2 hours	1 hours	0 hours	45 Marks	30 Marks

Course Outcomes

CO1 To understand basics of material science and surfactants.
CO2 To understand the fundamentals of instrumental methods of analysis.
CO3 To study and understand about chemical methods of analysis and phase rule.
CO4 To develop an understanding of basics of electrochemistry.
CO5 To understand about the fundamentals of polymers.

UNIT-I: BASICS OF MATERIAL SCIENCE AND SURFACTANTS

Types of crystal system, Bravais lattices, Miller indices, Atomic packing factor, Planar atomic density, Crystal defects. Surface active agents: Soaps, Types and advantages. Detergents, Critical Micellar Concentration, Hydrophilic and Hydrophobic interactions, HLB values.

UNIT-II: INSTRUMENTAL METHODS OF ANALYSIS

Chromatography: Definition and its types, Adsorption chromatography, Partition chromatography, High Pressure Liquid Chromatography. Fundamentals of Spectroscopy: Principles and Applications of UV-Visible, Infra-Red and Atomic Absorption Spectrometry.

UNIT-III: CHEMICAL METHODS OF ANALYSIS AND PHASE RULE

Gravimetric Analysis: Digestion and its Importance, Favorable Conditions for Precipitation. Volumetric Methods of Analysis: Expression of concentration of solutions, Redox, Precipitation and Complexometric Titrations. Phase Rule and its applications to One and Multiple Component systems.

UNIT-IV: ELECTROCHEMISTRY

Reversible and Irreversible cell: Electrolytic and Galvanic cell, Electrode Potential, Standard Electrode Potential, EMF series, Nernst Equation, Cell emf Measurement. Thermodynamic Overview of Electrochemical Processes. Conductance, Cell Constant and its determination.

UNIT-V: POLYMERS

Fundamentals of polymer chemistry: Molecular weight, Glass transition temperature and Melting point. Methods of polymerization, Structure-property relationship, Thermoplastics and Thermosets. Fabrication of polymers by Compression, Injection, Extrusion and Transfer Moulding. Synthesis, properties and uses of common polymers, Conducting polymers and their applications.

Textbooks

1. V. Raghvan, “Material Science and Engineering: A first Course”, Prentice Hall, 2006.
2. Jain and Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company.
3. Satyaprakash & Manisha Agrawal, “Engineering Chemistry”, Khanna Book Publishing, Delhi.
4. V. R. Gowarikar: “Polymer science”, New age international Publishers.

Reference Books

1. William D. Callister, Jr and David G. Rethwisch, Materials Science and Engineering: An Introduction, 10th Edition, Wiley, USA
2. Colin N. Banwell and Elaine M. McCash, Fundamentals of Molecular Spectroscopy, McGraw Hill Book

3. Company Europe, England
4. Jeffery, G.H.; Bassett, J.; Mendham, J.; Denney, R.C. (1989), Vogel's Textbook of Quantitative Chemical
5. Analysis, John Wiley and Sons
6. Atkins, P.W.; Paula, J.de. (2014),Atkin's Physical Chemistry Ed., 10th Edition, Oxford University Press.
7. Robert J. Young and Peter A. Lovell, Introduction to Polymers, CRC Press, Taylor & Francis

ASB-103: ENGINEERING MATHEMATICS - I

Credits	Hours/week	Lecture	Tutorial	Practical	End-Sem Exam	Internal Assessment
3	3	2 hours	1 hours	0 hours	45 Marks	30 Marks

Course Outcomes

CO1 Successive differentiation, expansion of functions, partial derivatives, double points and asymptotes.

CO2 Tracing of curve of two-dimensional, curvature, quadrature, rectification, volume and surface area of solids of revolutions.

CO3 Theory of two variable Calculus, Eigenvalues, Eigen vectors, consistency of system, vector space and linear transformations.

CO4 Solution of ordinary differential equations with its applications.

CO5 Learning the concepts of partial differential equations.

UNIT–I: CALCULUS OF ONE VARIABLE AND ITS APPLICATIONS

Successive differentiation (Leibnitz's theorem of nth derivative), Maclaurin's and Taylor's expansion of a function; Double point and its nature; Concavity, convexity and points of inflexion; Oblique and rectangular asymptotes, Curve tracing (Cartesian and polar forms), Curvature, Radius of curvature (Cartesian and polar forms)

UNIT–II: CALCULUS OF SEVERAL VARIABLES AND ITS APPLICATIONS

Partial derivatives and their geometrical interpretation, Total derivative, change of variables, Euler's Theorem on Homogeneous Function, Taylor's expansion of a function of two and more variables; Leibnitz's rule for differentiation under the sign of integration; Maxima and minima of a function of two and more variables including Lagrange's method.

UNIT-III: INTEGRATION AND ITS APPLICATIONS

Beta and Gamma Functions, Evaluation of multiple integrals by change of order of integration, applications of multiple integrals(Rectification, Volume and Surface of revolution)

UNIT-IV: ORDINARY DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS

Linear Differential Equations, Exact Differential Equations, complementary function and particular integral, solution of ordinary linear differential equations of higher order with constant and variable coefficients (Cauchy and Legendre forms); Orthogonal and isogonal trajectories of a family of curves.

UNIT–V: PARTIAL DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS

Introduction to partial differential equations, Lagrange's method of undetermined multipliers for the solution of linear partial differential equations of first order, solution of nonlinear partial differential equations of first order by means of Charpit's methods.

Text/Reference Books

1. Quddus Khan; Advamced Engineering Mathematics, Tyrasons Publications, Delhi-110092, (2022)
2. B. V. Raman, Higher Engineering Mathematics, McGraw Hill Education India, 26th edition 2016.
3. R. K. Jain and S. R. K. Iyengar: Advanced Engineering Mathematicsl Narosa, 5tr Edition, 2018.
4. H. K. Dass; Advanced Engineering Mathematics, S. Chand Publishing, 22 edition,2018.

EES-101: BASICS OF ELECTRICAL ENGINEERING

Credits	Hours/week	Lecture	Tutorial	Practical	End-Sem Exam	Internal Assessment
3	3	2 hours	1 hours	0 hours	45 Marks	30 Marks

Course Outcomes

CO1 To solve electrical circuits applying KCL, KVL and network theorems.
CO2 To understand the concept of phasors, waveforms and behaviour of basic electric circuit components.
CO3 To analyze the various types of losses in magnetic circuits.
CO4 To understand the construction, operation and applications of DC machines and single phase induction motors.
CO5 To introduce various types of electrical machines and its applications

UNIT-I

Kirchoff's laws, node voltage and mesh current methods, delta-star and star-delta conversion, classification of network elements, superposition principle, Thevenin's and Norton's theorems.

UNIT-II

Single phase AC circuits, average and effective values of sinusoids, solution of R,L,C series circuits, the j operator, complex representation of impedances, phasor diagram, power factor, power in complex notation, solution of parallel and series-parallel circuits, resonance. Introduction to balance three phase AC circuits.

UNIT-III

Introduction to magnetic circuits, analogy between electrical and magnetic circuit, Simple magnetic circuit with DC and AC excitations-Faraday's laws, induced emfs and inductances, magnetic leakages, B-H curve, hysteresis and eddy current loss, magnetic circuit calculations, mutual coupling.

UNIT-IV

Single Phase Transformers- Principle of operation, construction, e.m.f. equation, ratings, phasor diagram for no-load and full load, equivalent circuit, power losses, regulation and efficiency calculations, open circuit and short circuit tests. Introduction to auto-transformer.

UNIT-V

Types of electrical machines, working principle and construction of DC and AC machines, domestic and industrial applications of various types of electrical machines.

Textbooks

1. V. Del Torro, Electrical Engineering Fundamentals, Second Edition, Prentice Hall of India Pvt. Ltd
2. R. L. Boylestad, Introductory Circuit Analysis, Pearson
3. I. J. Nagrath, Basic Electrical Engineering, McGraw-Hill Education (India) Pvt Limited

Reference Books

1. S.S. Parker, Problems in Electrical Engineering, Asia Publishing House.
2. H. Cotton, Advanced Electrical Technology, Pitman, London
3. T. L. Floyd, Principles of Electric Circuits, Pearson
4. E. Hughes, Electrical & Electronic Technology, Revised by John Hiley, Keith Brown and Ian Mckenzie Smith, Pearson

CSS-101: FUNDAMENTALS OF COMPUTING

Credits	Hours/week	Lecture	Tutorial	Practical	End-Sem Exam	Internal Assessment
3	3	2 hours	1 hours	0 hours	45 Marks	30 Marks

Course Outcomes

CO1 Students will be able to understand the basics of computer, generation and types of computer and Number system.

CO2 Student will be able to understand the concept of algorithms, flowchart and C programming basics.

CO3 Student will be able to implement loops and array in C programming.

CO4 Students will be able to apply the concepts of searching and sorting techniques in C programming.

CO5 Students will be able to describe different types of operating systems and its functions and they will understand basics of computer networking and internet.

UNIT-I: BASICS OF COMPUTERS

Computer fundamentals, Bits and Bytes, CPU, Memory, Types of memory, Input and output devices, Operating system, application software, system software, generation of computer, classification of computer Number system:decimal number system, binary number system, octal number system, hexadecimal number system.

UNIT-II: INTRODUCTION TO C PROGRAMMING

Introduction to Programming Language, Compiler, Interpreter, Algorithms, flow chart, C character set, C-tokens:constants, variable, keywords, Data types, operator and expressions. Decision controls: if-else, if-else ladder, nested if-else,conditional operator, switch case.

UNIT-III: LOOP AND ARRAY

For loop, while loop and do-while loop, continue and break statement, Function: inbuilt and user defined functions,call by value and call by reference, Array: Single dimensional array. 2D array, multidimensional array, Operations on array.

UNIT-IV: SEARCHING AND SORTING

Pointers, searching and sorting, Searching techniques: linear search, binary search, Sorting techniques: bubble sort,selection sort, Strings, library string functions.

UNIT-V: OPERATING SYSTEM & NETWORKING

OS definition, role of OS in computer system, multi programming, time sharing OS, multitasking OS, multiprocessing OS, real time system OS, client server computing, distributed OS, functions of OS. Computer Network, transmission media, network topologies, LAN, WAN, MAN, Internet, ISP, WWW, Email, URL, Web browsers, websites, intranet. Latest technologies in IT.

References / Text Books:

1. Herbert Schildt C-The Complete Reference., Tata McGraw Hill Edition
2. Ritchie, D. M., Kernighan, B. W., & Lesk, M. E. (1988). The C programming language. Englewood Cliffs: Prentice Hall.
3. Kamthane, A. N. (2011). Programming in C, 2/e. Pearson Education India.
4. Doja, M. N. (2005). Fundamentals of Computers and Information Technology
5. Yashwant, K. Let us C. 8th edition, BPB publication.
6. Balagurusamy, E. (2012). Programming in ANSI C. Tata McGraw-Hill Education.

ASL-101: LANGUAGE LABORATORY

Credits	Hours/week	Lecture	Tutorial	Practical	Practical Exam	Internal Assessment
1	2	0 hours	0 hours	2 hours	10 Marks	15 Marks

Course Outcomes

CO1	Gaining proficiency in English
CO2	Developing personality
CO3	Inculcating ideation and exposition skills
CO4	Honing the interpretative, logical, creative and imaginative skills.
CO5	Creating human sensibilities and forge convergences of technology with larger humanity.

Activities

Self-Introduction, Presentation Skills, Group Discussions, Personal Interviews, Formal Conversation & Chit-Chat, Topic Expressions/ Oration, Word Games, Debates, Simulated discussion, Personality Development, Resume writing, Book Reviews, Affirmative body language/gestures, Voice modulation.

Note:
Language lab Classes are meant to complement Communication Skills classes with a practical insight. The study material and teaching aid for the purpose would be devised by the Language Lab instructor/teacher as per the specific need of the batch/section.

ASL-102: ENGINEERING PHYSICS LABORATORY – I

Credits	Hours/week	Lecture	Tutorial	Practical	Practical Exam	Internal Assessment
1	2	0 hours	0 hours	2 hours	10 Marks	15 Marks

Course Outcomes

CO1 Introducing the concept of data analysis & its application in experimental physics
CO2 Understanding the practical application of mechanics & kinematics.
CO3 Developing the skills of data analysis & its interpretation.
CO4 Inculcating the skills of writing scientific reports.
CO5 Emphasizing on developing the spirit of teamwork.

List of Experiments

1. To determine the acceleration due to gravity (g) and to determine radius of gyration (K) of a bar pendulum.
2. To determine the value of acceleration due to gravity (g) using Kater's pendulum (by plotting graph).
3. To calculate the moment of inertia (M.I) of M.I. table using solid metallic objects such as cube, cone, cylinder, sphere.
4. To verify the parallel axis theorem using M.I. table.
5. To determine the M.I. and energy lost per revolution of the given flywheel by measuring time interval.
6. To determine the spring constant (k) of a given spring by static
7. To determine the spring constant (k) of a given spring by dynamic method.
8. To convert Galvanometer into Ammeter (range: 0-100 mA).
9. To convert Galvanometer into Voltmeter (range: 0-250 mV).
10. To compare the emf's of two cells using Potentiometer.
11. To verify a series combination of two cells using a Potentiometer.
12. To determine the resistance per unit length (R/1) of Potentiometer wire.
13. To determine the internal resistance of a cell using Potentiometer.
14. To determine spring constant, effective mass, damping constant using damped harmonic oscillator.

ASL-103: ENGINEERING CHEMISTRY LABORATORY

Credits	Hours/week	Lecture	Tutorial	Practical	Practical Exam	Internal Assessment
1	2	0 hours	0 hours	2 hours	10 Marks	15 Marks

Course Outcomes

CO1 Determination of concentration of analyte by volumetric analysis.
CO2 Preparation of thermosetting polymer.
CO3 Determination of rate constant of 1st order reaction.
CO4 Understanding importance of use of water in industries, softening methods and problems on water treatment.
CO5 Understanding the basis of fuel analysis and their combustion.

List of Experiments

1. To determine the percentage composition of a given mixture of NaCl and NaOH.
2. To determine the percentage composition of a given mixture of KCl and KOH.
3. To determine the amount of copper in the given copper ore solution by titrating it against standard
4. sodium thiosulphate solution.
5. To prepare urea formaldehyde, a thermosetting resin.
6. To determine the rate constant of the acid catalyzed hydrolysis of ethyl acetate.
7. To determine the amount of total chlorine residual in a given water sample by Iodometric method
8. To determine chloride ions in a given water sample by Argentometric method (Mohr's method)
9. To determine temporary, permanent and total hardness of the given water sample by Versenate
10. method.
11. To determine alkalinity of a given water sample by acid titration using phenolphthalein and methyl
12. orange.
13. To determine dissolved oxygen contents of the given water sample using Winkler's method.
14. To determine moisture, volatile & ash contents in a given coal sample by proximate analysis.

Textbooks

1. Jeffery, G.H.; Bassett, J.; Mendham, J.; Denney, R.C. (1989),Vogel's Textbook of Quantitative
2. Chemical Analysis, John Wiley and Sons.

Reference Books

1. Laboratory manuals

MEL-101: ENGINEERING GRAPHICS & DESIGN

Credits	Hours/week	Lecture	Tutorial	Practical	Practical Exam	Internal Assessment
2	4	0 hours	0 hours	4 hours	20 Marks	30 Marks

Course Outcomes

CO1	Student will able to understand basics of drawing and design of engineering components
CO2	Student will able to understand scaling of designs
CO3	Student will able to understand the different view of any object
CO4	Student will able to understand detail construction of any object
CO5	Student will able to understand sheet metal work

UNIT-I: ORTHOGRAPHIC PROJECTION

Conversion of pictorial/ isometric views into orthographic views of machine blocks. Identification of surface in orthographic views. Some practice on an AutoCAD package.

UNIT-II: ISOMETRIC PROJECTION

Isometric scale, isometric projection of solids, missing line and missing views. Isometric view of simple objects when their orthographic views are given. Preparation of isometric views using an AutoCAD package.

UNIT-III: SECTIONING

Conventional representation in the section of engineering materials. Methods of sectioning, sectional views of machine components, brackets, bushed bearing and foot step bearing.

UNIT-IV: FASTENERS

Sketches of different types of threads, permanent fasteners (riveted and welded joints), temporary fasteners (nut and bolt assembly, studs, keys. etc.)

UNIT-V: BUILDING DRAWINGS

Symbols of electrical and sanitary items. Terminology used in building drawing, plan and elevation of 2/3-rooms building using Auto-CAD package, from corrosion, refractories, their manufacturer and properties: neutral, acid and basic refractors; glass its types and manufacture.

Text/Reference Books

1. A.N. Siddiqui, Z.A. Khan and Mukhtar, Engineering Graphics with Primer on Auto-cad
2. N.D. Bhutt, Engineering Drawing

ASL-104: DESIGN THINKING & IDEA LAB

Credits	Hours/week	Lecture	Tutorial	Practical	Practical Exam	Internal Assessment
1	2	0 hours	0 hours	2 hours	10 Marks	15 Marks

Course Outcomes

CO1 Understanding basic concept of design thinking and innovation and learning elements of design.
CO2 Knowing of the design process and its implementation in driving inventions.
CO3 Understanding tools of design thinking. Knowing the implementation of design thinking.
CO4 Understanding design thinking for startups.
CO5 Gaining the knowledge of machine learning in different sectors. Apply the design thinking techniques for solving problems in various sectors.

Course Description

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. Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, customer, journey map, brainstorming, product development. 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. problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications.
An exercise in design thinking – implementing design thinking for a better process. Implement design thinking process in various Industries. Design thinking for Startups. Design thinking in various sectors: Case studies in Information Technology, Finance, Education, Management and Retail sector. Analyze and Prototyping, Usability testing, Organizing and interpreting results.

Textbooks

1. Change by design, Tim Brown, Harper Bollins (2009)
2. Design Thinking in the Class Room by David Lee, Ulysses press

Reference Books

1. Design the Future , by Shrrutin N Shetty , Norton Press
2. Universal principles of design- William Lidwell, Kritina Holden, Jill Butter.
3. The era of open innovation – chesbrough. H
4. Product Design and Manufacturing by A.K. Chitale and R.C. Gupta, Prentice Hall.

ASB-201: ENGINEERING PHYSICS - II

Credits	Hours/week	Lecture	Tutorial	Practical	End-Sem Exam	Internal Assessment
3	3	2 hours	1 hours	0 hours	45 Marks	30 Marks

Course Outcomes

CO1 Conceptualizing two frames. Applying the theory relativity in describing the motion of high speed objects.

CO2 Understanding the phenomena of light. Introducing Lasers and its working principle for various applications.

CO3 Discussing the theories of electromagnetism, validating maxwell's equations and applying these equations to verify the properties of EM wave

CO4 Introducing wave functions, its properties and applications. Understanding Schrodinger equations and solving related problems.

CO5 Applying quantum ideas to solids. Discussing the origin of energy gap and applying quantum mechanical approach to free electron theory and band theory of solids.

UNIT-I: SPECIAL THEORY OF RELATIVITY

Inertial and Non-inertial frame of reference, Galilean transformations of position, velocity and acceleration and it's invariance, Concept of Ether, Michelson Morley Experiment,Postulates of special theory of relativity, Lorentztransformations of position, Time Dilation, Length contraction, Einstein velocity addition theorem, Relativistic mass,momentum and energy.

UNIT-II: OPTICS &LASERS

Introduction of interference and diffraction, Interference in Thin film (Interference due to reflected and transmitted light), Interference in Wedge-Shaped film, Newton`s Rings experiment, Newton`s rings by reflected and transmitted light, Determination of wavelength of sodium light using Newton`s Rings .Introduction of Laser, General characteristics of lasers, Applications of Lasers. Principle of Lasing action, Concept of Population Inversion,Einstein's transition probabilities, Basic idea of Optical resonator, Working and Principle of Ruby Laser, He-Ne laser.

UNIT-III: ELECTROMAGNETISM

Maxwell`s equation: Integral and differential form and their physical significance, Wave equation in terms of Electric and Magnetic field, Propagation of Electromagnetic waves (EM) in free space and its transverse characteristic, Flow of energy, Poynting vector, Energy density in electromagnetic waves.

UNIT-IV: QUANTUM MECHANICS

Wave function and its significance, properties of wave function, Normalization, Orthogonal, Orthonormal and probabilistic interpretation. Position operator, momentum operator and energy operator, Eigen values and eigen functions, Expectation value of position, momentum and energy. Derivation of Schrodinger time dependent and independent equation for wave function. One-dimensional problem- confinement of particle in a box, wavefunction,energy eigenvalues.

UNIT-V: PHYSICS OF MATERIALS

Quantum free electron theory, Sommerfeld Model, Merits of Quantum free electron theory, Density of states, Wavefunctions and Energy of free electrons in metals, Electrons in periodic potential, Bloch theorem, Kronig Penney model, Band theory of solids, Origin of Energy band gap in solids, Quantum aspect of Hall's Effect.

Text Books

1. Concepts of Modern Physics: Arthur Beiser
2. Qunatum Mechanics, Concept and Applications: NouredineZettili.
3. Introduction to Electrodynamics: David J. Griffiths
4. Optics, A. Ghatak
5. Electronic Fundamentals and Applications: J. Milliman and Christos C. Halkias

Reference Books

1. Principles of Lasers: O. Svelto
2. Fundamentals of Physics: Halliday and Resnick

ASB-202: ENGINEERING MATHEMATICS - II

Credits	Hours/week	Lecture	Tutorial	Practical	End-Sem Exam	Internal Assessment
3	3	2 hours	1 hours	0 hours	45 Marks	30 Marks

Course Outcomes

CO1 Tracing of 3D curves, evaluation of multiple integrals by change of order of integration, change of variables.

CO2 Series solution and applications of partial differential equations.

CO3 Study of analytical functions, expansion of complex functions, zeros and singularities of functions, theory of residues, evaluation of contour integrals and conformal mappings.

CO4 Laplace transform and its applications in solving differential and integral equations.

CO5 Learning of theory and applications of Fuzzy mathematics.

Unit –I: SOLID GEOMETRY AND APPLICATIONS OF MULTIPLE INTEGRALS

Formation of equations of cylinder and cone under the given geometrical conditions. Applications of multiple integral sin finding mass, centre of gravity, centre of pressure, moment of inertia, product of inertia, curved surface area and volume.

Unit –II: SERIES SOLUTION AND APPLICATIONS OF P.D.E.

Ordinary point, regular singular point, series solutions of ordinary differential equations of second order, Frobenius method for the solution of O.D.E.

Unit- III: COMPLEX ANALYSIS AND ITS APPLICATIONS

Complex function, Analytical function, C-R equations (Cartesian and polar forms), Milne - Thomson method and related problems; Evaluation of complex integrals using Cauchy's integral theorem, Cauchy's integral formula,conformal mapping, Zeros, singularities and residues of an analytic function; Application of Cauchy's residue theorem in solving contour integrals and evaluation of real definite integrals using residue method.

Unit- IV: LAPLACE TRANSFORM AND ITS APPLICATIONS

Notion of Laplace transform and its properties, Laplace transform (some well-known elementary functions and Special functions) , Inverse Laplace transforms and its properties (some well-known elementary functions and Special functions), Laplace transforms of Derivative, Integral, Convolution theorem. Applications of Laplace and inverse Laplace transform in finding the particular solutions of ordinary linear differential equations with constants and variables coefficients, system of differential equations, integral equation, Integro-differential equations.

Unit –V: TENSOR ANALYSIS AND ITS APPLICATIONS:

Notion of tensors, operations on tensors (Addition, subtraction, multiplication and contraction), Types of tensors (reciprocal tensors, Fundamental tensors, Relative tensors, symmetric and skew symmetric tensors), Christoffel symbol and its properties.

Text/ Reference Books

1. Quddus Khan; Advanced Engineering Mathematics, Tyrasons Publications, Delhi-110092, (2022)

2. B. V. Raman, Higher Engineering Mathematics, McGraw Hill Education India, 26th edition 2016.
3. R. K. Jain and S. R. K. Iyengar: Advanced Engineering Mathematics Narosa, 5tr Edition, 2018.
4. H. K. Dass; Advanced Engineering Mathematics, S. Chand Publishing, 22"" edition,2018.

ASB-203: BIOLOGY FOR ENGINEERS

Credits	Hours/week	Lecture	Tutorial	Practical	End-Sem Exam	Internal Assessment
3	3	3 hours	0 hours	0 hours	45 Marks	30 Marks

Course Outcomes

CO1	Understanding the concept of nanotechnology.
CO2	Learning the applications of nanotechnology in multiple disciplines.
CO3	Understanding the concepts of biological sciences, genetics, biological indicators and biosensors.
CO4	Exploring the field of advanced biological sciences and biotechnology.
CO5	Exploring nano-biotechnology and its various applications.

UNIT-I: INTRODUCTION TO NANOTECHNOLOGY

Introduction to Nanotechnology, Theoretical Basis of nanotechnology, Quantum confinement and size effect, Classification of Nanomaterials: Nanowires, QuantumWell and Quantum Dots, Properties of Nanomaterials, Carbonaceous Nanomaterials and their examples. Molecular Nanotechnology, Green Nanotechnology.

UNIT-II: FUNDAMENTALS OF AI, DATA SCIENCE, AND MACHINE LEARNING

AI Introduction, Applications in Engineering, Types & Subfields, EthicalConsiderations. Data Science Overview, Significance in Engineering, Components, Data Types, Tools & Languages. Python Fundamentals: Variables, Data Types, Control Structures. Machine Learning Introduction, Types, Workflow, Popular Algorithms, Python for ML. Practical AI Applications in Engineering: Automation, Maintenance, Computer Vision, NLP, Optimization. Case Studies.

UNIT-III: INTRODUCTION TO BIOLOGICAL SCIENCES

Darwinian evolution & molecular perspective; Introduction to phylogeny -Classification systems in biology and relationships; Cellular assemblies – From single cell to multi – cellular organisms: Geometry, Structure and Energetics; Comparing natural Vs human-made machines, Chromosomes and Cell Division. Basic Genetics-biological indicators, Mutation-causes. types and effect.

UNIT-IV: BASICS OF MICROBIOLOGY & IMMUNOLOGY

Introduction to microbiology, Introduction to immunology, Immunology – A classic example of permutations and combinations in biology; Concept of Gene, Gene regulation, Infection, disease and evolution – synergy and antagonism; Cancer biology – Control and regulation; Stem cells – Degeneracy in biological systems; Engineering designs inspired by biology – Micro – to Macro – scales.

UNIT-V: BIOTECHNOLOGY

Basic concepts of biotechnology: Totipotency and cell manipulation, Classifications of biotechnologies, Bio-Processing Technologies, Imaging techniques, Electrophysiology, Introduction to Nanobiotechnology, Regenerative medicine, Targeted drug delivery. Nanoimaging, Cancer treatment using Nanotechnology, Nanotoxicology: basics of cellular and organ level toxicity.

Text/Reference Books

1. B. S. Murthy, P. Shankar, B. Raj , J. Murday, " Textbook of Nanoscience & Nanotechnology", Universities Press Springer.
2. Tom Taulli, "Artificial Intelligence Basics: A Non-technical Introduction", Apress.
3. Mark Lutz "Learning Python", OReilly Media publishers, 5th Edition.

ECS-201: BASICS OF ELECTRONICS & COMMUNICATION ENGINEERING

Credits	Hours/week	Lecture	Tutorial	Practical	End-Sem Exam	Internal Assessment
3	3	3 hours	0 hours	0 hours	45 Marks	30 Marks

Course Outcomes

CO1	Becoming familiarize with the semiconductor diodes and various logic gates
CO2	Analyzing biasing, load line and amplifier action of transistor
CO3	Designing various operational amplifier circuits
CO4	Explaining oscillators, CRO and electronics multi-meters
CO5	Becoming familiarize with various schemes of modulation

UNIT-I

P-N Junction diode, V-I characteristics, static and dynamic resistance, linear and non-linear applications of diodes, half wave, full wave and bridge rectifiers, Zener diode, characteristics and its use as a voltage regulator. AND, OR, NAND,NOR and Ex-OR gates.

UNIT-II

Bipolar junction transistor (BJT), biasing and amplifier action, load line analysis of transistor amplifier, BJT amplifier configurations, Junction field effect transistor (FET), biasing and amplifier action.

UNIT-III

Op-amp basics, practical op-amp circuits, inverting and non-inverting amplifier, summing amplifier, integrators and differentiators.

UNIT-IV

Feedback concept, Barkhausen Criteria of oscillation, Wein bridge and phase shift oscillator, cathode ray oscilloscope(CRO), electronics multimeters.

UNIT-V

Introduction to modulation, amplitude modulation, generation of AM waves, demodulation of AM waves, introduction to FM.

Text Books:

1. J. Millman and A. Grabel, 'Microelectronics' 2nd Edition, McGraw Hill, International Edition, 1988.
2. Robert Boylestad and Louis Nashlesky, 'Electronic Devices and Circuit Theory' 5th Edition, PHI, 1992.

Reference Books:

1. Schilling and Beloved, 'Electronic Circuits-Discrete and Integrated', McGraw Hill International Edition, 1988.

2. Simon Haykin, 'Communication Systems', 2nd Edition, Wiley Eastern Ltd, New Delhi, 1992

MES-201: BASICS OF MECHANICAL ENGINEERING

Credits	Hours/week	Lecture	Tutorial	Practical	End-Sem Exam	Internal Assessment
3	3	3 hours	0 hours	0 hours	45 Marks	30 Marks

Course Outcomes

CO1 The students will be able to apply the basic laws of thermodynamics in engineering system for analysis.

CO2 After finishing this unit, a student should be able to understand the concepts of Fluid Mechanics and recognize the various types of problem when the fluid is at rest or in motion.

CO3 At the end of the unit, students will be able to analyze the real time applications of heat transfer and describe the fundamental modes of heat transfer.

CO4 The student will be able to apply the principle of impulse and momentum to solve three-dimensional rigid body kinetics problems including gyroscopic motion.

CO5 The student will be able to determine the inversions of kinematic chain and degrees of freedom of a mechanism.

UNIT-I: THERMODYNAMICS

Introduction to Thermodynamics, Concepts of systems, control volume, state, properties, Equilibrium, quasi-static process, reversible & irreversible process, cyclic process. Zeroth Law and Temperature Heat and Work, First Law of Thermodynamics for closed & open systems. Non-Flow Processes, numerical based on the above concepts Energy Equation. Steady Flow Energy Equation. Numerical based on SFEE. Second Law of Thermodynamics-Kelvin and Plank's and Clausius Statement.

UNIT-II: FLUID MECHANICS

Introduction, fluid properties, basic equation of fluid statics pressure variation in a static fluid, hydro-static force on submerged surfaces buoyancy and stability fluids in rigid-body motion Introduction to fluid dynamics

UNIT-III: HEAT TRANSFER

Heat Transfer: What and how? Application areas of heat transfer, historical background, Physical origin and heat transfer mechanism/Modes of heat, Transfer: Conduction, Convection and Radiation, Fourier's law of heat conduction, Thermal conductivity of materials,Thermal resistance, General heat conduction equation, Newton's law of cooling, Surface emission properties:absorptivity, reflectivity and transmissivity, Concept of a black body, The Stefan-Boltzmann law and Kirchhoff 's law problems

UNIT-IV: DYNAMICS OF RIGID BODIES

Angular momentum of a rigid body in three dimensions, Application of the principle of impulse and momentum to the three-dimensional motion of a rigid body, Kinetic energy of a rigid body in three dimensions, Motion of a rigid body in three dimensions, Euler's equations of motion, Motion of a rigid body about a fixed point, Rotation of a rigid body about a fixed axis, Motion of a gyroscope. Eulerian angles, Steady precession of a gyroscope

UNIT-V: BASIC CONCEPT OF MECHANISMS AND MACHINES

Link, kinematic pairs and their classifications, Kinematic chain, Mechanism and their inversions. Degree of Freedom of a mechanism, Four bar chain and its inversions, Single and double Slider-crank chains, Quick return motion mechanisms, Mobility of four bar linkage (Grashof criterion), Power Transmission systems: Gear Drives, belt drives,chain drives, friction drives

Text books

1. Engineering Thermodynamics, P. K. Nag, Tata McGraw-Hill 2005
2. Vijay Gupta & Santosh K Gupta, Fluid Mechanics and ItsApplications, Third Edition, New Age International, 2017
3. Sachdeva, R.C., Fundamentals of Heat and Mass Transfer, 4th ed.,New Age International, 2012
4. Ferdinand P. Beer, E. Russell Johnston, Jr., David F. Mazurek, Phillip J. Cornwell, Brian P. Self, Vector Mechanics For Engineers: Statics And Dynamics, Twelfth Edition, McGraw Hill Education.
5. Ghosh & Mallick, Theory of Mechanisms and Machines, EWP

Reference books

1. Fundamentals of Classical Thermodynamics, G. J. Van Wylen and R. E. Santag
2. Fox & McDonald, Introduction to Fluid Mechanics, Fifth Edition, John Wiley & Sons, Inc. 2004

CES-201: BASICS OF CIVIL ENGINEERING

Credits	Hours/week	Lecture	Tutorial	Practical	End-Sem Exam	Internal Assessment
3	3	2 hours	1 hours	0 hours	45 Marks	30 Marks

Course Outcomes

CO1 Understanding various disciplines of civil engineering and different types of structures.
CO2 Understanding various systems of Infrastructure.
CO3 Recognizing different materials and equipment used in Civil Engineering.
CO4 Understanding different components of buildings.
CO5 Explaining various material properties and calculating uniaxial deformations.

UNIT-I OVERVIEW - INTRODUCTION TO CIVIL ENGINEERING

Broad Civil Engg. Disciplines; Different Civil Engineering structures (Only Types): Buildings, Bridges, Aqueducts and viaducts, Towers and Chimneys, Tunnels, Dams, Retaining Walls, Tanks, Coastal defences.

UNIT-II INFRASTRUCTURE

Roadways, Railways, Airports, Distance and Elevation Measurements, Water Supply Systems, Sewage Systems, Solid Waste Management Systems, Power Supply Systems, Emergency Systems.

UNIT-III CIVIL ENGINEERING MATERIALS AND EQUIPMENTS

Materials: Cement, Steel, Stone, Bricks, Timber, Mortar, Concrete; Equipments: Excavator, Bulldozer, Road Rollers, Concrete Mixer, Needle Vibrator, Nondestructive Testing Equipment.

UNIT-IV BUILDING COMPONENTS & SERVICES

Types of Foundations: Isolated, Combined, Strap, Mat/ Raft, Piles, Well, Piled-Raft; Super-structure: Plinth, Floor, Wall, Column, Beam, Slab, Ceiling, Cantilever, Stairs; Lifts, Sanitary and Plumbing appurtenances.

UNIT-V MATERIAL PROPERTIES AND UNIAXIAL DEFORMATION

Uniaxial Tension Test: Stress-Strain Diagrams for Different Materials, Elasticity, Yielding, Plasticity, Work Hardening; Normal Stress & Strain, shear Stress & Strain, Stress-Strain Relationship; Elastic Constants and their inter-relationships, Uniaxial Deformations in uniform x-sections.

Text/Reference Books

1. Basic Civil Engineering by Satheesh Gopi, Pearson
2. Basic Civil Engineering by Punmia, Jain & Jain, Laxmi Publication
3. Basic Civil Engineering by S. S. Bhavikatti, New Age International Publishers
4. Building Materials by S. K. Duggal, New Age Press
5. Mechanics of Solid by Abdul Mubeen, Pearson, Pearson Education
6. Infrastructure Engineering and Construction Techniques by Lad, Kulkarni, Patil, Minde, Apte, Phadke, Nirali Prakashan

ASM-201: CONSTITUTION OF INDIA

Credits	Hours/week	Lecture	Tutorial	Practical	End-Sem Exam	Internal Assessment
0	2	2 hours	0 hours	0 hours	00 Marks	00 Marks

Course Outcomes

CO1 Understanding the history and structure of the Indian Constitution and its important parts.
CO2 Understanding the features and preamble of the constitution of India.
CO3 Developing an awareness of the fundamental rights and duties as a responsible citizen of India.
CO4 Exploring how different parts of the government like the President, the Prime Minister, Parliament, State Governments and Judiciary work together to govern the country.
CO5 Developing the knowledge of elections and activities of the Elections Commission of India.

INTRODUCTION

Constitution of India: Sources, interpretation and constitutional history, salient features of the constitution

FEATURES AND PREAMBLE OF THE CONSTITUTION OF INDIA

The Preamble of the constitution, socialism, secularism, democracy, republican charter, justice, liberty, equality, fraternity, dignity of the individual, unity and integrity of the nation.

CITIZENSHIP AND THE FUNDAMENTAL RIGHTS OF THE CITIZENS OF INDIA

Citizenship, fundamental rights of a citizen: right to equality, right to freedom, right against exploitation, right to freedom of religion, cultural and educational rights, right to constitutional remedies, fundamental duties of a citizen.

THE UNION AND STATE LEGISLATURES AND THE JUDICIARY

The union executives: The President, The Vice President, Council of Ministers, The Prime Minister, Attorney General of India. The Union Legislature: the Parliament and Parliamentary proceedings. The Judiciary - The Supreme Court, The High Court and the sub ordinate courts: its powers and functions. The states and union territories, Union-State relations.

ELECTIONS, FUNCTIONS AND ROLE OF ELECTION COMMISSION

Elections: electoral reforms. The Election Commission – role of chief election commissioner, power and functions of the Election Commission of India. Amendment of the Constitution. Panchayti Raj. Working of the Constitution.

Textbooks

1. Subhash C Kashyap, Our Constitution, National Book Trust, India 2012

Reference Books

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd. New Delhi 2014
2. J.A. Siwach, Dynamics of Indian Government & Politics, 2nd Edition 2016

ASL-201 ENGINEERING PHYSICS LABORATORY -II

Credits	Hours/week	Lecture	Tutorial	Practical	Practical Exam	Internal Assessment
1	2	0 hours	0 hours	2 hours	10 Marks	15 Marks

Course Outcomes

CO1	Understand the fundamental concepts and theory behind any experiments for physics laboratory.
CO2	Employ the proper use of equipment, utilize experimental techniques and setting the apparatus to collect data, and apply the tools.
CO3	Develop skills in the recording and analyzing of data, and produce problem solving skills.
CO4	Appraise the skills for writing scientific reports.
CO5	Work on multidisciplinary team's report writing.

List of Experiments

1. Measurement of the diameter (d) of hair using the phenomenon of diffraction and to measure the divergence of a laser beam.
2. To determine temperature coefficient of junction voltage and energy band gap (Eg) of PN junction diode.
3. To determine the energy band gap (Eg) of a semiconducting material using 4-probe method.
4. To study the characteristics of a pnp/npn transistor in Common Emitter (CE) configuration.
5. To determine Hall Coefficient (RH) and numbers of charge carriers per unit volume (n) in a semi conducting sample.
6. To determine the value of Planck's constant (h) by LED.
7. To determine the wavelength of sodium light by Newton's rings arrangement.
8. To plot the I-V characteristics of a Zener diode, PN diode and LED.
9. To determine the refractive index of the material of a prism for the given wavelength of light
10. To verify the Malus law.
11. To determine the dielectric constant of a given material.

MEL-201: WORKSHOP PRACTICE

Credits	Hours/week	Lecture	Tutorial	Practical	Practical Exam	Internal Assessment
2	4	0 hours	0 hours	4 hours	20 Marks	30 Marks

Course Outcomes

CO1 To instill fundamentals of materials, properties, various tools and their specifications employed in various shops/trades

CO2 To understand science and engineering of every task and tool employed in each shop/trade

CO3 To understand the drawing and specification of various tasks/jobs; plan, operate and acquire tools to make jobs as per specifications

CO4 Encourage student to use web/computing resources and relate the completed task with real life processes

CO5 Educate them for safety and security while performing assigned tasks in group of small size, prepare the record of tasks and submit

List of Experiments

1. FITTING SHOP: To make a job of mild steel plate according to the given drawing by using Fitting shop's tools and operations.
2. PATTERN MAKING SHOP: To make a job of soft wood according to the given drawing by using Pattern making shop's tools and operations.
3. FOUNDRY SHOP: To prepare a mould with a given pattern by using Foundry shop's tools and operations.
4. WELDING SHOP: To make a job by joining mild steel plates according to the given drawing by using Electric Arc welding.
5. LATHE MACHINE (MACHINE SHOP): To make a job according to the given drawing by machining a workpiece on the Lathe Machine.
6. SHAPER MACHINE (MACHINE SHOP): To make a job according to the given drawing by machining a workpiece on the shaper Machine.

MEL-202: ENGINEERING MECHANICS LABORATORY

Credits	Hours/week	Lecture	Tutorial	Practical	Practical Exam	Internal Assessment
1	2	0 hours	0 hours	2 hours	10 Marks	15 Marks

Course Outcomes

CO1	Student will able to understand basics of drawing and design of engineering components
CO2	Student will able to understand scaling of designs
CO3	Student will able to understand the different view of any object
CO4	Student will able to understand detail construction of any object
CO5	Student will able to understand sheet metal work

List of Experiments

1. To determine the coefficient of friction between various surfaces on an Horizontal plane apparatus.
2. To determine the coefficient of friction between various surfaces on an inclined plane apparatus.
3. To determine the mechanical advantage, Velocity ratio and efficiency of the Differential wheel and Axle apparatus.
4. To determine the mechanical advantage, Velocity ratio and efficiency of Double purchase winch crab apparatus and plot the curves (i) Effort VS Load (ii) Efficiency VS Load
5. To determine the mechanical advantage, Velocity ratio and efficiency of Worm & worm wheel apparatus and plot the curves (i) Effort VS Load (ii) Efficiency VS Load
6. To determine the mechanical advantage, Velocity ratio and efficiency of Screw jack and plot the curves (i) Effort VS Load (ii) Efficiency VS Load
7. To determine the beam reactions in Simply supported beams for different loads using parallel beam apparatus.
8. To verify the law of moments using the Bell crank lever.
9. To verify the triangular law of forces using the polygon law of Forces apparatus.

ASM-301: UNIVERSAL HUMAN VALUES : UNDERSTANDING HARMONY

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Course Outcomes

- **CO1** Understanding basic concept of universal human value and basic human aspirations.
- **CO2** Understanding harmony in self and its importance learning concept of happiness.
- **CO3** Knowing about harmony in family and society, the value of relationship, respect, trust.
- **CO4** Learning about harmony and disharmony with nature and its fulfillment.
- **CO5** Learning importance of understanding harmony and its impact on professional ethics.

UNIT I – Introduction, Concept of Universal Human Value (UHV)
Introduction, need, characteristics of UHV, difference between value-based education and skill based education, benefits of value education, Basic Human Aspirations – Meaning and basic requirements for fulfilling. Measures to fulfil the basic human aspirations in the current scenario. Continuous happiness and prosperity, understanding happiness and prosperity correctly, understanding of relationships.

UNIT II- Understanding Harmony in self
Concept of Human Existence – Conscious and Material Entities, Difference between the Conscious and the Material Entities of Human Existence, Measures to ensure Harmony in the Self. Need of self and the body – happiness and physical facility. Body as an instrument – the doer, seer and enjoyer.

UNIT III – Understanding Harmony in Family and Society
Exploring value of feelings in relationships, Measures to ensure Harmony in the family. Harmony in the Family – the Basic Unit of Human Interaction; 'Trust' – the Foundational Value in Relationship; 'Respect' – as the Right Evaluation: Other Feelings, Justice in Human-to-Human Relationship; Understanding Harmony in the Society; Vision for the Universal Human Order; Understanding conflict (meaning, types), Dimensions of Human order for harmony in society, Universal value of justice, democracy, respect and gratitude. Values Crisis in contemporary society, Nature of values: Value Spectrum of a good life, Psychological values: Integrated personality; mental health, Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution.

UNIT IV – Understanding Harmony in Nature and Existence
Understanding Harmony in the Nature; Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature. Meaning of harmony in nature. Disharmony with Nature – causes. Implications of disharmony with nature. Harmony through symbiotic relationship with nature, Achieving competence in maintaining harmony with nature in professional life.

UNIT V – Implications of Understanding Harmony on Professional Ethics
Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of the Technologists. Codes of professional ethics. Whistle blowing and beyond, ethics of duty, ethics of responsibility. Holistic Technologies, Production Systems and Management Models; Strategies for Transition towards Value-based Life and Profession

TEXT BOOKS/ REFERENCE BOOKS:

1. Simon Blackburn Being Good: A Short Introduction to Ethics, Oxford University Press, 2001.
2. Peter Singer, The Most Good You Can Do: How Effective Altruism Is Changing Ideas About Living Ethically, Yale University Press 2015.
3. Govindarajan M Professional Ethics and Human Values 2013.
4. R.S. Naagarazan, A Textbook on Professional Ethics and Human Values, New Age International, 2007.

ASM-302 ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT-I: Introduction to traditional knowledge (10 Lectures)

Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge.

Unit-II: Protection of traditional knowledge (10 Lectures)

The need for protecting traditional knowledge Significance of TK Protection, the value of TK in the global economy, Role of Government to harness TK.

Unit-III: Legal framework and Traditional Knowledge (10 Lectures)

A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act); B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indications act 2003.

Unit-IV: Traditional knowledge and intellectual property (10 Lectures)

Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

Unit-V: Traditional knowledge in different sectors (10 Lectures)

Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

Textbooks

1. *Traditional Knowledge System in India*, by Amit Jha, 2009.
2. *Traditional Knowledge System and Technology in India* by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012. .

References

1. *Traditional Knowledge System in India* by Amit Jha Atlantic publishers, 2002
2. *Knowledge Traditions and Practices of India*, Kapil Kapoor, Michel Danino

E-resources:

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/

ASB-301: ENGINEERING MATHEMATICS- III

(Probability and Statistics)

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT 1: Algebraic Structures
Review of Relations, equivalence relations, partial orders, Hash function, characteristics function. Algebraic structure: Semi-groups, Monoids, Groups, Permutation groups, Rings, Fields, Integral domain, Lattice.

UNIT 2: Graph Theory
Definition and properties of graphs, directed and undirected graphs, degree sequence, cycles, path, connectivity, adjacency matrix, incidence matrix. Complete graphs, Regular graphs, Bipartite graphs, Planar graphs. Graph Isomorphism. Euler circuit, Hamiltonian circuit. Coloring of graphs: Welch-Powell algorithm, Dijkstra's shortest path algorithm.

UNIT 3: Recurrence Relations
Introduction, Generalized linear homogenous/non-homogenous recurrence relations, common recurrence relations. Solving recurrence relations: Iteration method, characteristic equation method. Introduction to generating functions. Solving recurrences using generating functions. Solving simultaneous recurrences.

UNIT 4: Mathematical Techniques
Propositional calculus, Principle of inclusion and exclusion, Pigeonhole principle, Principle of mathematical induction, Permutation and combination, Recursive functions, Boolean algebra.

UNIT 5: Linear Programming Problems
Introduction, Formulation of LPP, Solution of LPP: Graphical methods, Simplex algorithm. Duality principle.

Reference Material

1. K. H. Rosen, Discrete Maths and its Applications, McGraw Hill International Editions.
2. C. L. Liu, Elements of Discrete Mathematics, McGraw Hill International Editions.
3. Thomas Koshy, Discrete Maths with Applications, Elsevier Academic Press.
4. E. G. Goodaire, Discrete Maths with Graph Theory, Pearson.
5. J L Mott, A Kandel, T P Baker, Discrete Maths for Computer Scientists & Mathematicians, Pearson.
6. Kolman, Ross & Busby, Discrete Mathematical Structures, Pearson K. D. Joshi, Foundations of Discrete Maths, Wiley Eastern Ltd.

EEC-302: NETWORK ANALYSIS

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT-I
Network graph, properties of tree in a graph, incidence matrix, cut- set matrix, tie- set matrix and their properties, No. of possible trees of graph, Maximum power transfer theorem, Tellegen's theorem, Millman's theorem, Reciprocity theorem, duality.

UNIT-II
Transfer function, transient and steady state system, transient response, natural response, zero state response, initial condition, complete response: inductance, capacitance, RL, RC and RLC network their Continuity relationship, their response to sinusoidal input, to exponential excitation, second order response.

UNIT-III
Two port networks, synthesis, impedance parameters, admittance parameters, transmission parameters, inverse transmission parameters, hybrid parameters, inverse hybrid parameters, their reciprocity and symmetry conditions, inter- relationship between the parameters, inter- connection of two port networks, cascaded connection, series, parallel, series –parallel connection.

UNIT-IV
Network functions, driving point impedance function, voltage transfer function, ladder network, poles-zeros, necessary condition for transfer function, necessary conditions for driving function, effect of pole position on stability, significance of pole zero position, time- domain and frequency response from pole-zero plot.

UNIT-V
Driving point immitance function: properties, physical realizability, Synthesis: Hurwitz polynomial and properties, positive real function and properties, LC, RC, RL- network and their synthesis using Foster –I, II and Cauer –I, II form.

TEXT/REFERENCE BOOKS.

1. A. Sudhakar, Shyammohan S. Palli, "Circuits & Networks – Analysis and Synthesis", Tata Mc Graw Hill Co.,3rd Edition,New Delhi.
2. Network Analysis by Mac Van Valkenberg
3. Network analysis and synthesis by F. F. Kuo
4. Network analysis and synthesis by C. L. Wadhwa
5. Fundamentals of Network analysis and synthesis by Behrouz Peikari

EEC-303: SIGNALS AND SYSTEM

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT-I
Morphology of signals and their classifications. Even and odd functions, orthogonal function, definition of Step, impulse, ramp functions. Other non-sinusoidal signals and wave forms as the sum of standard functions. Fourier series representation of signals.

UNIT-II
Fourier Integral and Fourier transform and its properties. Parsevel's theorem. System representation using differential equations, transfer function, impulse response. Poles and zeroswith their concepts and significance

UNIT-III
Analysis of continuous-time Linear Time Invariant (LTI) system using Laplace Transform. Frequency response of LTI systems, zero input response, forced input response. Stability of LTI system, pole criteria for stability.

UNIT-IV
Introduction to Z-transform, Inverse Z- transform and their properties, region of convergence. Poles and zeros. Difference equation, transfer function, pulse response. Application of Z-transform for the analysis of discrete-time LTI systems.

UNIT-V
Correlation: Energy signals, power signals, autocorrelation, cross-correlations its properties and examples. Power spectral density, it's definition and derivations.

TEXT/REFERENCE BOOKS.

1. S. Hykin, Barry Van Veen "Signals and System", John Wiley & Sons.
2. Robert A Gabel, "Signal and Linear Systems", John Wiley & Sons.
3. Mahmood Nahvi, "Signals and Systems", Mc Graw Hill Education.
4. Material from internet.

EEC-305: DATA STRUCTURES AND ALGORITHMS

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT 1:

Definition of Data Structure, Types & characteristics of Data structures, Abstract Data Type (ADT), Algorithms: Algorithm Concepts, Objectives of algorithms, Quality of an algorithm, Space complexity and Time complexity of an algorithm. Characteristics of an array, Definition of an Array, Implementation of 1-D arrays, Row and Column Major Implementations of 2-D, 3-D and n-D arrays. Advanced concept of Pointers in C, Dynamic allocation of Memory. Program related to Arrays and Pointers.

UNIT 2:

Stack as a ADT, operations on stack, Stack implementation using array and linked list, Applications of Stack: Polish and reverse Polish notations, Recursion, Garbage collection. Queue as ADT, Operations on queue, and Types of queues: Linear Queue, Circular Queue, Priority Queue, and Double Ended Queue, Applications of Queue.

UNIT 3:

Concept of a Linked List, Linear Single and Double link lists, Circular Single and Double link List, Generalized Linked List, Header Linked list, Applications of Link List.

UNIT 4:

Concepts of a Tree, Tree as ADT, Definitions of n-ary, binary trees, Terms associated with trees. Operations on tree, Tree Search Algorithms, Binary Search Tree, Tree traversal Algorithms, AVL Trees, Threaded binary trees, Heap Tree, Expression tree, Huffman Tree, B – Tree and B+ Tree.

UNIT 5:

Graph: Different terminology associated with Graphs, Types of graphs – directed/undirected, connected/disconnected, cyclic/acyclic, Representation of graphs: Adjacency matrix, linked list. Graph Traversal – BFS, DPF, Graph algorithm-Warshall's, Djikastra's, Minimum Spanning Tree – Prim's and Kruskal's Algorithm.
Sorting Algorithms - Sequential Sort, Shell Sort, Insertion Sort, Merge Sort, Quick Sort, Topology sort.

Recommended Books:

1. Data Structure, Seymour Lipschutz, Schaumn Series, Tata McGraw publications.
2. An Introduction to Data Structure with Applications by Trembley and Sorenson, McGraw Hill education.
3. Fundamentals of Data Structure in C by Horowitz, Sahni and Anderson-Freed, University Press.
4. Data Structure and Algorithm – John Beidler, Springer.

EEC-306: ELECTRIC MACHINES & POWER SYSTEM

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT-I

Transformers: Different types of transformers, Transformer Construction, Core and Shell type of transformers, Core materials and laminated core, Cooling systems, Equivalent circuit of a transformer, OC test, SC test, Voltage regulation and efficiency, Testing of transformers, Polarity test, three-phase transformer connections, Auto-transformer, Applications.

UNIT-II

DC Machines: Construction and working principle of DC motors and generators, commutation process, armature reaction, types of dc motors and their operating characteristics, starters, speed control of dc motors, losses and efficiency of dc motors, applications.

UNIT-III

Three-phase Induction motors: Construction, rotating magnetic field, principle of operation of three-phase Induction motors, equivalent circuit diagram, Torque-slip characteristics, no-load and blocked rotor tests, starting of induction motor, speed control of induction motors, losses and efficiency, applications.

Single-phase Induction motors: Construction, Main and starting windings, starting methods, split phase starting, capacitor split phase starting, torque-slip characteristics, applications.

UNIT-IV

Three-phase Synchronous machines and electric power generation: Construction**,** Types of synchronous machines, Concepts of three-phase circuits, open-circuit and short-circuit characteristics, synchronous reactance, voltage regulation of the alternators, active and reactive power flow, synchronization process, two reaction theory of salient pole type synchronous machines, power-angle characteristics, damper winding, types of power plants.

UNIT-V

Modeling and analysis of transmission lines: Types of overhead lines, poles and towers, Transmission line voltage levels in our country, conductors, resistance, inductance and capacitance of transmission lines (without derivation), Short, Medium, and long transmission lines, T-and pi models of medium and long transmission lines, Voltage regulation, efficiency, active and reactive power flow through a transmission line, Equations of long transmission line (without derivation), Ferranti effect, Surge impedance loading. Corona phenomenon.

Text Books:

1. D. P. Kothari and I. J. Nagrath, Electrical Machines. McGraw- Hill Higher Education, 4th edition, 2010.
2. S. J. Chapman, Electric Machinery Fundamentals. McGraw-Hill, Inc. 5th edition, 2012.
3. P. S. Bhimbra, Electrical Machinery. Khanna publishers, 2012.
4. C. L. Wadhwa, Electrical Power Systems. New Age Publication, 6th edition, 2014.

Reference Books:

1. Fitzgerald and Kingsley, Electrical Machinery. McGraw- Hill Higher Education, 7th edition, 2013.
2. M. G. Say, The Performance and Design of Alternating Current Machines. CBS Publishers, 3rd Edition,
3. T. Gonen, Electric Power Transmission System Engineering: Analysis and Design. CRC Press, Taylor and Francis Group, New York, 2009.
4. W. D. Stevenson Jr. and J. J. Grainger, Power System Analysis. McGraw Hill, 2017.

ASM-401: ENVIRONMENTAL SCIENCE

Credits	Hours/week	Lecture	Tutorial	Practical	End-Sem Exam	Internal Assessment
2	2	2 hours	0 hours	0 hours	30 Marks	20 Marks

Course Outcomes

CO1	To develop an understanding of water, its quality, properties and treatment in industries
CO2	To understand the chemistry of corrosion, its types and protection from it.
CO3	To study and understand about the basics of environment and pollution.
CO4	To study and understand about various hazardous wastes in the environment and their management.
CO5	To develop knowledge and understanding of biotechnology.

UNIT-I: WATER TREATMENT

Hardness, types of hardness and its Units. Determination of hardness by EDTA method. Alkalinity of water & its significance, Numerical problems. Problems with boiler feed water and its treatment; Scale & Sludge formation, Boiler corrosion, Caustic Embrittlement, Priming & foaming, Softening methods; Lime-soda, Zeolite & Ion Exchange processes, Numerical problems.

UNIT- II: CORROSION AND ITS PROTECTION

Corrosion; Definition and its scope, Chemical Corrosion, Electrochemical Corrosion, Types of Corrosion; Intergranular Corrosion, Soil Corrosion, Waterline Corrosion, Differential Aeration Corrosion, Galvanic and Concentration Cell Corrosion, Factors affecting corrosion, Protection of corrosion.

UNIT - III: ENVIRONMENTAL CHEMISTRY

Environment and its Segments, Zones of Atmosphere, Air Pollution: Air pollutants and their resources; Aerosol and its Types, RSPM, SPM, Acid rain, Greenhouse Effect, Global warming, Ozone Layer Depletion, Water Pollution: sewage Treatment, Determination and Significance of COD, BOD, TOC.

UNIT- IV: WASTE MANAGEMENT

Definition, types and sources of hazardous waste (Municipal, industrial and biomedical). Need for solid and hazardous waste management. Physical, chemical and biological properties of wastes. Elements of integrated waste management (waste minimization and disposable methods).

UNIT-5: ENVIRONMENTAL BIOTECHNOLOGY

Biotechnology and its applications, Fermentation, Production of alcohol and vitamins, Biological indicators, Biosensors, Bioremediation, Bio-fertilizers, Bioreactors, Biodiversity and its conservation.

Reference Books

1. S.C. Sharma, “Environmental Engineering”, Khanna Publishing House
2. R.C. Gaur, “Basic Environmental Engineering”, Newage Publications
3. P.N. Modi, “Water Resources Engineering”, Standard Publishers
4. Dr. A.K. Jain, “Environmental Engineering”, (ISBN: 978-93-86173560), Khanna Publishers

AST-401: OPERATIONS RESEARCH

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Prerequisite: Strong foundation in mathematics: Calculus. Linear Algebra, Probability and Statistics. Familiarity with computer programming

COURSE OBJECTIVES & COURSE DESCRIPTION: This foundational course introduces you to the powerful tools and techniques used to make optimal decisions in a variety of complex, real-world situations. It will facilitate to understand core concepts like modelling, optimization, and uncertainty in making impactful decisions.

COURSE OUTCOMES

After successfully completing the course, students should be able to

- **CO1** Understand operational research and its general methodology.
- **CO2** Formulate problems and solve it with Integer programming.
- **CO3** Formulate problems and solve it with Goal programming, understanding the queuing system and concepts with basic numerical.
- **CO4** Understand simulation and its applications to decision making under uncertainty
- **CO5** Understand network development and project management with Project time management using CPM & PERT

UNIT - I

Nature and development of operations research, OR general methodology, applications of OR to industrial problems. Formulation of linear programming, deterministic models Linear Optimization Models: Graphical solutions. Simplex algorithm, computational procedure in simplex, duality and its concept, elementary sensitivity analysis, Application of Linear Programming. Application ofLINDO, LINGO and related software for solving optimisation problems.

UNIT- II

Integer Programming: Relationship to linear programming (LP), Formulating IP models, Solving IP Problems:Branch-and-Bound, Cutting Plane Method.

Transportation problems; methods for obtaining the solution, degeneracy in transportation problems. Stepping stone method. Trans-shipment problems. Assignment problems.

UNIT - III:

Goal Programming (GP): Definition and purpose of GP, Comparison with other optimization techniques (LP, IP), Formulation and Solution Techniques of Goal Programming Models Queuing Problems: Queuing systems and concepts; classification of queuing situations; Kendall's notation, solution of queuing problems. single channel, single stage, finite and infinite queues with Poisson arrival and exponential service time; applications to industrial. problems.

UNIT- IV

Simulation: Introduction, reasons for using simulation, limitations of simulation. Steps in simulation process. Application of simulation. Computer simulation. Monte Carlo simulation. Sequencing, n jobs two stations, two jobs n stations and graphical method. Decision Theory.

UNIT-5

Network development, Gantt chart. Project Critical path scheduling. construction of a CPM network, the critical path. Float calculations. Project Evaluation and Review Technique and its calculations. Network applications in operations management, Project crashing and resource allocation. Newer Network methods. Mathematies I, II and III.

TEXTBOOKS:

[T1] Operations Research Introduction, Taha, H.A., Pearson Education. India

REFERENCE BOOKS:

[R1] Quantitative Techniques for Decision Making, Gupta MP, Prentice Hall of India.
[R2] Introduction to Operations Research by Hillier and Lieberman, Tata McGraw Hill, India

Computer Usage / Software required: MS Project 2000 (and Prima Vera), Operation research software like LINDO, LINGO, SOLVER SUIT, EXCEL etc.

AST-402: ENGINEERING ECONOMICS

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
2	1	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Prerequisite: Basic Mathematics

COURSE OBJECTIVES & COURSE DESCRIPTION: The course introduces concepts and economic analysis procedures to assist with decision making in engineering analysis. Concepts include demand and supply. time value of money and cash flow diagrams, simple, compound, nominal, and effective interest rate: single and series payments. Methods to compare project alternatives include present, future, and annual worth, and rate of return analysis Methods to forecast demand include extrapolative, explanatory and judgemental methods. It also provides an introduction to different depreciation methods.

COURSE OUTCOMES:
After successfully completing the course, students should be able to

- **CO1** Interpret the significance of engineering economy, demand and supply, and market structure.
- **CO2** Apply the basic principles of the time value of money and its application to draw the cash-flow diagrams (CFD) and to compute equivalent values for time based cash flows of varying complexities.
- **CO3** Select and apply different standard methods for economy studies.
- **CO4** Evaluate different alternatives using the economy study methods to design the best one for considered application.
- **CO5** Suggest, customize and implement the most suitable forecasting, depreciation.

UNIT - I
Introduction to engineering economy. Definition, the economic environment. methodology and application, Principles of engineering economy, Steps in engineering economic analysis. Cost concepts and its application to break-even analysis, Basies of demand, supply and equilibrium. Price elasticity of demand. Income elasticity of demand. Cross elasticity of demand, Market structure Perfect competition, Monopoly, Monopolistic competition and Oligopoly

UNIT- II
Interest and money-time relationship: Simple and compound interest, notation and cash flow diagram, the concept of equivalence. Interests formulas for discrete compounding and discrete cash flows relating present and future worth of single cash flows and uniform time series (annuity), deferred annuities. annuities with beginning of period cash flows, equivalent present worth, future worth and annual worth, Interest formulas relating an arithmetic gradient series to its present and annual worth, Nominal and effective interest rates, interest problems with uniform cash flows occurring less often and more often than compounding periods. Increasing and decreasing gradients.

UNIT - III
Basic methods of making economic studies: Present worth (P.W. method. annual worth (A. W.) method, future worth (F.W.) method, internal rate of return (I.R.R.) method, external rate of return (E.R.R.) method, explicit reinvestment rate of return (E.R.R.R.) method.

UNIT- IV
Selection among alternatives: alternatives having identical (or not known) revenues and lives, Alternatives having identical revenues and different lives, Selection among independent alternatives.

UNIT-5
Demand estimation and forecasting: Basic categories of forecasting method. Extrapolative methods. simple average. moving average and exponential smoothing. Errors involved in forecast. Explanatory methods, regression analysis for linear forecaster, coefficient of determination and correlation. Qualitative

method. Delphi approach. Market survey, Depreciation and depletion: Definition and purpose, types of depreciation, and depreciation.

TEXTBOOKS:

[T1] Principles of Engineering Economics with Applications, Zahid A. Khan, Arshad Noor Suldiquee, Brajesh Kumar, Mustuta 11. Abidi Cambridge University Press, New Delhi, India.

REFERENCE BOOKS:

[R1] Engineering Economy, Degarmo E. Paul, Sullivan William G. And Bontadelli James A. Macmillan Co. of Singapore.
[R2] Engineering Economy, I eyland Blank T. and Tarquin Anthony J. (1989), McGraw Hill Publishing Company Ltd., India
[R3] Engineering Economy. Panneerselvam R Prentice Hall of India.
[R4] Modern Production/Operations Management, Elwood S. Buffa and Rakesh K. Sarin, Wiley India Pvt. Ltd

Computer Usage / Software required: MS EXCEL.

EEC-403: POWER ELECTRONICS

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT-I: Introduction, Devices: Diodes-silicon, fast recovery, Schottky diode, SCR,TRIAC, SCS, GTO, PUT, SUS, CUJT, LASCR, Mosfet, IGBT with their V-I characteristics. SCR: Operating principle, Gate Characteristics, Two transistor model, over-current and over voltage protection,snubber circuits, methods of turning on (triggering) and turning off (commutation).

UNIT-II: Half-wave and full-wave controlled rectifiers with resistive and reactive load,battery load Freewheeling diode. Detailed derivation of rms, average value, harmonic factor, displacement factor, THD, crest factor. Three phase half wave and full wave controlled rectifiers. Effect of Source impedance.

UNIT-III: Voltage-driven inverter, current-driven inverter, Single-phase inverter with resistive load, inductive load: Bridge, Parallel, Centre tapped. Mc-Murrey-Bedford inverter,Zero current switching(ZCS), Zero voltage Switching (ZVS). Introduction of resonant inverters. Three phase bridge inverter, 120-180 degree conduction.

UNIT-IV Principle of chopper, Step down-Step up chopper, Step down chopper with RL load without linear approximation, Chopper classification: First Quadrant, Second Quadrant, Third and Fourth Quadrant, Fourth Quadrant, All Four Quadrant Chopper. Buck, Boost, Buck-boost DC-DC converters. Morgan and Jones Chopper.

UNIT-V: Voltage Controllers: Single and three phase ac voltage controllers. Cycloconverters: Singlephaseto single-phase, three-phase to single-phase, three-phase to three-phase cyclo-converter circuit and their operation. Various PWM Techniques. Additional topics: Control Analysis of Converters, Simulation using PSIM

TEXT/REFERENCE BOOKS

1. M. H. Rashid, “Introduction to Power Electronics”, Pearson Education India, New Delhi.
2. Reference book names + websites
3. P. C. Sen, “Power Electronics” Tata McGraw Hill Book Co., New Delhi.
4. G. K. Dubey, S.R. Doradla, A.Joshi and R.M.K. Sinha, “Thyristorised Power Controllers” Wiley Eastern Ltd., New Delhi.

Websites

www.nptel.ac.in
www.electricalcircuits.com

EEC-404: ANALOG AND DIGITAL ELECTRONICS

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT – I: Diodes and Applications: Junction diode characteristics
Open circuited p-n junction, p-n junction as a rectifier, V-I characteristics, effect of temperature, diode resistance, diffusion capacitance, diode switching times, breakdown diodes, Tunnel diodes, photo diode, LED. Diode Applications - clipping circuits, comparators, Half wave rectifier, Full wave rectifier, rectifier with capacitor filter.

UNIT – II: BJTs
Transistor characteristics: The junction transistor, transistor as an amplifier, CB, CE, CC configurations, comparison of transistor configurations, the operating point, self-bias or Emitter bias, bias compensation, thermal runaway and stability, transistor at low frequencies, CE amplifier response, gain bandwidth product, Emitter follower, RC coupled amplifier, two cascaded CE and multistage CE amplifiers.

UNIT-III: FETs and Digital Circuits: FETs:
JFET, V-I characteristics, MOSFET, low frequency CS and CD amplifiers. Digital Circuits: Digital (binary) operations of a system, OR gate, AND gate, NOT, EXCLUSIVE OR gate, De Morgan Laws, NAND and NOR DTL gates, modified DTL gates, HTL and TTL gates, output stages, RTL and DCTL, CMOS, Comparison of logic families.

UNIT – IV: Combinational Logic Circuits:
Basic Theorems and Properties of Boolean Algebra, Canonical and Standard Forms, Digital Logic Gates, The Map Method, Product-of-Sums Simplification, Don't-Care Conditions, NAND and NOR Implementation, Exclusive-OR Function, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers.

UNIT – V: Sequential Logic Circuits:
Sequential Circuits, Storage Elements: Latches and flip flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Shift Registers, Ripple Counters, Synchronous Counters, Random-Access Memory, Read-Only Memory.

BOOKS:

1. Integrated Electronics: Analog and Digital Circuits and Systems, 2/e, Jaccob Millman, Christos Halkias and Chethan D. Parikh, Tata McGraw-Hill Education, India, 2010.
2. Digital Design, 5/e, Morris Mano and Michael D. Cilette, Pearson, 2011.
3. Electronic Devices and Circuits, Jimmy J Cathey, Schaum's outline series, 1988.
4. Digital Principles, 3/e, Roger L. Tokheim, Schaum's outline series, 1994.

EEC-405: OBJECT ORIENTED PROGRAMMING

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT 1: Object Oriented Programming Using C++

Object Oriented Paradigm, Structured vs Object Oriented Development, Concept of Object and classes, Encapsulation, Polymorphism, Inheritance Generic Programming, Merits and demerits of OOP. Class specification, Class objects, Defining member function, Inline functions, Data Hiding, Empty class, Pointers inside a class, Passing objects as parameters, Returning objects from functions, Friend function and class, Static data and member functions. Constructors and destructors, overloading of constructors, Dynamic initialization through constructors, Copy constructors, Static data members with constructors and destructors. Pointers to objects, Array of objects, this pointer, Self-referential classes.

UNIT 2: Implementing Polymorphism in C ++: Overloading

Function and Operator overloading, Overloading of unary and Binary operators, Limitations of overloading of increment and decrement operators, overloading of arithmetic, Relational, assignment, new and delete, subscript operators. Data conversion between objects. Complete conversion. Overloading through friend functions. Tracing of memory leaks.

UNIT 3: Inheritance and Virtual Functions

Declaration of derived class, forms of inheritance, constructors and destructors in derived class, types of inheritance, abstract class, Virtual functions: Need of virtual functions, Pointers to derived class objects, pure virtual functions, Virtual destructors, Rules of writing virtual function

UNIT 4: Object Oriented Programming Using JAVA

Classes, objects and constructor in Java, Implementing inheritance and polymorphism - dynamic binding, method overriding, abstract classes and methods. Interfaces - Interfaces vs. Abstract classes, defining an interface, implementing interfaces, accessing implementations through interface references, extending interfaces. Packages - Defining, Creating and Accessing a Package, importing packages.

UNIT 5: Exception Handling and Multithreading

Exception handling - Dealing with errors, benefits of execution handling, the classification of exceptions- exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, re throwing exceptions, exception specification, built in exceptions, creating own exception sub classes. Multithreading - Difference between multiple processes and multiple threads, thread states, creating threads, interrupting threads, thread priorities, synchronizing threads.

Books:

1. The C++ Programming Language by B.Stroustrup, Pearson Education.
2. Thinking in C++ by Bruce Eckel , Pearson Education
3. Object Oriented Programming in C++ by N.Barkakati, PHI
4. Mastering C++ by Venugopal and et all, Tata McGraw Hill
5. C++ How to Program by Deital and Deital, Pearson Education
6. The Complete Reference Java by Herbert Shildt, Tata McGraw Hill

EEC-501: CONTROL SYSTEMS

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT-I
Introduction, Terminology and basic structure, Industrial control examples, Mathematical modeling of mechanical, electrical, thermal, hydraulic and pneumatic systems. Industrial control devices: Potentiometers, tacho-generators, DC and AC servo-motors, Open and closed loop systems: their merits and demerits.

UNIT-II
Transfer Functions of linear systems, Block Diagram representation, Block Diagram reduction techniques, Signal Flow Graphs and Mason's Gain Formula. Time Response analysis of second order systems, Performance specifications in time domain. Steady state errors and error constants, static error coefficients.

UNIT-III
Stability concept, Necessary conditions for stability. Routh stability criterion, Hurwitz's stability criterion. Root locus plots, examples, general rules for constructing root loci, analysis of control system by root loci. Sensitivity of the roots of the characteristic equation. Relative stability analysis.

UNIT-IV
Relationship between time and frequency response, Polar plot, Bode's Plot, Nyquist plot and Nyquist stability criterion, Relative Stability, Phase and Gain Margins, Constant M and N circle and Nichol's chart.

UNIT-V
Concept of state, State-variable, State model, State models for linear continuous-time function, control system analysis using state-variable methods, state variable representation, conversion of state-variable modes to transfer functions, conversion of transfer function to canonical state variable models, solution of state equation, concepts of controllability and observability. Equivalance between transfer function and state variable representation.

TEXT/REFERENCE BOOKS

1. Gopal, M., "Control Systems: Principles and Design", Tata McGraw Hill Book Co., New
2. Delhi.
3. Gopal, M., "Digital Control Systems and State Variable techniques", Tata McGraw Hill
4. Book Co., New Delhi.
5. Kou, B.C., "Automatic Control System", Prentice Hall of India Pvt. Ltd., New Delhi.
6. Ogata, K., "Modern Control Engineering", Prentice Hall of India Pvt. Ltd., New Delhi.
7. Nagrath and Gopal, "Modern Control Systems" New Age International, New Delhi.

EEC-506: MEASUREMENT AND INSTRUMENTATION

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT I INTRODUCTION

Functional elements of an instrument — Static and dynamic characteristics — Errors in measurement — Statistical evaluation of measurement data — Standards and calibration-Principle and types of analog and digital voltmeters, ammeters.

UNIT II ELECTRICAL AND ELECTRONIC INSTRUMENTS

Principle and types of multi meters — Single and three phase watt meters and energy meters — Magnetic measurements — Determination of B-H curve and measurements of iron loss — Instrument transformers — Instruments for measurement of frequency and phase.

UNIT III COMPARATIVE METHODS OF MEASUREMENTS

D.C potentiometers, D.C (Wheatstone, Kelvin and Kelvin Double bridge) & A.C bridges (Maxwell, Anderson and Schering bridges), transformer ratio bridges, self-balancing bridges. Interference & screening — Multiple earth and earth loops — Electrostatic and electromagnetic Interference — Grounding techniques.

UNIT IV STORAGE AND DISPLAY DEVICES

Magnetic disk and tape — Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & Dot matrix display — Data Loggers.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS

Classification of transducers — Selection of transducers — Resistive, capacitive & inductive Transducers — Piezoelectric, Hall effect, optical and digital transducers — Elements of data acquisition system — Smart sensors-Thermal Imagers.

Text Books

1. Sawhney A.K., A course in Electrical and Electronic Measurements & instrumentation, DhanpatRai.
2. J. B. Gupta, A course in Electrical & Electronic Measurement & Instrumentation., S K Kataria& Sons
3. Kalsi H. S., Electronic Instrumentation, 3/e, Tata McGraw Hill, New Delhi, 2012
4. S Tumanski, Principles of electrical measurement, Taylor & Francis.
5. David A Bell, Electronic Instrumentation and Measurements,3/e, Oxford

Reference Books

1. Golding E.W., Electrical Measurements & Measuring Instruments, Wheeler Pub.
2. Cooper W.D., Modern Electronics Instrumentation, Prentice Hall of India
3. Stout M.B., Basic Electrical Measurements, Prentice Hall
4. Oliver & Cage, Electronic Measurements & Instrumentation, McGraw Hill
5. E.O Doebelin and D.N Manik, Doebelin's Measurements Systems, sixth edition, McGraw Hill Education (India) Pvt. Ltd.
6. P.Purkait, B.Biswas, S.Das and C. Koley, Electrical and Electronics Measurements and

Instrumentation, McGraw Hill Education (India) Pvt. Ltd.,2013

EEC-507: DATA COMMUNICATIONS AND COMPUTER NETWORKS

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT –I
Data Communication System: Introduction, Purpose, Components; Concepts of Frequency, Spectrum, and Bandwidth; Bit Rate and Baud Rate, Bandwidth of a Transmission System, Channel Capacity, Nyquist and Shannon Theorems, Throughput, Latency, Jitter, Transmission Impairments - Attenuation, Distortion, Noise: Modes of Digital Data Transmission,

UNIT -II
Transmission Media: Guided Media - Twisted Pair, Co-Axial Cables, Optical Fiber, Wireless Transmission – Antennas, Use of Frequency Spectrum, Terrestrial Microwaves, Satellite Microwaves, Wireless Propagation- Line-of-sight Transmission, Communication Satellites.
Error Detection and Correction: Types of Errors: Single-Bit Error, Burst Error; Block Coding, Process of Error Detection and Error Correction in Block Coding, Parameters of a Coding Scheme, Minimum Hamming Distance for Error Detection and Error Correction, Linear Block Codes, Simple parity Check Code.

UNIT -III
Computer Networks: Network Topologies, IEEE LAN standards, Metropolitan Area networks, Wide Area Networks, Internetworks, Overview of OSI Reference Model, TCP/IP Protocol Suite, Comparison OSI and TCP/IP models, Addressing Schemes, Dotted Decimal Notation, Classful and Classless Addressing, IPv4 and IPv6 addressing.

UNIT -IV
Medium Access Control: Multiple Access Protocols at Data Link Layer, Random Access: ALOHA, Slotted ALOHA, Carrier Sense Multiple Access (CSMA), CSMA/CD, CSMA/CA; Controlled Access: Reservation, Polling, Token Passing; Channelization: Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA).

UNIT -V
Data and Network Security: Symmetric Key Cryptography, Traditional Cyphers, Substitution Cypher, Shift Cypher, Transposition Cypher, Simple Modern Cyphers, XOR Cypher, Rotation Cypher, Substitution Cyphers, S-box and P-box Cyphers, Modern Round Cyphers; Asymmetric Key Cryptography, RSA and Diffie-Hellman Algorithms; Network Security Services: Message Confidentiality, Message Integrity, message Authentication, Digital Signature.

TEXT/REFFERENCE BOOKS

1. Andrew S. Tanenbaum, David J. Wetherall,"Computer Networks," 5th Edition, Pearson Education, India, 2012.
2. Behrouz A. Forouzan, "Data Communication and Networking," 5th Edition, Mc Graw Hill, India, 2013.
3. William Stallings, "Data and Computer Communications," 10th Edition, Pearson Education, Inc., NJ.

EEC-508: COMPUTER ARCHITECTURE

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT –I:

Architecture of a computer system, Classes of Computers, Measuring, Reporting, and Summarizing Performance, Quantitative Principles of Computer Design, Computer Arithmetic: ALU, Integer Representation, Integer Arithmetic, Floating Point Representation, Floating Point Arithmetic.

UNIT – II:

Fundamentals of designing a processor: instruction set, Processor Structure & Functions, Control Unit, Microprogrammed Control, Technique of segmentation (pipeline): Operation, Associated Concepts: Latency and Performance (Throughput); Processor Design with pipeline, Limitations of the pipelined instructions channel: Causes of performance loss due to stop of pipeline, Techniques to avoid halts.

UNIT – III:

Memory Organization and Structure, Memory Hierarchy, Internal Memory, External Memory, Cache Memory, Basic principles of the cache: Multi-level Cache, Organizations, Operating schemes, Replacement Algorithms, Cache Coherence, Examples of Caches, Virtual Memory, Integration of the Memory.

UNIT – IV:

External Devices, I/O Modules, Programmed I/O, Interrupt Driven I/O, Direct Memory Access, Direct Cache Access, I/O Channels and Processors, External Interconnection Standards.

UNIT –V:

Instruction level parallelism, Superscalar Processors, VLIW Processors, Multicore, Multiprocessors and Clusters: Hardware and Software Performance Issues, Shared memory Multiprocessors, Clusters and other message-passing Multiprocessor; Introduction to Graphics Processors.

TEXT/REFFERENCE BOOKS

1. J. L. Hennessy and D. A Patterson, "*Computer Architecture: A Quantitative Approach"*, 5th ed. Morgan Kaufmann, 2012. ISBN: 978-0-12-383872-8.
2. William Stalling, "Computer Organization and Architecture: Designing for Performance" , 10th ed., Pearson, 2016. ISBN: 978-0-13-410161-3
3. M. Morris Mano, "Computer System Architecture", 3rd ed, Pearson, 2013

EEC-509: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT-I
Introduction: Artificial Intelligence, Application of AI, AI Problems, Problem Formulation, Intelligent Agents, Types of Agents, Agent Environments, PEAS representation for an Agent, Architecture of Intelligent agents. Reasoning and Logic, Prepositional logic, First order logic, Using First-order logic, Inference in First-order logic, forward and Backward Chaining, Search Strategies: Solving problems by searching, Search- Issues in The Design of Search Programs, Un-Informed Search- BFS, DFS; Heuristic Search Techniques: Generate-And- Test, Hill Climbing, Best-First Search, A* Algorithm, Alpha beta search algorithm, Problem Reduction, AO*Algorithm, Constraint Satisfaction, Means-Ends Analysis

UNIT-II
Artificial Neural Networks: Introduction, Activation Function, Optimization algorithm- Gradient decent, Networks- Perceptrons, Adaline, Multilayer Perceptrons, Backpropogation Algorithms Training Procedures, Tuning the Network Size

UNIT-III
Introduction to ML: Machine Learning basics, Applications of ML,Data Mining Vs Machine Learning vs Big Data Analytics. Supervised Learning- Naïve Base Classifier, , Classifying with k-Nearest Neighbour classifier, Decision Tree classifier, Naïve Bayes classifier. Unsupervised Learning - Grouping unlabeled items using k-means clustering, Association analysis with the Apriori algorithm Introduction to reinforcement learning

UNIT-IV
Forecasting and Learning Theory: Non-linear regression, Logistic regression, Random forest, Baysian Belief networks, Bias/variance tradeoff, Tuning Model Complexity, Model Selection Dilemma Clustering: Expectation-Maximization Algorithm, Hierarchical Clustering, Supervised Learning after Clustering, Choosing the number of clusters, Learning using ANN

UNIT-V
Kernel Machines & Ensemble Methods Introduction, Optimal Separating Hyperplane, Separating data with maximum margin, Support Vector Machine (SVM), Finding the maximum margin, The Non-Separable Case: Soft Margin Hyperplane, Kernel Trick, Defining Kernels Ensemble Methods : Mixture Models, Classifier using multiple samples of the data set, Improving classifier by focusing on error, weak learner with a decision stump, Bagging , Stacking, Boosting ,Implementing the AdaBoost algorithm, Classifying with AdaBoostBootstrapping and cross validation, Dimensionality Reduction: Introduction, Subset Selection, Principal Components Analysis, Multidimensional Scaling, Linear Discriminant Analysis.

Text Books:

1. Deisenroth, Faisal, Ong, Mathematics for Machine Learning, Cambridge University Press, 2020.
2. B Joshi, Machine Learning and Artificial Intelligence, Springer, 2020.
3. Parag Kulkarni and Prachi Joshi, “Artificial Intelligence – Building Intelligent Systems”, PHI learning Pvt. Ltd., ISBN – 978-81-203-5046-5, 2015
4. Stuart Russell and Peter Norvig (1995), “Artificial Intelligence: A Modern Approach,” Third edition, Pearson, 2003.

EEC-502: SWITCHGEAR & PROTECTION

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Pedagogy: Classrooms lecture, Tutorial, Case studies, Group discussion, Seminar etc.

Prerequisites: Fundamentals of Power Systems

COURSE OBJECTIVES & COURSE DESCRIPTION: This course aims to provide students with a comprehensive understanding of power system protection, including its fundamental principles, components, and various aspects of circuit breakers, protective relaying, and protection schemes. By the end of the course, students should be equipped with the knowledge and skills necessary to contribute to the safe and reliable operation of electrical power systems and effectively protect them from various electrical faults and disturbances.

COURSE OUTCOMES: After successfully completing the course, students should be able to

CO1	To understand the qualities and importance of arc and protection of electrical systems i.e. Fuse, isolator.
CO2	To understand the working and testing of various types of circuit breakers and their applications.
CO3	To understand various types of relays (electromagnetic and static etc.) for any electrical system and their need and applications.
CO4	To apply protection schemes for Generator, Transformer, Bus-Zone, Transmission line.
CO5	To understand about lightning arresters and switching surges and the importance of grounding of power system.

UNIT-I: Need for protection system, Elements of power system protection. Fuse, H.R.C. fuse, Isolators, Theory of arc formation, properties of arc, Arc interruption theories. Circuit constants and circuit conditions, Restriking voltage transient Rate of Rise of Restriking voltage(RRRV), Current Chopping, Duties of switch-gear, Resistance switching , Circuit breaker rating.

UNIT-II: Construction and Operation of Air-break circuit breakers (CBs), Oil CBs, Single and Multibreak construction, Air-blast CB, Recent development in circuit breakers, Vacuum Breaker, Sulpher Hexa-flouride CB's, DC circuit breaker, Comparative merits and demerits of CBs.

UNIT-III: Need for protective relaying, Protective Zones, Primary and back up protection, Desirable Properties of protective relaying, Principle and operation of Electromagnetic and Induction type Relays, Relay settings, Directional, Distance, Differential, Overcurrent and earth fault relays, Static Relays, Numerical Relays/IEDs (Intelligent Electronic Devices).

UNIT-IV: Scheme of protection of Generator, Transformer, Bus-Zone, Transmission line. Merz-Price circulating current scheme, Restricted earth fault protection, Negative Sequence Protection, Bucholz relay, Translay scheme, pilot protection.

UNIT-V: Lightning and switching surges, dynamic overvoltages, ground wire, transmission reflection, refraction and attenuation of surges, spark gap, arresters, surge absorbers, BIL, insulation coordination, grounding of power system.

TEXTBOOKS:

[T1] Badri Ram, D. N. Vishwakarma, "Power System Protection and Switchgear, McGrawHill Publishing Co., New Delhi

REFERENCE BOOKS:

[R1] C. R. Masion, "The Art and Science of Protective Relaying", New Age International, New Delhi..
[R2] Haroon Ashfaq, "Switchgear & Protection", Khanna Publishing House, New Delhi.
[R3] Suni S. Rao, "Switchgear and Protection", Khanna Publishers, New Delhi

WEB RESOURCE :

[W1] https://archive.nptel.ac.in/courses/108/107/108107167/
[W2] https://archive.nptel.ac.in/courses/108/105/108105167/

ALTERNATIVE NPTEL/SWAYAM COURSE:

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Power System Protection and Switchgear	Prof. Bhaveshkumar R. Bhalja	IIT Roorkee
2.	Power System Protection	Prof. A. K. Pradhan	IIT Kharagpur

EEE-510: DIGITAL SIGNAL PROCESSING

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT-I
Discrete-time signal, discrete-time convolution, classification of discrete-time systems and their realization, transfer function and stability, steady-state frequency response of discrete-time systems.

UNIT-II
Introduction, properties of DFT, functional operations with DFT, convolution and correlation.Fast Fourier Transform (FFT), FFT algorithms: Decimation in time (DIT) and Decimation in frequency (DIF) algorithms.

UNIT-III
Introduction of IIR filters. Design of IIR filters: Bilinear transformation, Impulse invariance response and Stop Invariance Response methods. Design of digital Butterworth and Chebyshev filters. Frequency transformation.

UNIT-IV
Introduction, characteristics of FIR filter. Windowing and rectangular window. Design of FIR filter using windows. Hamming window, Hann window, Optimal FIR filter design.

UNIT-V
Representation of band-pass signals, sampling of band-pass signals. Analog to digital conversion: Sample and hold, quantization and coding, analysis of quantization errors. Digital to analog conversion: Sample and hold, sample and hold, first order hold, linear interpolation with delay, over sampling.

Text/Reference Books

1. S. K. Mitra “Digital Signal Processing”, Tata Mc Graw Hill, New Delhi.
2. J G Proakis and D G Manolakis “Introduction to digital signal processing,” Prentice Hall of India, New Delhi.
3. Johnny R Johnson “Introduction to digital signal processing,” Prentice Hall of India.
4. A. Antonio “Digital Filter Analysis and Design”, Tata McGraw Hill, New Delhi.

EEE-511: INTRODUCTION TO ROBOTICS

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT-I: Robot Basics
Robot-Basic concepts, Need, Law, History, Anatomy, specifications. Robot configurations-cartesian, cylinder, polar and articulate. Robot wrist mechanism, Precision and accuracy of robot. ROBOT ELEMENTS End effectors-Classification, Types of Mechanical actuation, Gripper design, Robot drive system Types, Position and velocity feedback devices-Robot joints and links-Types, Motion interpolation.

UNIT II: Robot Kinematics and Control
Robot kinematics – Basics of direct and inverse kinematics, Robot trajectories, 2D and 3D Transformation-Scaling, Rotation, Translation Homogeneous transformation. Control of robot manipulators – Point to point, Continuous Path Control, Robot programming

UNIT III: Robot Sensors
Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors. Force sensor-Light sensors, Pressure sensors, Introduction to Machine Vision and Artificial Intelligence.

UNIT IV: Robot Applications
Industrial applications of robots, Medical, Household, Entertainment, Space, Underwater, Defense, Disaster management. Applications, Micro and Nanorobots, Future Applications.

Text/Reference Books

1. Mikell P. Groover, Mitchell Weiss, Roger N Nagel, Nicholas G Odrey, “Industrial Robotics Technology, Programming and Applications”, Tata –McGraw Hill Pub. Co., 2008.
2. Deb.S.R and Sankha Deb, "Robotics Technology and Flexible Automation", Tata McGraw Hill Publishing Company Limited, 2010.
3. Klafter.R.D, Chmielewski.T.A, and Noggin’s., “Robot Engineering: An Integrated Approach”’, Prentice Hall of India Pvt. Ltd., 1994.
4. Fu.K.S, Gonzalez.R.C&Lee.C.S.G, “Robotics control, sensing, vision and intelligence”, Tata- McGraw Hill Pub. Co., 2008
5. Yu. “Industrial Robotics”, MIR Publishers Moscow, 1985.

EEE-512: DATABASE MANAGEMENT SYSTEM

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT 1: DATA MODEL IMPLEMENTATION AND E-R DIAGRAM

Database – Characteristics, advantages, disadvantages and applications. Data models - Hierarchical, Network and relational model. Three schema architecture and data independence. Client server architecture for DBMS. Classification of DBMS Data modeling using E-R diagram, Entity type, entity sets, attribute and keys. Weak entity. Relational model concepts, Relational database schemas, Constraint violations. Introduction to Tuple relational calculus, Domain relational calculus, relational algebra

UNIT 2: NORMALIZATION AND DATA REDUNDANCY

Design guidelines for Relational schemas, Functional dependency, Normal forms based on primary keys. Definition of First Normal form, Second normal form, Third normal form and BCNF. Multivalued Dependency and Fourth Normal form, Join dependency and fifth Normal form. Inclusion dependency, Other dependencies and Normal form.

UNIT 3 : STRUCTURED QUERY LANGUAGE (SQL)

SQL: Data Manipulation, Data Definition, Commercial RDMS: Oracle / MySql / Sql Server, PL/SQL . PL/SQL programming, views, cursors and Trigger.

UNIT 4: TRANSACTION MANAGEMENT

Transaction processing concepts, Locks, Serializability and Concurrency Control, Database Security.

UNIT 5 : EMERGING AREAS IN DATABASE AND DATA MODELS

Introductions to Distributed database, Object oriented database, Mobile database, Multimedia database, Geographic Information system, data warehousing and data mining

Text/Reference Books

1. "Fundamentals of Database Systems", Elmasri, Navathe, Pearson Education, IVth Edition. Pearson Education.
2. "Database system concepts", Henry F Korth, Abraham Silberschatz, S. Sudurshan, McGraw-Hill.
3. "An Introduction to Database Systems", C.J.Date, Pearson Education.
4. "Data Base System", Michael kifer and et all, Pearson Education..
5. "Database Management Systems" ,Ramakrishnan, Gehrke;Mcgraw-Hill.
6. "The Database Book –Principle and Practice" By Narain Gehani, University Press.
7. "A first course in Database Systems", Jeffrey D. Ullman, Jennifer Windon, Pearson Education.

EEC-603: POWER SYSTEMS ANALYSIS

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT-I
Typical transmission and distribution scheme. DC 2-Wire and 3-wire, A.C single-phase, 3-phase and 4 wire system, comparison of copper efficiency, Kelvin's law, D.C. distributor fed at one end, three wire D.C. distributor fed at one end, distributor fed at both ends, uniformly loaded distributor, ring mains, stepped mains, A.C. distribution. Standard voltages and advantages of high voltage transmission. Comparison of D.C. and A.C. transmission

UNIT-II
One line diagram, impedance and reactance diagram, per unit representation of single phase and three phase system, change of base, per unit impedance of a transformer, Network model formulation, Formulation of Y-Bus and Load flow equation formulation, Classification of Buss.

UNIT-III
Load Flow Solution Techniques, Gauss-Siedal method, Newton-Raphson method, Fast decoupled load flow equation, comparison of solution methods.

UNIT-IV
Symmetrical 3-phase fault. Short-circuit current and reactance of synchronous machines. Fault current in unloaded systems. Internal voltage of loaded machines. Short-circuit currents by method of internal voltage and Thevenin's theorem. Symmetrical components of three-phase unbalanced phasors, Power in terms of symmetrical components, Phase-shift in Star-Delta transformer banks, Sequence impedance and sequence network. Zero-sequence equivalent circuits for various three-phase transformer connections.

UNIT-V
Inter-connection of sequence network for various faults: line-to-ground fault, line-to-line fault, double-line to ground fault, Fault through impedance. Introduction to computer calculations of fault current problems.

Additional topics:
Economic Operation of Power System
Stability Analysis

TEXT/REFFERENCE BOOKS
1. William D. Stevenson, Jr., "Elements of Power Systems Analysis", McGraw Hill Book Co., Singapore.
2. H. Cotton and Barber, "The Transmission and Distribution of Electrical Energy", Third Edition, B.I. Publications Pvt. Ltd., New Delhi.
3. I. J. Nagrath and D.P. Kothari, "Modern Power System Analysis", Tata McGraw Hill Publishing Co., New Delhi.
4. C. L. Wadhwa, "Electrical Power System", New Age International, New Delhi.
5. HadiSaadat, "Power System Analysis", Tata McGraw Hill Pubishing co. New Delhi

Websites
www.electricaltutorials.com.
www.epsinc.com
www.electrical4u.com

EEC-604: SCADA AND SMART GRID TECHNOLOGIES

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Unit-I:
Automation Systems, Supervisory Control & Data Acquisition (SCADA) Systems, Components of SCADA Systems, Remote Terminal Unit (RTU)/Intelligent Electronic Devices (IEDs), Communication systems, Master Station & Human Machine Interface, Application of SCADA in Power Systems.

Unit II:

Evolution of Smart Grid, Components of Smart Grid, Old Vs New Grid, Challenges & Opportunities, Smart Grid benefits, Smart Grid solutions, Status of Indian Electricity System, Markets, Case Studies.

Unit-III:
Substation Automation, Substation LAN, Substation Communication Architecture, The new Digital Substation, Wide area monitoring systems (WAMS), Phasor Measurement Unit (PMU), Applications, Grid Automation Initiatives-Case Studies.

Unit-IV:
Distribution Automation, Subsystems, Application functions-Voltage/VAR Control, Power Quality, Network Reconfiguration, Demand side management, demand Response, Advanced Metering Infrastructure (AMI), Smart meters, Smart Appliances, Home Automation Systems.

Unit-V:
ISO OSI 7 layers communication Reference Model, TCP/IP Model, SCADA communication requirements, SCADA communication system topologies, SCADA and Smart Grid communication protocols- Modbus, IEC60870-5-101/103/194, DNP3, IEC 61850, Challenges

TEXT/REFFERENCE BOOKS

1. Mini S. Thomas and John Douglas McDonald, “Power System SCADA and Smart Grids” CRC Press-2015.
2. Stuart Borlase, “Smart Grids, Infrastructure, Technology and Solutions, CRC Press-2013
3. James Momoh, “Smart Grid, Fundamentals of Design and Analysis”, IEEE Press, John Wiley & Sons, 2012.
4. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, “Smart Grid: Technology and Applications”, John Wiley & Sons, 2012.

EEC-605: MICROPROCESSOR & MICROCONTROLLERS

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT I : THE 8086 MICROPROCESSOR

Introduction to 8086 — Microprocessor architecture — Addressing modes — Instruction set and assembler directives — Assembly language programming — Modular Programming — Linking and Relocation — Stacks — Procedures — Macros — Interrupts and interrupt service routines — Byte and String Manipulation.

UNIT II : 8086 SYSTEM BUS STRUCTURE

8086 signals — Basic configurations — System bus timing –System design using 8086 — I/O programming — Introduction to Multiprogramming — System Bus Structure — Multiprocessor configurations — Coprocessor, Closely coupled and loosely Coupled configurations — Introduction to advanced processors.

UNIT III I/O : INTERFACING

Memory Interfacing and I/O interfacing — Parallel communication interface — Serial communication interface — D/A and A/D Interface — Timer — Keyboard /display controller — Interrupt controller — DMA controller — Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

UNIT IV : MICROCONTROLLER

Architecture of 8051 — Special Function Registers(SFRs) — I/O Pins Ports and Circuits — Instruction set — Addressing modes — Assembly language programming.

UNIT V : INTERFACING MICROCONTROLLER

Programming 8051 Timers — Serial Port Programming — Interrupts Programming — LCD & Keyboard Interfacing — ADC, DAC & Sensor Interfacing — External Memory Interface- Stepper Motor and Waveform generation — Comparison of Microprocessor, Microcontroller, PIC and ARM processors

TEXT/REFERENCE BOOKS

1. Yu-Cheng Liu, Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design”, Second Edition, Prentice Hall of India, 2007
2. Doughlas V. Hall, “Microprocessors and Interfacing, Programming and Hardware”, Tata McGraw-Hill, 2012
3. Mohammad Ali Mazidi, the 8051 Microcontroller and embedded systems, Pearson Education
4. Kenneth Ayala, the 8051 Microcontroller Architecture, Programming and Applications, 2nd Ed. Penram International.
5. Ajay Deshmukh, Microcontrollers [Theory and Applications], Tata McGraw Hill.

EEC-606: OPERATING SYSTEMS

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT – I INTRODUCTION AND OPERATING SYSTEM STRUCTURES

Definition, What Operating System Do, Single Processor Systems, Multiprocessor/parallel Systems. Concept of Multiprogramming, Time-sharing System, Operating System Operation: Dual Mode Operation: Kernel Mode, User Mode. Distributed system, Real Time system, Process Management, Memory Management, Storage Management. Protection and security, Operating System Services, thread, multithreading model, System Call, Types of System calls, System Programs, process, cooperating process-Inter process communication, Operating system structure, User Operating- System Interface, multiprocessor system

UNIT- II PROCESS CONCEPT AND SCHEDULING

The Process, Process State, Process Control Block, Process Scheduling, Operations on Processes, Concept of Threading. Schedulers, Scheduling Criteria, Scheduling Algorithms: First Come, First Served (FCFS), Shortest Job First(SJF), Shortest Remaining Time First(SRTF) , Longest Job First(LJF) , Longest Remaining Time First(LRTF), Highest Response Ratio Next (HRRN), Priority Scheduling, Round Robin Scheduling, Multilevel Queue Scheduling(MLQ), Multilevel Feedback Queue(MLFQ) Scheduling, Multiprocessor Scheduling. Algorithm evaluation, deterministic modeling, queueing models.

UNIT- III MEMORY-MANAGEMENT STRATEGIES

Background: Basic Hardware, Address Binding, Logical vs. Physical Address Space. Swapping, Contiguous Memory Allocation, fixed partition, Best-Fit, First-Fit and Worst-Fit Memory Allocation Method, dynamic partitioning, compaction, protection and sharing, Buddy System, fragmentation-internal and external , Non-Contiguous Allocation, Paging, hardware support for paging, Translation Lookaside Buffer, Protection , shared pages, Structure of Page Table, Hierarchical Paging, Hashed Page Table, Inverted Page Table, Segmentation, Segmentation with paging, Virtual Memory: Background, swapping, Demand paging, Page Replacement Algorithms, First in First out(FIFO),Least-recently-used(LRU), optical page replacement, clock page replacement, Least Frequently Used(LFU), Belady's Anomaly, Second-Chance Algorithm, Enhanced Second-Chance Algorithm, thrashing

UNIT- IV SYNCHRONIZATION AND DEADLOCK

Background, The Critical- Section Problem, Race condition, Synchronization Hardware, Peterson's Solution, Semaphores, Mutex and Classical Problems of Synchronization: Bounded-Buffer Problem, The Reader- Writers Problem, Sleeper barber problem, Dining- Philosophers Problem, Monitors Usage, Synchronization problem Solution using Monitors, System model, Deadlock characterization, Methods for handling deadlocks, Deadlock Prevention, Deadlock Avoidance, Banker's Algorithm, Deadlock Detection, Recovery from Deadlock

UNIT – V FILE-SYSTEM INTERFACE AND MASS- STORAGE STRUCTURE

File Concept, Access methods, Directory and Disk Structure, file-System Mounting, file sharing, protection File-system structure, file-system implementation, Directory implementation, Allocation Methods. Free-space Management, efficiency and performance Secondary Storage Disk- structure, Disk- scheduling: FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK Scheduling algorithms, RAID

References / Text Books:

1. Operating system concepts: Silberchatz Galvin, Gagne: john Wiley & Sons, inc.2007
2. Operating systems: A Concept-based approach: D M Dhamdhere 2nd edition TMH 2007
3. Operating systems: Deitel Deitel Choffnes 3rd edition Pearson Education 2007
4. Milenkovic, Milan: Operating system concepts and Design, McGraw Hill, 1994.e.g. Mac or Linux Operating System, Bash Shell, Gedit, GCC
5. http://quiz.geeksforgeeks.org/

EEE-602: HVDC Transmission

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Unit-1
Introduction of DC Power transmission technology – Comparison of AC and DCtransmission – Application of DC transmission – Description of DC transmission system – Planning for HVDC transmission – Modern trends in DC transmission

Unit–2
Pulse number – Choice of converter configuration – Simplified analysis of Graetz circuit– Converter bridge characteristics – Characteristics of a twelve pulse converter –Detailed analysis of converters.

Unit- 3
General – Required regulation – Inverter compounding – Uncompounded inverter –Rectifier compounding – Transmission characteristics with the rectifier and inverter compounding – Communication link – Current regulation from the inverter side –Transformer tap changing.

Unit-4
Introduction – Generation of harmonics – Design of AC filters and DC filters –Interference with neighboring communication lines.

Unit–5
Introduction of DC cables – Basic physical phenomenon arising in DC insulation –Practical dielectrics – Dielectric stress consideration – Economics of DC cables compared with AC cables. Introduction to system simulation – Philosophy and tools –HVDC system simulation – Modeling of HVDC systems for digital dynamic simulation.

Additionaltopics:

1. Matlab (Simulink) based problem solving procedures.

Textbooks:

1. Padiyar, K. R., "HVDC power transmission system", Wiley Eastern Limited, New Delhi 1990. First edition.
2. Edward Wilson Kimbark, "Direct Current Transmission", Vol. I, Wiley interscience, New York, London, Sydney, 1971.

Reference book + websites

1. Colin Adamson and Hingorani N G, "High Voltage Direct Current Power Transmission", Garraway Limited, London, 1960.
2. Arrillaga, J., "High Voltage Direct Current Transmission", Peter Pregrinus, London, 1983.
3. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", New Age Interantional (P) Ltd., New Delhi, 1990.

Websites:

1. www.nptel.ac.in

EEE-603: Electrical Power Generation

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT-I
Cost of Power Generation: running cost and fixed cost, Method for providing for depreciation factor affecting cost of generation. Load Factor, Load Curve, Demand Factor, Diversity Factor. Number and size of generation units: plant capacity factor and plant use factor. Tariffs: Flat-rate, Two part, Block rate, Maximum Demand and Power Factor, Tariff Economics of Power Factor improvements.

UNIT-II
Selection of site, Thermal Power Plants: Types and their relative merits, Boilers accessories, Economisers, Preheater and Super Heater. Fuel, Combustion Equipment: Types of Steam Turbines, Condensers, Pumps, Cooling Towers. Layout of Plant, Pollution Control Equipments. Elements of Nuclear Power Plant. Nuclear Reactor- it's components and their functions. Types of Nuclear Reactor, Boiling water, Pressurized water fast breeder reactor and Candu Reactor, their advantages and disadvantages.

UNIT-III
Hydro-Electric Power Plant: Selection of site. Classification based on: quantity of water available, Nature of load, Available head, Layout, it's main parts and their function: reservoir, Dam, spillways, intake,forebay, Penstock, Search tank, Prime-mover, Draft-tube. Governing of turbines, Types of Turbines and their characteristics, Comparison of various types of plants.

UNIT-IV
Advantages of coordinated operation of different types of power plants, hydro-thermal scheduling – short term and long term.

UNIT-V
Tidal, Wind, Geo-Thermal, Wave, Magneto-Hydro Dynamic (MHD), Photo-voltaic and Solar Power used for generation. Recent advances such as biogasgeneration, hydrogen, fuel cell.

Additional topics:

Biogas generation, hydrogen, fuel cell
Types of Turbines and their characteristics.

TEXT/REFFERENCE BOOKS

1. M. V. Deshpandae, "Elements of Electrical Power Station Design", A. H. Wheeler and Co. Pvt. Ltd. Allahabad.
2. B. G. A. Shrotzki and W. A. Vopal, "Power Plant Engineering and Economics", McGraw Hill Book Co.
3. C. L. Wadhwa," Generation Distribution and Utilization of Electrical Engineering", New Age International, New Delhi.
4. C. L. Wadhwa, "Electrical Power Systems", New Age International, New Delhi.

Websites

www.nptel.ac.in

EEE-604: INTRODUCTION TO CYBER SECURITY

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT I: Cyber Security Concepts

CIA, Risks, Breaches, Threats, Attacks, Exploits. Information Gathering (Social Engineering, Foot Printing & Scanning). Open Source/ Free/ Trial Tools, Port Scanners, Network scanners Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Overview of Firewalls- Types of Firewalls, User Management, VPN Security, Security Protocols: - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec. Open Source/ Free/ Trial Tools: Implementation of Cryptographic techniques, OpenSSL, Hash Values Calculations MD5, SHA1, SHA256, SHA 512, Steganography (Stools)

UNIT II: Infrastructure and Network Security

System Security, Server Security, OS Security, Physical Security, Network packet Sniffing, Network Design Simulation. DOS/ DDOS attacks. Asset Management and Audits, Intrusion detection and Prevention Techniques, Network Session Analysis, System Integrity Validation. Internet Security, Cloud Computing & Security, Social Network sites security, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Access control, Open Web Application Security Project (OWASP), Open Source/ Free/ Trial Tools: WinAudit, Zap proxy (OWASP), burp suite, DVWA kit.

UNIT III: Malware
Explanation of Malware, Types of Malware: Virus, Worms, Trojans, Rootkits, Robots, Adware's, Spywares, Ransom wares, Zombies etc., OS Hardening (Process Management, Memory Management, Task Management, Windows Registry/ services another configuration), Malware Analysis. Open Source/ Free/ Trial Tools: Antivirus Protection, Anti Spywares, System tuning tools, Anti Phishing.

UNIT IV: Security in Evolving Technology: Biometrics, Mobile Computing and Hardening on android and ios, IOT Security, Web server configuration and Security. Introduction, Basic security for HTTP Applications and Services, Basic Security for Web Services like SOAP, REST etc., Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges. Open Source/ Free/ Trial Tools: adb for android, xcode for ios, Implementation of REST/ SOAP web services and Security implementations.

UNIT V: Cyber Laws and Forensics
Cyber Security Regulations, Roles of International Law, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013. Cyber Forensics, Cyber Evidence, Documentation and Management of Crime Sense, Image Capturing and its importance, Partial Volume Image, Web Attack Investigations, Internet Forensics, Email Crime Investigations.

LIST OF SUGGESTED BOOKS

1. William Stallings, "Cryptography and Network Security", Pearson Education/PHI, 2006.
2. V.K. Jain, "Cryptography and Network Security", Khanna Publishing House.
3. Gupta Sarika, "Information and Cyber Security", Khanna Publishing House, Delhi.
4. Atul Kahate, "Cryptography and Network Security", McGraw Hill.
5. V.K. Pachghare, "Cryptography and Information Security", PHI Learning
6. Nina Godbole, "Information System Security", Wiley
7. Bothra Harsh, "Hacking", Khanna Publishing House, Delhi.

Reference Websites :
http://www.ignou.ac.in/upload/Announcement/programmedetails.pdf

EEE-605: THEORY OF COMPUTATION

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT I AUTOMATA FUNDAMENTALS

Introduction to formal proof, Additional forms of Proof, Inductive Proofs, Finite Automata, Deterministic Finite Automata, Non-deterministic Finite Automata, Finite Automata with Epsilon Transitions

UNIT II REGULAR EXPRESSIONS AND LANGUAGES

Regular Expressions, FA and Regular Expressions, Proving Languages not to be regular, Closure Properties of Regular Languages, Equivalence and Minimization of Automata.

UNIT III CONTEXT FREE GRAMMAR AND LANGUAGES

CFG — Parse Trees — Ambiguity in Grammars and Languages — Definition of the Pushdown Automata — Languages of a Pushdown Automata — Equivalence of Pushdown Automata and CFG, Deterministic Pushdown Automata.

UNIT IV PROPERTIES OF CONTEXT FREE LANGUAGES

Normal Forms for CFG — Pumping Lemma for CFL — Closure Properties of CFL — Turing Machines — Programming Techniques for TM.

UNIT V UNDECIDABILITY

Non Recursive Enumerable (RE) Language — Undecidable Problem with RE — Undecidable Problems about TM — Post?s Correspondence Problem, The Class P and NP.

EEE-606: DATA MINING

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT 1:

Introduction to Data Mining: KDD, Process and Data Mining; KDD Steps; Types of Data for Data Mining, Data Mining Functionalities: Data Characterization, Data Discrimination, Mining Frequent Patterns, Association, Correlation, Classification, Prediction, Cluster Analysis, Outlier Analysis, and Evolution Analysis; Classification of Data Mining Systems; Data Mining Task Primitives; Major Issues in Data Mining.

UNIT 2:

Data Preprocessing: Introduction to Data Preprocessing; Descriptive Data Summarization: Measuring and Central Tendency and Dispersion of Data; Visualization of Descriptive Data Summaries; Data Cleaning: Handling Missing Values, Filtering Noisy Data – Binning Method; Data Integration; Data Transformation: Smoothing, Aggregation, Generalization, Normalization and Feature Selection; Data Reduction; Data Discretization and Concept Hierarchy Generation.

UNIT 3:

Association Rule Mining: Market basket Analysis; Frequent Itemsets, Closed Itemsets, and Association Rules; Support and Confidence; Apriori Algorithm for Mining Frequent Itemsets Using Candidate Generation; Generating Association Rules from Frequent Itemsets; Improving the Efficiency of Apriori Algorithm; FP-Growth Algorithm for Mining Frequent Itemsets without Candidate Generation; Mining Closed & Max Frequent Itemsets; Correlation Analysis.

UNIT 4:

Classification Rule Mining: Introduction to Classification and Prediction; Classification by Decision Induction; Attribute Selection Measures: Information Gain, Gain Ratio, and Gini Index; Tree Pruning; Bayesian Classification: Bayes' Theorem, Naïve Bayesian Classification, Bayesian Belief Networks; Classifier Accuracy Measures: Sensitivity, Specificity, Precision, and Accuracy; Predictor Error Measures; Accuracy Evaluation Methods: Holdout, Random Subsampling, Cross-validation, and Bootstrap; Accuracy Enhancement Methods: Bagging and Boosting; Lazy Learners: K-Nearest- Neighbour Classifier; Prediction: Introduction to Linear and Non- Linear Regression.

UNIT 5:

Cluster Analysis: Introduction to Cluster and Clustering; Features Required for Clustering Algorithms; Data Types and Dissimilarity Measures in Cluster Analysis; Categorization of Clustering Methods; Partitioning-Based Clustering: k- means Algorithms, k-Medoids algorithms (PAM, CLARA, CLARANS); Hierarchical Clustering: Agglomerative and Divisive Methods (e.g.: AGNES, DIANA, BIRCH); Density-Based Clustering: DBSCAN, OPTICS, Outlier Analysis. Introduction to Web Mining and Text mining. Problem discussion.

Recommended Books:

1. Data Mining by Han and Kamber, Elsevier Publication.
2. Introduction to Data Mining by Tan, Steinbach and Kumar, Pearson Publication.
3. Practical Machine Learning Tools and Techniques with Java Implementations by H. Witten and E.

Frank Morgan Kaufmann.

4. Advances in Knowledge Discovery and Data Mining by U. M. Fayyad, G. Piatetsky-Shapiro, P. Smyth, and R. Uthurusamy, MIT Press.

EEE-702: Embedded Systems

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT 1:

Embedded system:- Definition, components, I/O, Processor, Memory, Characteristics, attributes, design metrics , design challenges, application areas, Issues of designing efficient Embedded system, Difference between ES and PC, Design Technology, Integration and Testing of Embedded Hardware and Firmware, Embedded System Development Environment:-IDE, compiler, assembler, simulator, Emulator, debugging, Target hardware debugging and Boundary Scan , EDLC, Trends in the Embedded Industry:-Processor trends, OS trends, Development languages trends, Open Standard and framework, S/W H/W Co-design

UNIT 2:

Microcontroller:- Introduction, criteria for choosing a microcontroller**,** Overview of 8051 Microcontroller family: Architecture, basic assembly language programming concepts, Memory Organization of 8051,SFR, Watch Dog Timer, Real Time clock. Interfacing to an external memory and Accessing External data Memory and External Code Memory, Interfacing to LCD/Keyboard, DAC/ADC, Sensors, a Stepper Motor, Interfacing with 8255

UNIT 3:

Addressing Modes, Instruction set including bit manipulating instruction and programming using it, Subroutine, Stack, I/O port programming, programs based on the instruction set,

UNIT 4:

Programming of 8051 Timers, Counter Programming. Time delay generations and calculations, Basic Concepts of Interfacing, Introduction to Arm , Pic, and AVR Processors and other recent processors

UNIT 5:

basics of Communication with 8051**,** Basics of Communication, Overview of RS-232, I^2C Bus, UART, USB, 8051 connections to RS-232, 8051 serial communication programming, 8051 interrupts, Programming of timer interrupts, Programming of External hardware interrupts, Programming of the serial communication interrupts, Interrupt priority in the 8051,. RTOS:- introduction, type, overview of commercially available RTOS, Introduction to ES design using RTOS ., Soc, NOC,

Books:

1. Shibu K V , “Introduction to Embedded Systems” , TMH 2009
2. M.A. Mazidi and J. G. Mazidi, “The 8051 Microcontroller and Embedded Systems”, PHI, 2004
3. Frank Vahid & Tony Givargis, “Embedded System Design ”, John Wiley & sons , 2002
4. David E. Simon, “An Embedded Software Primer”, Pearson Education, 1999.
5. Raj Kamal, “Embedded Systems”, TMH, 2004.
6. K.J. Ayala, “The 8051 Microcontroller”, Penram International, 1991.
7. Dr. Rajiv Kapadia, “8051 Microcontroller & Embedded Systems”, Jaico Press
8. Dr. Prasad, “Embedded Real Time System”, Wiley Dreamtech, 2004.

9. Wayne Wolf, "Computers As Components, Principle of Embedded Computing System Design", Morgan Kauf man Publishers, 2008.
10. Asang Dani & Yashavant Kanetkar, "Go Embedded", BPB Publications, 2008

EEE-703: Power System Operation and Control

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Unit - 1
System constraints, Economic dispatch neglecting losses, Optimal load dispatch including transmission losses, Exact transmission loss formula, Coordination equation, Automatic load dispatching

Unit - 2
Methods of voltage control, VAR compensation, Reactive power injection and Control by transformers, Power flow through transmission line, Receiving-end and Sending-end power circle diagrams, Universal power circle diagram.

Unit - 3
Introduction to automatic generation and voltage control, Speed governor, Turbine and Power system modeling, Load Frequency Control (LFC), Single area case, Automatic voltage control.

Unit - 4
Introduction, Rotor dynamics, Swing equation, Power angle curve, Steady state stability, Transient stability, Equal area criterion (Sudden change in mechanical input, sudden loss of one of the parallel lines, sudden short-circuit on one of the parallel lines), Point-by-point solution of the swing equation, Multi-machine stability studies, Factors affecting transient stability, Effect of grounding on stability, Prevention of steady-state pullout.

Unit - 5
Flexible AC transmission, Series and Shunt Compensation schemes, HVDC transmission, Limitation and advantages, Classification of DC links, Back – to – back and bulk power supply systems.

Reference Books:
1. William D. Stevenson Jr, 'Elements of Power System Analysis', Tata McGraw Hill Publishing Co., New Delhi.
2. C. L. Wadhwa, 'Electrical Power System', New Age International, New Delhi.
3. I. J. Nagrath and D. P. Kothari, 'Modern Power System Analysis', Tata McGraw Hill Publishing Co., New Delhi.
4. N. G. Hingorani and L. Gyugyi, 'Understanding FACTS', IEEE Press, USA.

EEE-711: Compiler Design

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT 1:

INTRODUCTION TO COMPILER AND LEXICAL ANALYSIS PHASE: Introduction to compilation, Language processing system, Analysis of the Source Program, Phases and Passes in compilers, compiler construction tools. Introduction to Lexical analysis, Input buffering, tokens, lexemes & pattern, FA & Regular Expressions, NFA to DFA, Minimization, Specification and recognition of tokens, Design of lexical analyzer generator.

UNIT 2:

SYNTAX ANALYSIS PHASE (PARSING): Role and position of a Parser, A simple Backtracking parser, Predictive Parsing, A review of Context Free Grammar, Derivation tree, Ambiguity. Parsing approaches. Top-down Parsing: LL Parsing; Bottom-Up Parsing technique: LR Parsing, SLR, CLR & LALR Parsing, Error recovery strategies, Yacc: an LALR Parser generator.

UNIT 3:

SEMANTIC ANALYSIS AND TYPE CHECKING: Syntax Directed Definitions and translations, Attributes and Attribute grammar, construction of syntax trees, bottom up evaluation of S attributed definition, Type Checking: Type systems, Specification of simple type checker, Type checking for expression and statements, type conversions.

UNIT 4:

INTERMEDIATE CODE GENERATION: Intermediate representations, Types of TAC statements, TAC implementation, TAC generation for Assignment statements, Declarative statements, Boolean expression & Flow of control statements. Short circuit code, Backpatching.

UNIT 5:

CODE OPTIMIZATION AND TARGET CODE GENERATION: Code Optimization, Principle sources of optimization, Types of Optimizations. Control Flow Analysis, Flow Graph, Dominator, Natural Loops, Data Flow Analysis, Gen-Kill and IN & OUT Computations. Issues in the design of a code generator, the target machine, code generation from DAG, Heuristic Node Listing Algorithm, Code generation from a tree, Labeling Algorithm, Function Gencode, A simple code generator.

Books:

1. Aho, Sethi, Ullmann & Lam “Compilers: Principles, techniques and tools”, Pearson Education Asia
2. Keith Cooper & Linda Torczon, "Engineering a Compiler", Morgan Kaufmann publication.
3. Levine, Mason, and Brown, “Lex & Yacc”, O’ Reilly publication.
4. Vinu V. Das, “Compiler Design using FLEX and YACC” PHI.

EEO-702 Robotics and Automation

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Course Outcomes

- **CO1**: *Understand* the fundamental principles and concepts of robotics, including the history, evolution, and types of robots.
- **CO2**: *Apply* kinematic, dynamic, and control models to analyze and simulate robotic systems.
- **CO3**: *Analyze* robotic systems and automation processes, identifying key factors affecting their efficiency and performance.
- **CO4**: *Design* and *implement* robotic control systems, applying appropriate algorithms for path planning, motion control, and coordination.
- **CO5**: *Create* automation solutions by integrating robots with sensors, actuators, and control systems, and applying them to real-world industrial applications.

UNIT-I: INTRODUCTION TO ROBOTICS AND AUTOMATION

- Overview of Robotics: History, Applications, and Current Trends
- Types of Robots: Industrial Robots, Service Robots, Autonomous Robots, Mobile Robots, Humanoid Robots
- Basic Components of Robots: Sensors, Actuators, End Effectors, and Controllers
- Industrial Automation: Role of Robotics in Modern Manufacturing
- Introduction to Robot Operating Systems (ROS) and Automation Platforms
- Key Technologies in Automation: PLCs, SCADA Systems, and IoT in Automation

UNIT-II: ROBOTICS KINEMATICS AND DYNAMICS

- Coordinate Frames and Transformations in Robotics
- Forward and Inverse Kinematics for Robotic Arms
- Robot Jacobian and its Application to Velocity and Force Control
- Dynamics of Robotic Manipulators: Modeling of Forces and Torques
- Lagrangian and Newton-Euler Methods for Dynamics Modeling
- Control of Robotic Arms: PID Controllers, Force Control, and Impedance Control

UNIT-III: MOTION PLANNING AND CONTROL

- Path Planning Algorithms: A*, Dijkstra's Algorithm, and RRT (Rapidly-exploring Random Trees)
- Trajectory Planning: Polynomial Interpolation, Quintic Spline Interpolation
- Motion Control Techniques: PD, PID, and Model-Based Control
- Control of Autonomous Mobile Robots: Differential Drive, Ackermann Steering
- Sensor Fusion: Kalman Filters, Extended Kalman Filters (EKF), and Particle Filters
- Localization and Mapping: SLAM (Simultaneous Localization and Mapping) Techniques

UNIT-IV: ROBOTIC SENSORS AND ACTUATORS

- Types of Sensors: Proximity Sensors, Vision Sensors, Force Sensors, LIDAR, and Cameras
- Sensor Integration in Robotics: Sensing for Navigation and Manipulation
- Actuators in Robotics: DC Motors, Stepper Motors, Pneumatic Actuators, and Hydraulic Actuators
- Robot Vision: Image Processing, Object Detection, Feature Extraction, and Stereo Vision
- Visual Servoing and Machine Vision in Robotics
- Haptics and Tactile Sensing in Robotic Manipulation

UNIT-V: ADVANCED ROBOTICS AND AUTOMATION TECHNIQUES

- Collaborative Robots (Cobots) and Human-Robot Interaction (HRI)
- Multi-Robot Systems and Swarm Robotics
- Industrial Robotic Systems and their Applications in Automation
- Automation in Smart Manufacturing and Industry 4.0: Concepts and Applications
- Autonomous Vehicles: Control, Navigation, and Sensing
- Internet of Things (IoT) in Robotics and Automation: Smart Sensors, Cloud Robotics
- Artificial Intelligence in Robotics: Machine Learning for Robotic Systems, Reinforcement Learning for Robotics

Text Books

1. *Robotics: Control, Sensing, Vision, and Intelligence* by K.S. Fu, R.C. Gonzalez, and C.S.G. Lee, McGraw-Hill.
2. *Introduction to Autonomous Robots: Mechanisms, Sensors, and Algorithms* by Nikolaus Correll, Bradley Hayes, et al., Springer.
3. *Robotics: Modelling, Planning, and Control* by Bruno Siciliano and Lorenzo Sciavicco, Springer.
4. *Robotics and Automation Handbook* by Thomas R. Kurfess, CRC Press.
5. *Robot Operating System (ROS) for Absolute Beginners* by Lentin Joseph, Apress.

Reference Books

1. *Robotics: Principles and Practice* by John J. Craig, Addison-Wesley.
2. *Advanced Robotics: Systems and Applications* by S. S. I. H. F. L. Peter, Springer.
3. *Machine Learning for Robotics and Computer Vision* by K.S. Rajasekaran, Springer.
4. *Introduction to Robotics: Mechanics and Control* by John J. Craig, Pearson.
5. *Industrial Automation and Robotics* by A. K. Gupta, S. K. Arora, and H. K. Patel, Tata McGraw-Hill.

EEO-705 Advanced Protective Relays

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Course Outcomes

- **CO1**: *Recall* the fundamental principles and types of protective relays used in electrical power systems.
- **CO2**: *Examine* and *illustrate* the operation of overcurrent, differential, and distance relays in power systems.
- **CO3**: *Critique* protection schemes for various power system components and *justify* the selection of protection devices.
- **CO4**: *Construct* protection systems using advanced digital relays and *demonstrate* their integration into real-world power systems.
- **CO5**: *Evaluate* the performance of protection systems, *suggest* improvements, and *formulate* solutions to complex protection challenges.

UNIT-I: INTRODUCTION TO PROTECTION RELAYS

- Overview of Protective Relays: Principles, History, and Applications
- Types of Protective Relays: Electromechanical, Solid-State, and Digital Relays
- Protection Relay Characteristics: Time-Current Characteristics, Sensitivity, Selectivity, and Reliability
- Relay Coordination and Protection Zones
- Basic Relay Functions: Overcurrent, Undervoltage, Differential, and Directional Protection
- Protection Systems in Power Generation, Transmission, and Distribution

UNIT-II: OVERCURRENT AND DIFFERENTIAL PROTECTION

- Overcurrent Protection: Time-Current Characteristics, Inverse, and Definite Time Characteristics
- Overcurrent Protection Coordination for Radial and Ring Main Systems
- Differential Protection for Transformers, Generators, and Busbars
- Operating Principles of Differential Relays and their Applications
- CT Saturation in Differential Protection
- Numerical Relays for Differential Protection: Design and Application

UNIT-III: DISTANCE PROTECTION AND TRANSFORMER PROTECTION

- Distance Protection for Transmission Lines: Impedance, Reactance, and Mho Relay Principles
- Relay Settings for Distance Protection: Single-Pole and Multi-Pole Protection
- Phase and Ground Fault Protection in Distance Relays
- Transformer Protection: Differential Protection, Overcurrent, and Buchholz Relays
- Differential Protection for Power Transformers: Current Balance and Percentage Differential Relays
- Fault Detection and Protection in Auto-transformers

UNIT-IV: MODERN PROTECTIVE RELAYS AND SYSTEMS

- Digital Protection and Numerical Relays: Advantages and Implementation
- Microprocessor-Based Protection Systems
- High-Speed Protection Schemes: Line and Busbar Protection
- Communication Protocols for Protection Systems: IEC 61850, DNP3, Modbus
- Integration of Protection Relays with SCADA and Smart Grid Systems

- Remote Monitoring and Protection System Performance Evaluation
- Protection for Distributed Generation (DG) and Renewable Energy Systems

UNIT-V: ADVANCED PROTECTION SCHEMES AND CASE STUDIES

- Adaptive Protection Systems and Their Applications
- Wide Area Protection Systems (WAPS): Implementation and Communication
- Fault Location Algorithms and Protection Coordination
- Protection of FACTS Devices: Thyristor-Controlled Series Capacitors (TCSC), STATCOM, SVC
- Protection of HVDC and Offshore Systems
- Case Studies: Protection System Design and Fault Analysis in Complex Power Systems
- Advanced Protection Systems for Smart Grids and Microgrids

Text Books

1. *Power System Protection and Switchgear* by B. Ravindra and M. Chander, McGraw-Hill Education.
2. *Advanced Protection Systems* by A. R. van C. Mouton, CRC Press.
3. *Modern Power System Protection* by K. S. Suresh and N. S. B. R. P. R. Babu, Oxford University Press.
4. *Digital Protection of Power Systems* by S. A. Soliman, Wiley-IEEE Press.
5. *Protection of Electricity Distribution Networks* by I. R. Craddock and L. A. J. Whittingham, Wiley.

Reference Books

1. *Power System Protection: Static Relays with Microprocessor Applications* by K. B. Gupta, Wiley.
2. *High Voltage Power System Protection* by J. CIGRE and L. V. John, IET.
3. *Advanced Digital Protection for Power Systems* by P. G. CIGRE and M. B. Singh, Springer.
4. *Smart Grids: Infrastructure, Technology, and Solutions* by Mohammad Shahidehpour and M. Alomoush, CRC Press.
5. *Power System Protection and Control: Proceedings of the International Conference on Power System Protection and Control* by T. M. J. U. Ali, Springer.

EEE-712: Big Data Analytics

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT I : INTRODUCTION TO BIG DATA AND HADOOP
Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.

UNIT II : HDFS(Hadoop Distributed File System)
The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

UNIT III :
Map Reduce Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

Unit IV : Hadoop Eco System Pig :
Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL: Introduction

UNIT V : Data Analytics with R Machine Learning :
Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR. Text Books • Tom White “Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012. • Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

References

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007.
2. Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press (2013)
3. Tom Plunkett, Mark Hornick, “Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop”, McGraw-Hill/Osborne Media (2013), Oracle press.
4. Anand Rajaraman and Jef rey David Ulman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
5. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.
6. Glen J. Myat, “Making Sense of Data”, John Wiley & Sons, 2007 • Pete Warden, “Big Data Glossary”, O’Reily, 2011.
7. Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
8. ArvindSathi, “BigDataAnalytics: Disruptive Technologies for Changing the Game”, MC Press, 2012
9. Paul Zikopoulos, Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

EEE-709: VLSI DESIGN

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT-I MOSFET MODELS
Introduction, MOSFET modeling: accumulation, flat-band, depletion and inversion mode of operation,subthreshold conduction, Modeling Noise sources in MOSFET, Inverters, depletion load and enhancement mode MOSFET

UNIT-II DIGITAL VLSI DESIGN
NMOS device sizing, Device sizing in NOR and NAND gates, CMOS device sizing. Symmetric devices: Advantages and limitations, Transmission gates, signal propagation delay modeling.

UNIT-III CURRENT TRENDS IN VLSI DESIGN
Bulk Technology, Advantages and limitations, short channel effects: threshold voltage roll-off, channel length modulation, velocity saturation, DIBL, hot carrier effects, SOI Technology, Partially and fully depleted SOI, layout designing.

UNIT-IV CMOS PROCESSING TECHNOLOGY
Device fabrication, crystal growth, CZ technique, FZ technique, Oxidation, dry and wet oxidation, Lithography, Etching, Diffusion, Ion Implantation and Metallization.

UNIT-V PROGRAMMABLE DEVICES
Introduction to VHDL, design methodology, styles of modeling, designing basic building blocks and functional units as adder, multiplexer and decoder; programming the FPGA and CPLD.

Text Book:

1. Allen Strader, “VLSI Design technologies”, McGraw Hill International Edition, 1990.
2. May and Sze, “Semiconductor fabrication”, John Wiley, 2004.
3. Boris and Backer, “CMOS VLSI designing”, John Wiley, 3rd edition, 2001

Reference Books:

1. Neil H. E. Waste, “CMOS VLSI Design”, Pearson, 3rd edition, 2006.
2. R.J. Baker, H.W. Li and D.E. Boyce, “CMOS: Circuit Design, Layout and Simulation”, IEEE Press, PHI, Pvt. Ltd. New Delhi – 2000
3. R.L. Geiger, P.A. Allen and N.R. Strader, “VLSI: Design Techniques for analog Digital Circuits”, McGraw Hill International Edition, Electronic Engineering Series, 1990
4. S.M. Szee, “VLSI”, McGraw Hill International Editions, 2000
5. Malcolm R. Haskard, “ASIC Designing”, Printice Hall, New York, Edition, 1990
6. Donald L. Schilling and Charles Belove, “Electronic Circuits: Discrete and Integrated”, McGraw Hill Book Company, New Delhi

EEE-713: Cloud Computing

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT I VIRTUALIZATION
Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines –Emulation –Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization – Management Virtualization –– Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization

UNIT II VIRTUALIZATION INFRASTRUCTURE
Comprehensive Analysis – Resource Pool – Testing Environment –Server Virtualization – Virtual Workloads – Provision Virtual Machines – Desktop Virtualization – Application Virtualization - Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data center automation.

UNIT III CLOUD PLATFORM ARCHITECTURE
Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software- A Generic Cloud Architecture Design – Layered cloud Architectural Development – Virtualization Support and Disaster Recovery –Architectural Design Challenges - Public Cloud Platforms :GAE,AWS – Inter-cloud Resource Management

UNIT IV PROGRAMMING MODEL
Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job –Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster – Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Nimbus

UNIT V CLOUD SECURITY
Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud - Key privacy issues in the cloud – Cloud Security and Trust Management

REFERENCES:
1. Danielle Ruest, Nelson Ruest, “Virtualization: A Beginner‟s Guide”, McGraw-Hill Osborne Media, 2009.
2. Jim Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005
3. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation,
4. Management, and Security", CRC Press, 2010.
5. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
6. Tim Mather, Subra Kumaraswamy, and Shahed Latif,"Cloud Security and Privacy", O’Reilly Media, Inc., 2009.
7. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
8. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.

EEE-714 Electric Drives

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Course Outcomes

- **CO1**: *Identify* and *describe* the basic components and working principles of electric drives and their control systems.
- **CO2**: *Analyze* the performance of DC and AC drives and *evaluate* their suitability for different applications.
- **CO3**: *Design* and *simulate* drive systems for different types of motors (DC, induction, synchronous) using appropriate control strategies.
- **CO4**: *Apply* advanced control techniques, such as vector control and direct torque control, to enhance the performance of electric drives.
- **CO5**: *Assess* the efficiency, reliability, and economic factors associated with electric drives and *recommend* improvements in industrial drive systems.

UNIT-I: INTRODUCTION TO ELECTRIC DRIVES

- Overview of Electric Drives: Definition, Components, and Applications
- Basic Elements of an Electric Drive System: Motor, Controller, and Load
- Components of a Drive System: Power Converter, Motor, and Controller
- Types of Motors Used in Electric Drives: DC Motors, Induction Motors, Synchronous Motors, Permanent Magnet Motors
- Operating Principles of Electric Drives and System Characteristics
- Selection of Motors for Various Applications

UNIT-II: DC MOTOR DRIVES AND CONTROL

- Basic Control of DC Motors: Armature and Field Control
- Steady-State and Dynamic Performance of DC Motors
- Types of DC Motor Drives: Separately Excited, Series, and Shunt Motors
- Speed Control Methods: Armature Voltage Control, Field Flux Control, and DC Chopper Control
- Characteristics of DC Motor Drives in Constant and Variable Speed Applications
- Regenerative Braking and its Applications in DC Drives

UNIT-III: AC MOTOR DRIVES AND CONTROL

- Induction Motor Drives: Steady-State and Dynamic Characteristics
- Control of Induction Motors: Scalar Control (V/f Control) and Vector Control
- Direct Torque Control (DTC) of Induction Motors
- Synchronous Motor Drives: Operating Principles and Control Strategies
- Control Techniques for Synchronous Motors: Rotor Field Control, V/f Control, and Direct Torque Control
- Variable Speed Drives for Industrial Applications

UNIT-IV: ADVANCED CONTROL TECHNIQUES FOR ELECTRIC DRIVES

- Vector Control of Induction Motors: Principles and Implementation
- Direct Torque Control (DTC) of Induction Motors: Principles and Applications
- Field-Oriented Control: Speed and Torque Control Strategies
- Power Electronics in Electric Drives: Inverters, Choppers, and PWM Techniques
- Modern Techniques: Adaptive Control, Fuzzy Logic Control, and Neural Networks for Drive

Systems
- Multilevel Inverters for High-Power Motor Drives

UNIT-V: DESIGN AND APPLICATIONS OF ELECTRIC DRIVES

- Design of Electric Drive Systems for Industrial Applications: Cement Mills, Paper Mills, Elevators, Conveyors
- Energy Efficiency in Electric Drives: Loss Minimization, Efficiency Maximization
- Performance Evaluation: Thermal Design, Overload Protection, and Fault Detection
- Power Quality Issues and Mitigation in Electric Drive Systems
- Electric Drives in Electric Vehicles (EVs) and Hybrid Electric Vehicles (HEVs)
- Future Trends: Integration of Electric Drives with Renewable Energy Sources and Smart Grids

Text Books

1. *Electric Motor Drives: Modeling, Analysis, and Control* by R. Krishnan, Prentice Hall.
2. *Fundamentals of Electric Drives* by G. K. Dubey, Narosa Publishing House.
3. *Electric Drives* by Vedam Subrahmanyam, Tata McGraw-Hill Education.
4. *Power Electronics and Motor Drives: Advances and Trends* by Bimal K. Bose, Elsevier.
5. *Control of Electric Drives* by Werner Leonhard, Springer.

Reference Books

1. *Electric Drives* by Mohamed A. El-Sharkawi, CRC Press.
2. *Analysis of Electric Machinery and Drive Systems* by Paul C. Krause, Oleg Wasynczuk, and Scott D. Sudhoff, Wiley.
3. *Power Electronics: Converters, Applications, and Design* by Ned Mohan, Tore M. Undeland, and William P. Robbins, Wiley.
4. *Modern Electric Vehicle Technology* by C. C. Chan and K. T. Chan, Oxford University Press.
5. *Electric Drives and Applications* by S. S. K. S. R. Anjaneyulu and K. S. R. Anjaneyulu, Wiley.

EEE-710: Advance Power Electronics

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT-I
Performance parameters of Power Electronics Switches, Special types of switches. Performance evaluation of 1-Phase rectifier, III Phase rectifier, PWM control of controlled rectifier

UNIT-II
Advance Step up / Step down DC-DC converters - Cuk, SEPIC, ZETA, bidirectional, Flyback converter, Forward Converter, Push-Pull Converter.

UNIT-III
Advance DC-AC Converters- Resonant, Multilevel, Z-Source inverter. Control of Inverters. Performance Parameters of DC-AC Converters.

UNIT-IV
Stability analysis of power electronics Converters, Effect ESR, Designing of High Frequency Transformers, Digital Control of Power Electronics Converter

UNIT-V
Industrial design of Power Electronics Converters- Renewable Energy, Power Supplies, Traction, Micro & Nano grid, LED drivers, Hybrid Electric Vehicle, Grid connection.

Additional topics:

1. International Standards related to Power electronics application like IEC, UL etc
2. Simulation using PSIM

Text Book

1. Ned Mohan, Undeland, Robin, "Power Electronics, Converters, Application and Design", John Wiley and Sons. Inc, New York, 2011.

Reference book names + websites

1. P. C. Sen, "Power Electronics" Tata McGraw Hill Book Co., New Delhi.
2. G. K. Dubey, S.R. Doradla, A.Joshi and R.M.K. Sinha, "Thyristorised Power Controllers" Wiley Eastern Ltd., New Delhi.
3. M. H. Rashid, "Introduction to Power Electronics", Pearson Education India, New Delhi

Websites

1. www.nptel.ac.in

EEE-715: Deep Learning

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT I MACHINE LEARNING FUNDAMENTALS
Machine Learning Fundamentals - linear classifiers, loss functions -Neural networks and deep feedforward neural networks - Regularization techniques for deep learning – Activation functions, initialization, regularization, batch normalization, model selection, ensembles Optimization techniques for training deep neural networks- Fundamental principles and techniques to deep learning and reinforcement learning Successful application examples

UNIT II DEEP LEARNING FUNDAMENTALS
Convolutional neural networks - Fundamentals, architectures, pooling, visualization – Recurrent and recursive neural networks - Deep learning for spatial localization Transposed convolution, efficient pooling, object detection, semantic segmentation. Deep learning applications with a focus on the ones that have achieved superhuman performance (in face recognition, object recognition, speech recognition, natural language processing (machine translation)

UNIT III DEEP LEARNING MODELS
long-short term memory (LSTM), language models, machine translation, image captioning, video processing, visual question answering, learning from descriptions, attention. Deep generative models Auto-encoders, variational auto-encoders, generative adversarial networks, autoregressive models, generative image models, unsupervised and self-supervised representation learning.

UNIT IV LEARNING TECHNIQUES IN DEEP LEARNING
Reinforcement learning framework - Dynamic programming algorithms for reinforcement learning - Monte Carlo methods for reinforcement learning - Temporal-difference learning and n-step bootstrapping algorithms for reinforcement learning Deep reinforcement learning • Policy gradient methods, Q-Learning

UNIT V APPLICATIONS OF DEEP LEARNING
Function approximation algorithms for reinforcement learning -Case studies of reinforcement learning applications that have achieved superhuman performance - Active research topics in deep and reinforcement learning Q-learning for wireless sensor networks.

REFERENCES:

1. Deep Learning Fundamentals Author: Pan Chao Publisher: Create space Independent Publishing Platform Genre ISBN: 9781721230884, 9781721230884
2. Deep Learning from Scratch: Building with Python from First Principles 1st Edition, Kindle Edition, by Seth Weidman
3. Deep Learning (MIT Press Essential Knowledge series) Kindle Edition by John D. Kelleher
4. Deep Learning (Adaptive Computation and Machine Learning series) by Ian Goodfellow, YoshuaBengio, Aaron Courville, Francis Bach
5. Deep Learning for Natural Language Processing: Applications of Deep Neural Networks to Machine Learning Tasks by Pearson Learn IT
6. Advanced Deep Learning with Keras by Rowel Atienza

EEE-716: GPU COMPUTING

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Course Outcomes

CO1: *Understand* the architecture of GPUs and parallel computing paradigms, distinguishing them from traditional CPU-based architectures.
CO2: *Apply* GPU computing frameworks (CUDA/OpenCL) to develop efficient parallel algorithms for computationally intensive tasks.
CO3: *Analyze* and *evaluate* GPU-accelerated applications in fields like simulations, image processing, and machine learning.
CO4: *Design* and *implement* performance optimization techniques for GPU-based applications, addressing common bottlenecks and improving throughput.
CO5: *Create* real-world GPU applications to solve complex computational problems, using the appropriate tools and libraries to leverage GPU resources effectively.

UNIT-I: INTRODUCTION TO GPU COMPUTING

Overview of Parallel Computing, Difference Between CPU and GPU, GPU Architecture, CUDA Architecture (Streaming Multiprocessors, Thread Blocks, Warps, Registers, Shared Memory, Global Memory), GPU Programming Models, Introduction to CUDA Programming, Basics of Thread Management, Memory Hierarchy, and Synchronization in CUDA.

UNIT-II: GPU PROGRAMMING WITH CUDA

CUDA Programming Basics, Threads, Blocks, and Grids, Memory Models (Global, Shared, Constant, and Texture Memory), CUDA Kernels, Thread Synchronization, CUDA Streams and Events, CUDA Profiler, Introduction to CUDA Libraries (cuBLAS, cuFFT, cuRAND, cuDNN), Error Handling in CUDA, Optimizing GPU Code for Performance.

UNIT-III: PARALLEL ALGORITHMS AND OPTIMIZATION

Parallel Reduction, Parallel Scan (Prefix Sum), Matrix Multiplication on GPU, Sorting Algorithms (Bitonic Sort, Parallel Merge Sort), Parallel Graph Algorithms, Optimization Techniques in GPU Programming, Memory Coalescing, Managing Divergence in Threads, Performance Evaluation and Bottlenecks in GPU Code, GPU Load Balancing, Latency Hiding, and Throughput Maximization.

UNIT-IV: GPU ACCELERATION IN MACHINE LEARNING AND IMAGE PROCESSING

Overview of Machine Learning on GPUs, Training Deep Learning Models on GPUs (using cuDNN and TensorFlow/PyTorch), GPU Acceleration for Image Processing Applications, Fast Fourier Transform (FFT) on GPUs, Image Filtering and Edge Detection Using GPUs, Convolutional Neural Networks (CNN) Optimization for GPUs, GPU Programming for Scientific Simulations, Monte Carlo Simulations on GPUs.

UNIT-V: ADVANCED TOPICS IN GPU COMPUTING

Parallel Computing with OpenCL, Programming for AMD and Intel GPUs, GPU Virtualization and Multi-GPU Systems, Heterogeneous Computing Systems, Real-time GPU Computing, GPU Computing for Cloud and High-Performance Computing (HPC) Environments, Future Trends in GPU Technology, Introduction to Tensor Processing Units (TPUs), Use of GPUs in Autonomous Systems and AI/ML Applications.

Text Books

1. *CUDA by Example: An Introduction to General-Purpose GPU Programming*: Jason Sanders and Edward Kandrot, Addison-Wesley.
2. *GPU Computing Gems* (Series): Wen-mei Hwu (Ed.), Morgan Kaufmann.
3. *CUDA Programming: A Developer's Guide to Parallel Computing with GPUs*: Shane Cook, Elsevier.
4. *Programming Massively Parallel Processors: A Hands-on Approach*: David B. Kirk and Wen-mei W. Hwu, Morgan Kaufmann.
5. *OpenCL Programming by Example*: Ravishekhar B. S., Packt Publishing.

References Books

1. *Introduction to High Performance Computing for Scientists and Engineers*: Georg Hager and Gerhard Wellein, CRC Press.
2. *High Performance Computing: Modern Systems and Practices*: Thomas Sterling, Matthew Anderson, and Maciej Brodowicz, Morgan Kaufmann.
3. *Parallel Programming in C with MPI and OpenMP*: Quinn, Michael J., McGraw-Hill Education.
4. *Heterogeneous Computing with OpenCL*: Benedict R. Gaster, Lee Howes, David R. Kaeli, Perhaad Mistry, and Dana Schaa, Elsevier.
5. *Mastering CUDA Programming*: Alexander D. Williams, Packt Publishing.

EEO-703: Software Engineering

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Unit 1: Introduction
Definition, Program Vs Software, Software processes, Software life cycle models: Build and Fix, Waterfall, Prototype, Iterative Enhancement Model, Evolutionary and Spiral model, V Model & RAD Model.

Unit 2: Software Project Planning.
Crucial process steps of Requirement Engineering, Types of requirements, Requirement Elicitation techniques and Requirement Documentation, SRS, COCOMO model, Risk management.

Unit 3: Software Requirement Analysis and Specifications, Design & Software Reliability.
Problem Analysis, Data Flow Diagrams, use case diagrams, Software Prototyping, Cohesion & Coupling, Classification of Cohesiveness & Coupling, Function Oriented Design, Object Oriented Design, User Interface Design. Software Reliability: Failure and Faults, Overview of Quality Standards like ISO 9001, SEI-CMM

Unit 4: Software Testing
Software Testing terminology, Functional testing: Boundary value analysis, Equivalence class testing, Cause- effect graphing, Structural testing: path testing, Data flow and mutation testing, unit testing, integration and system testing, Validation testing Debugging techniques & Approaches and Testing Tools.

Unit 5: Software Maintenance
Software Maintenance & its types: Management of maintenance, The Maintenance Process, Maintenance Models: Quick fix, Iterative Enhancement, Reuse Oriented. Reverse Engineering, Software RE-engineering, Configuration Management.

References
1. Prof: KK Aggarwal & Yogesh Singh: SOFTWARE ENGG:
2. Pankaj Jalote, "An Integrated Approach to Software Engg" Narosa Publishing House, New Delhi. Pressman" Priciples of Software Engg" TMC, 5th Ed. 2005

EEO-704: Power System Automation

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Unit - 1
System constraints, Economic dispatch neglecting losses, Optimal load dispatch including transmission losses, Exact transmission loss formula, Coordination equation, Automatic load dispatching

Unit - 2
Methods of voltage control, VAR compensation, Reactive power injection and Control by transformers, Power flow through transmission line, Receiving-end and Sending-end power circle diagrams, Universal power circle diagram.

Unit - 3
Introduction to automatic generation and voltage control, Speed governor, Turbine and Power system modeling, Load Frequency Control (LFC), Single area case, Automatic voltage control.

Unit - 4
Introduction, Rotor dynamics, Swing equation, Power angle curve, Steady state stability, Transient stability, Equal area criterion (Sudden change in mechanical input, sudden loss of one of the parallel lines, sudden short-circuit on one of the parallel lines), Point-by-point solution of the swing equation, Multi-machine stability studies, Factors affecting transient stability, Effect of grounding on stability, Prevention of steady-state pullout.

Unit - 5
Flexible AC transmission, Series and Shunt Compensation schemes, HVDC transmission, Limitation and advantages, Classification of DC links, Back – to – back and bulk power supply systems.

Reference Books:
1. William D. Stevenson Jr, 'Elements of Power System Analysis', Tata McGraw Hill Publishing Co., New Delhi.
2. C. L. Wadhwa, 'Electrical Power System', New Age International, New Delhi.
3. I. J. Nagrath and D. P. Kothari, 'Modern Power System Analysis', Tata McGraw Hill Publishing Co., New Delhi.
4. N. G. Hingorani and L. Gyugyi, 'Understanding FACTS', IEEE Press, USA.

EEO-705: Cyber Physical Systems

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT I CYBER PHYSICAL SYSTEMS
Cyber-Physical Systems (CPS) in the real world - Basic principles of design and validation of CPS - models of physical process, finite state machines, computation, converters between physical and cyber variables, and digital networks - Industry 4.0 – Auto SAR - IIOT implications - Building Automation - Medical CPS

UNIT II CPS - PLATFORM COMPONENTS
CPS HW platforms - Processors, Sensors, Actuators - mCPS Network – Wireless Hart, CAN, Automotive Ethernet - CPS Sw stack - RTOS - Scheduling Real Time control tasks

UNIT III PRINCIPLES OF AUTOMATED CONTROL DESIGN
Dynamical Systems and Stability - Controller Design Techniques - Stability Analysis: CLFs, MLFs, stability under slow switching - Performance under Packet drop and Noise - Tutorial: Matlab toolboxes - Simulink, State flow Features to software components - Mapping software components to ECUs - CPS Performance Analysis - effect of scheduling, bus latency, sense and actuation faults on control performance, network congestion

UNIT IV INTELLIGENT CPS
Safe Reinforcement Learning - Robot motion control - Autonomous Vehicle control – Gaussian Process Learning - Smart Grid Demand Response - Building Automation

UNIT V SECURE DEPLOYMENT OF CPS& APPLICATIONS OF CPS
Secure Task mapping and Partitioning - State estimation for attack detection – Automotive Case study : Vehicle ABS hacking - Power Distribution Case study : Attacks on Smart Grids – Virtual Instrumentation – Applications of CPS.

REFERENCES:
1. E. A. Lee and S. A. Seshia, “Introduction to Embedded Systems: A Cyber-Physical Systems Approach”, 2011.
2. R. Alur, “Principles of Cyber-Physical Systems,” MIT Press, 2015.
3. T. D. Lewis “Network Science: Theory and Applications”, Wiley, 2009.
4. P. Tabuada, “Verification and control of hybrid systems: a symbolic approach”, Springer Verlag 2009.
5. C. Cassandras, S. Lafortune, “Introduction to Discrete Event Systems”, Springer 2007.
6. Constance Heitmeyer and Dino Mandrioli, “Formal methods for real-time computing”, Wiley publisher, 1996.

EEO-807 Grid Protection and Control

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Course Outcomes

- **CO1**: *Understand* the principles and technologies involved in power grid protection and control, including their importance for grid stability and reliability.
- **CO2**: *Apply* protection schemes and algorithms for fault detection, isolation, and system restoration in power grids.
- **CO3**: *Analyze* the behavior of power systems during faults and disturbances, and *evaluate* the performance of protection systems in maintaining grid stability.
- **CO4**: *Design* and *implement* control strategies for modern smart grids, ensuring optimized power flow, reliability, and fault-tolerant operation.
- **CO5**: *Create* advanced grid protection solutions using emerging technologies such as wide-area monitoring systems, synchrophasors, and intelligent relays.

UNIT-I: INTRODUCTION TO POWER SYSTEM PROTECTION

- Overview of Power System Protection: Objectives and Principles
- Types of Protection: Overcurrent, Differential, Distance, and Under/Over Voltage Protection
- Components of Protection Systems: Relays, Circuit Breakers, Fuses
- Protection in Generation, Transmission, and Distribution Systems
- Protection Coordination: Time-Current Characteristics, Selectivity
- Common Protection Schemes in Power Systems

UNIT-II: PROTECTION SCHEMES FOR TRANSMISSION LINES AND GENERATORS

- Protection of Transmission Lines: Distance Protection, Impedance-Based Protection, Pilot Wire Protection
- Overcurrent Protection for Transmission Lines: Principles, Settings, and Coordination
- Protection of Transformers: Buchholz Relays, Differential Protection
- Generator Protection: Stator, Rotor, and Transformer Protection Schemes
- Protection for Busbars and Circuit Breakers

UNIT-III: FAULT ANALYSIS AND FAULT LOCATION

- Fault Analysis: Symmetrical and Asymmetrical Faults
- Fault Types: Line-to-Ground, Line-to-Line, and Three-Phase Faults
- Fault Detection and Fault Location Techniques
- Fault Indicators and Fault Clearing Methods
- Short-Circuit Calculations and Protection Coordination Studies
- Dynamic Behavior of Power Systems during Faults
- Application of Phasor Measurement Units (PMUs) in Fault Detection

UNIT-IV: ADVANCED PROTECTION AND CONTROL TECHNIQUES

- Introduction to Smart Grid and Protection Challenges
- Wide-Area Monitoring, Protection, and Control (WAMPAC) Systems
- Synchrophasors and their Role in Grid Protection
- Adaptive Protection: Principles and Applications
- Digital Protection Relays: Configuration, Features, and Applications

- Communication Networks for Protection Systems: IEC 61850, SCADA, and IEDs
- Remote Monitoring and Protection System Performance Evaluation

UNIT-V: CONTROL OF MODERN POWER GRIDS

- Basics of Power System Control: Frequency and Voltage Regulation
- Energy Management Systems (EMS): Functions and Applications
- Optimal Power Flow (OPF) and Economic Dispatch
- Control of Distributed Generation: Integration of Renewable Energy Sources
- Stability Control: Transient, Dynamic, and Voltage Stability
- Demand Response and Load Forecasting in Smart Grids
- Control of Microgrids: Design and Operation in Islanded and Grid-Connected Modes
- Role of Artificial Intelligence in Grid Protection and Control

Text Books

1. *Power System Protection and Switchgear* by B. Ravindra and M. Chander, McGraw-Hill Education.
2. *Power System Protection* by C. Christopoulos and A. M. Hughes, Wiley.
3. *Modern Power System Protection* by K. S. Suresh and N. S. B. R. P. R. Babu, Oxford University Press.
4. *Smart Grid Protection and Control* by Hongyu Wu, Springer.
5. *Electrical Power Systems Protection* by A. R. van C. Mouton, CRC Press.

Reference Books

1. *Power System Protection: Static Relays with Microprocessor Applications* by K. B. Gupta, Wiley.
2. *High Voltage Power System Protection* by J. CIGRE and L. V. John, IET.
3. *Wide Area Monitoring, Protection, and Control Systems* by R. L. Basso, Wiley.
4. *Power Systems Stability and Control* by P. Kundur, McGraw-Hill Education.
5. *Intelligent Grid Protection: High-Performance Protection Systems for the Smart Grid* by N. R. Watson and B. D. Russell, Wiley.

EEO-806: Computing and Sustainability

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Unit 1 Overview and Issues:
Problems: Toxins. Power Consumption, Equipment Disposal, Company's Carbon Footprint: Measuring. Details. reasons to bother, Plan for the Future. Cost Savings: Hardware. Power. Initiatives and Standards: Global Initiatives: United Nations, Basel Action Network, Bawl Convention, North America: The United States, Canada, Australia, Europe, WERE Directive, RoHS, National Adoption, Asia: Japan, China, Korea.

Unit 2 Minimizing Power Usage:
Power Problems, Monitoring Power Usage, Servers, Low-Cost Options, Reducing Power Use, Data De-Duplication, Vitalization, Management, Bigger Drives. Involving the Utility Company. Low-Power Computers, PCs, Linux, Components, Servers, Computer Settings, Storage, Monitors, Power Supplies. Wireless Devices. Software. Cooling: Cooling Costs, Power Cost, Causes of Cost. Calculating Cooling Needs, Reducing Cooling Costs, Economizers. On-Demand Cooling, IIP's Solution, Optimizing Airflow, Hot Aisle/Cold Aisle, Raised Floors, Cable Management, Vapour Seal, Prevent Recirculation of Equipment Exhaust, Supply Air Directly to Heat Sources, Fans, Humidity, Adding Cooling, Fluid Considerations, System Design, Datacentre Design, Centralized Control, Design for Your Needs. Put Everything Together.

Unit 3 Changing the Way of Work:
Old Behaviours, starting at the Top, Process Reengineering with Green in Mind, Analysing the Global Impact of Local Actions, Steps: Water, Recycling. Energy. Pollutants, Teleworkers and Outsourcing, Tekcommuting, Outsourcing, how to Outsource. Going Paperless: Paper Problems, The Environment, Costs: Paper and Office, Practicality, Storage, Destruction, Going Paperless, Organizational Realities, Changing Over, Paperless Billing, Handheld Computers vs. the Clipboard, Unified Communications, Intrancts, What to Include, Building an Intranet, Microsoft Office SharcPoint Server 2007, Electronic Data Interchange (EDI), Nuts and Bolts, Value Added Networks, Advantages, Obstacles.

Unit 4 Recycling:
Problems, Chinas Africa, Materials, Means of Disposal Recycling. Refurbishing. Make the Decision, Lifc Cycle, from beginning to end, Life, Cost, Green Design, Recycling Companies. Finding the Best One. Checklist, Certifications, Hard Drive Recycling, Consequences, cleaning a Hard Drive, Pros and cons of each method, CDs and DVDs. good and bad about CD and DVDs disposal Change the mind-set, David vs. America Online Hardware Considerations: Certification Programs, EPEAT, RollS, Energy Star. Computers, Monitors, Printers, Scanners, All-in-Ones, Thin Clients, Servers, Blade Servers, Consolidation, Products, Hardware Considerations. Planned Obsolescence. Packaging. Toxins. Other Factors, Remote Desktop, Using Remote Desktop. Establishing a Connection. In Practice

Unit 5 Greening Your Information Systems:
Initial Improvement Calculations, Selecting Metrics, Tracking Progress, Change Business Processes. Customer Interaction, Paper Reduction, Green Supply Chain, Improve Technobgy Infrastructure, Reduce PCs and Servers, Shared Services, I lardware Cogs, Cooling. Staying Green: Organizational Check-ups. Chief Green Officer, Evolution, Sell the CEO. SMART Goals, Equipment Check-ups, Gather Data, Tracking the data, Baseline Data. Benchmarking, Analyse Data, Conduct Audits, Certifications. Benefits, Realities, Helpful Organizations.

Books and References:

1. Toby Velte, Anthony Velte, Robert Elsenpcter, “Green IT”, McGraw Hill, 2008
2. Alvin Gales, Michael Schaefer, Mike Ebbcrs, “Green Data Center: Steps for the Journey”, Shroff Publishers and Distributers, 2011
3. Jason Harris, “Green Computing and Green IT Best Practice”, Emereo, 2014

4. Bud E. Smith, “Green Computing Tools and Techniques for Saving Energy. Money and Resources”, CRC Press,

EEO-807 Advanced Cybersecurity

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Course Outcomes

- **CO1**: *Understand* advanced concepts in network security and cryptography, including their application to real-world scenarios.
- **CO2**: *Analyze* and *evaluate* advanced persistent threats (APTs) and cyber attacks, identifying their characteristics, impact, and mitigation strategies.
- **CO3**: *Apply* advanced security mechanisms to protect enterprise systems and networks, addressing various threats in real-time environments.
- **CO4**: *Create* and *execute* penetration testing, vulnerability assessment, and ethical hacking techniques to identify security flaws in systems.
- **CO5**: *Design* and *implement* real-world cybersecurity solutions that enhance system integrity, confidentiality, and availability in modern network infrastructures.

UNIT-I: INTRODUCTION TO ADVANCED CYBERSECURITY

- Overview of Cybersecurity: Key Concepts and Principles
- Types of Cyber Threats: Malware, Ransomware, APTs, Phishing, Denial-of-Service (DoS) Attacks
- Understanding Attack Vectors: Social Engineering, Insider Threats, Zero-Day Exploits
- Security Policies and Risk Management: Risk Assessment and Threat Modeling
- Cybersecurity Governance and Compliance: NIST, ISO/IEC 27001, GDPR, and other frameworks

UNIT-II: NETWORK SECURITY AND ADVANCED FIREWALLS

- Advanced Network Security Concepts: Layered Security Models, Defense-in-Depth
- Firewalls: Types, Configuration, and Advanced Features (Stateful, Stateless, Next-Generation Firewalls)
- Intrusion Detection and Prevention Systems (IDS/IPS): Signature-based vs. Anomaly-based Detection
- VPNs, SSL/TLS, and Network Access Control (NAC)
- Network Traffic Analysis and Security Monitoring
- Advanced Persistent Threats (APT) Detection and Mitigation

UNIT-III: CRYPTOGRAPHY AND ADVANCED ENCRYPTION TECHNIQUES

- Modern Cryptographic Algorithms: AES, RSA, ECC, and Quantum-Resistant Cryptography
- Cryptographic Protocols: SSL/TLS, IPsec, PGP, and SSH
- Key Management and Public Key Infrastructure (PKI)
- Digital Signatures and Certificates
- Homomorphic Encryption and Privacy-Preserving Computation
- Attacks on Cryptosystems and Countermeasures

UNIT-IV: ETHICAL HACKING, PENETRATION TESTING, AND VULNERABILITY ASSESSMENT

- Ethical Hacking: Principles and Legal Implications
- Penetration Testing Methodology: Reconnaissance, Scanning, Exploitation, and Reporting
- Vulnerability Assessment and Management Tools: Nessus, OpenVAS, and Nikto
- Web Application Security: SQL Injection, XSS, CSRF, and Mitigations
- Wireless Network Security: WPA3, Rogue Access Points, and Evil Twin Attacks

- Social Engineering Techniques and Countermeasures

UNIT-V: ADVANCED TOPICS IN CYBERSECURITY

- Cloud Security: Cloud Computing Threats, Security Challenges, and Solutions
- Blockchain and Cryptocurrency Security: Blockchain Attacks, Smart Contract Security
- Threat Intelligence and Incident Response: Gathering Threat Intelligence, Incident Handling, and Forensics
- Security Automation and Orchestration
- Cybersecurity in IoT, Smart Devices, and SCADA Systems
- Artificial Intelligence and Machine Learning in Cybersecurity: Threat Detection, Predictive Models

Text Books

1. *Network Security Essentials* by William Stallings, Pearson.
2. *Cryptography and Network Security* by William Stallings, Pearson.
3. *The Web Application Hacker's Handbook* by Dafydd Stuttard and Marcus Pinto, Wiley.
4. *Advanced Persistent Threats* by Eric Cole, Elsevier.
5. *Hacking: The Art of Exploitation* by Jon Erickson, No Starch Press.

Reference Books

1. *The Practice of Network Security Monitoring* by Richard Bejtlich, Addison-Wesley.
2. *Applied Cryptography: Protocols, Algorithms, and Source Code in C* by Bruce Schneier, Wiley.
3. *Metasploit: The Penetration Tester's Guide* by David Kennedy, Jim O'Gorman, Devon Kearns, and Mati Aharoni, No Starch Press.
4. *Cybersecurity and Cyberwar: What Everyone Needs to Know* by P.W. Singer and Allan Friedman, Oxford University Press.
5. *Security Engineering: A Guide to Building Dependable Distributed Systems* by Ross Anderson, Wiley.

EEO-808: Natural Language Processing (NLP)

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Unit 1. Text Processing Tasks and Probabilistic Language Models
Introduction to Text, Speech and Language Technologies, Basic Text Processing Tasks, Normalization, Max Match Algorithm, Lemmatization, Porter Stemmer, Minimum Edit Distance, Probabilistic Language Models: N Grams, Bigram Probabilities, Perplexity, Smoothing Techniques: La Place, Good Turing, Kneser Ney, Interpolation.

Unit 2. Text Classification and Sequence Modelling
Text Classification: Bag of words, Conditional Independence, Multinomial Naïve Bayes Classifier, Maximum Likelihood Estimation, Evaluation of Text Classification Model. Sentiment Analysis: Entity based and aspect Based Feature Extraction, Baseline Algorithm, Sentiment Lexicons, Polarity Analysis. Building Sentiment Lexicons: Semi supervised Algorithm, Turney Algorithm. Sequence Modelling: Markov Models, HMM, Beam, Greedy and Viterbi inference, HMM, CRF, LSTM based POS tagging.

Unit 3. Lexical Semantics
Word Senses and Word Relations, Wordnet. Computing Word Similarities: Path Based, Information Content, Word Sense Disambiguation, Thesaurus based WSD using Wordnet, Lesk Algorithm, Typical Features of WSD, Supervised WSD, Semi supervised WSD.

Unit 4. Distributional Semantics
Vector Semantics: Distributed Representations, Word Context Matrix Generation, Weighting Methods, Dimensionality Reduction, Similarity Measures. Word Embeddings, Learning of Neural Embeddings.

Unit 5. Information Extraction
Named Entity Recognition: HandWritten Regular Expressions, Typical Features for NER, Classification models, Sequence Models. Relation Extraction: Binary Relation Association, Relation Extraction from Wikipedia, Supervised Relation Extraction, Semi-supervised Relation Extraction, Distant Supervision.

Books:
1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing”, 2nd Edition, Pearson Education, 2013.
2. Yoav Goldberg, “Neural Network Methods in Natural Language Processing”, Morgan & Claypool Publishers, 2017.
3. Steven Bird, Ewan Klein, Edward Loper “Natural Language Processing with Python”, O’Reilly, 2009.
4. Manning and Schuetze, “Foundations of Statistical Natural Language Processing”, MIT Press, 1999.

EEO-805: Electricity Markets

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Course Outcomes

CO1 Understanding the structure and operation of electricity markets.
CO2 Analyzing different market models and their impact on pricing and efficiency.
CO3 Developing skills to assess market dynamics, competition, and pricing mechanisms.
CO4 Evaluating the economic and regulatory aspects of electricity market policies.
CO5 Applying market optimization and bidding strategies for real-time operations and future planning.

UNIT-I: INTRODUCTION TO ELECTRICITY MARKETS
Overview of the Electric Power Industry, Historical Development of Electricity Markets, Key Components of the Electricity Market: Generation, Transmission, Distribution, and Retail, Electricity Market Models: Bilateral vs. Pool-based Markets, Market Players: Generators, Retailers, Consumers, and System Operators, Market Design and Market Participants' Roles.

UNIT-II: MARKET STRUCTURE AND DESIGN
Types of Electricity Markets: Spot Market, Ancillary Services, Forward and Futures Markets, Market Clearing Mechanism, Price Formation: Locational Marginal Pricing (LMP), Market Equilibrium, Demand Response, The Role of Market Operators, Market Monitoring, and Regulation, Market Power and Market Failures, Wholesale vs. Retail Market Structures.

UNIT-III: MARKET PRICING AND COMPETITION
Pricing in Competitive Markets, Bidding Strategies for Market Participants, Market Clearing Price Determination, Auctions and Market Clearing: Single-Price vs. Pay-as-Bid Markets, Price Volatility and Risk Management, Market Efficiency: Economic Dispatch and Unit Commitment, Impact of Renewable Energy on Market Pricing, Power System Security and Reliability in Market Operations.

UNIT-IV: REGULATION AND POLICY IN ELECTRICITY MARKETS
Electricity Market Regulations: Regulatory Framework and Market Governance, Roles of Regulators: FERC (Federal Energy Regulatory Commission), ISO/RTO (Independent System Operators / Regional Transmission Organizations), Energy Policy and Its Impact on Market Design, Capacity Mechanisms and Long-Term Investment Signals, Carbon Pricing and Emissions Trading, Energy Market Liberalization and Privatization.

UNIT-V: ADVANCED TOPICS AND EMERGING TRENDS
Market Integration and Cross-Border Electricity Trading, Role of Smart Grids and Distributed Energy Resources (DERs), Electricity Market Coupling and Integration of Renewables, Demand-Side Management and Consumer Participation, Blockchain Applications in Electricity Markets, Future Trends in Decentralized Markets and Peer-to-Peer Trading, Electricity Market Forecasting and Simulation Techniques.

Text Books

1. Electricity Markets: Pricing, Structures and Economics: S. R. N. Raju, Tata McGraw-Hill.
2. Modern Power System Analysis: D.P. Kothari and I.J. Nagrath, McGraw-Hill.
3. The Economics of Electricity Markets: Richard Green, Wiley.
4. Electricity Markets: Theories and Applications: Steven Stoft, Wiley-Interscience.
5. Power System Economics: Designing Markets for Electricity: Steven Stoft, Wiley.

References Books

1. Market Design for Electricity: How to Build Effective Market Structures: D. M. Kirschen, John Wiley & Sons.
2. Electric Power Systems: A Conceptual Introduction: Alexandra von Meier, Wiley-IEEE

Press.
3. Electricity Market Reform: An International Perspective: Fereidoon P. Sioshansi, Elsevier.
4. Power System Economics: A Modeling Approach: S. K. Gupta, Prentice Hall.
5. The Political Economy of Electricity Market Reform: David A. Victor, Cambridge University Press.

EEO-809: Evolutionary Optimization Techniques

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Unit- I
Introduction to optimization, functions of single variable, functions of several variables, formulation of optimization problems. Review of classical methods, linear programming, nonlinear programming.

Unit-II
Constraint optimality criteria, constrained optimization, constraint direct search method, linearization methods for constrained problems, transformation method. Nonlinear programming: problem formulation, Quadratic Approximation Methods for Constrained Problems Unconstrained minimization techniques.

Unit-III
Dynamic programming: sub-optimization, multistage optimization problem. Multi-objective and goal programming: problem formulation, solution of a multi-objective problem. Case studies

Unit-IV
Introduction to Stochastic Optimization Techniques, types: Local Search, Population Based, Introduction to Genetic Algorithms, Motivation from Nature, Genetic Algorithms: Working Principle: Representation, Fitness Assignment, Reproduction, Crossover, Mutation, Constraint Handling, Real Parameter Genetic Algorithms, Combined Genetic Algorithm, Advanced Genetic Algorithms, Applications.

Unit-V
Ant Colony Optimization: Introduction, Ant System, Ant Colony System, ANTS, Significant Problems, Convergence Proofs. Discrete Particle Swarm Optimization (PSO): Introduction, PSO Elements: Position and State Space, Objective Function, Velocity, PSO Algorithm, Examples and Results, Applications.

Text/Reference Books

1. Singiresu S. Rao, 'Optimization Techniques', New Age International Publishers.
2. D. P. Kothari and J. S. Dhillon, 'Power System Optimization, Tata McGraw Hill.
3. C. Mohan and Kusum Deep, 'Optimization Techniques, New Age International Publishers.
4. Godfrey C. Onwubolu, B. V. Babu, "New Optimization Techniques in Engineering", Springer-Verlag.
5. Marco Dorigo, Thomas Stützle, "Ant colony optimization", MIT Press.
6. Thomas Wiesi, "Global Opimization Algorithms", ebook. http://www.it-weise.de/.s

EEO-810: Blockchain Technology

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT I: Introduction
Overview of Block chain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Block chain, Transactions, Distributed Consensus, Public vs Private Block chain, Understanding Crypto currency to Block chain, Permissioned Model of Block chain, Overview of Security aspects of Block chain Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency.

UNIT II: Understanding Block chain with Crypto currency
Bitcoin and Block chain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay. Working with Consensus in Bitcoin: Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW) – basic introduction, Hashcash PoW, Bitcoin PoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool.

UNIT III: Understanding Block chain for Enterprises
Permissioned Block chain: Permissioned model and use cases, Design issues for Permissioned block chains, Execute contracts, State machine replication, Overview of Consensus models for permissioned block chain- Distributed consensus in closed environment, Paxos, RAFT Consensus

UNIT IV:
Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak-Pease BFT Algorithm, BFT over Asynchronous systems. Enterprise application of Block chain: Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Block chain, Block chain enabled Trade, We Trade – Trade Finance Network, Supply Chain Financing, Identity on Block chain

UNIT V: Block chain application development
Hyperledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric, Writing smart contract using Ethereum, Overview of Ripple and Corda

BOOKS

1. Melanie Swan, “Block Chain: Blueprint for a New Economy”, O’Reilly, 2015
2. Josh Thompsons, “Block Chain: The Block Chain for Beginners- Guide to Block chain Technology and Leveraging Block Chain Programming”
3. Daniel Drescher, “Block Chain Basics”, Apress; 1stedition, 2017
4. Anshul Kaushik, “Block Chain and Crypto Currencies”, Khanna Publishing House, Delhi.
5. Imran Bashir, “Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Packt Publishing
6. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Block Chain”, Packt Publishing
7. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O’Dowd, Venkatraman Ramakrishna, “Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer”, Import, 2018

EEO-811: IMAGE PROCESSING AND COMPUTER VISION

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Course Outcomes

CO1 Understanding the fundamental concepts of image processing and computer vision.
CO2 Applying various image processing techniques for image enhancement and feature extraction.
CO3 Developing algorithms for object recognition, tracking, and scene understanding.
CO4 Evaluating the performance of different computer vision algorithms in real-world applications.
CO5 Designing and implementing solutions for image classification, segmentation, and recognition tasks.

UNIT-I: INTRODUCTION TO IMAGE PROCESSING

Overview of Image Processing, Image Representation and Data Formats, Basic Image Operations (Resizing, Cropping, and Rotation), Image Enhancement (Contrast Adjustment, Histogram Equalization), Spatial Filtering, Noise Removal (Mean, Median Filtering), Edge Detection (Sobel, Prewitt, Canny), Thresholding Techniques (Global and Adaptive).

UNIT-II: IMAGE TRANSFORMS AND FEATURE EXTRACTION

Fourier Transform and its Applications, Discrete Fourier Transform (DFT), Wavelet Transform, Hough Transform, Principal Component Analysis (PCA) for Dimensionality Reduction, Local Binary Patterns (LBP), Histogram of Oriented Gradients (HOG), Scale-Invariant Feature Transform (SIFT), Speeded-Up Robust Features (SURF).

UNIT-III: IMAGE SEGMENTATION AND CLASSIFICATION

Segmentation Techniques: Region-based, Edge-based, Thresholding, and Clustering-based Methods, Watershed Algorithm, Graph Cut, and Active Contours, Texture and Color-based Segmentation, Image Classification Techniques: K-Nearest Neighbors (KNN), Support Vector Machines (SVM), Convolutional Neural Networks (CNN), Feature Matching and Recognition, Evaluation Metrics (Accuracy, Precision, Recall, F1-Score).

UNIT-IV: COMPUTER VISION AND OBJECT DETECTION

Object Recognition Techniques, Template Matching, Feature Matching, Object Detection (Haar Cascades, HOG + SVM), Region-based CNNs (R-CNN), YOLO (You Only Look Once), SSD (Single Shot Multibox Detector), Deep Learning for Object Detection, Applications in Surveillance, Face Detection, and Pedestrian Detection.

UNIT-V: ADVANCED TOPICS IN COMPUTER VISION

Deep Learning in Computer Vision (CNN, GANs), Semantic Segmentation (Fully Convolutional Networks, U-Net), Image Captioning, Optical Flow, Motion Detection and Tracking, Stereo Vision, 3D Reconstruction, Augmented Reality, Applications in Autonomous Vehicles, Medical Imaging, and Robotics.

Text Books

1. **Digital Image Processing**: Rafael C. Gonzalez and Richard E. Woods, Pearson.
2. **Computer Vision: Algorithms and Applications**: Richard Szeliski, Springer.
3. **Pattern Recognition and Machine Learning**: Christopher M. Bishop, Springer.
4. **Deep Learning for Computer Vision**: Rajalingappaa Shanmugamani, Packt Publishing.
5. **Computer Vision: A Modern Approach**: David A. Forsyth and Jean Ponce, Pearson.

References Books

1. **Computer Vision: Models, Learning, and Inference**: Simon J.D. Prince, Cambridge University Press.
2. **Learning OpenCV 4: Computer Vision with Python**: Adrian Kaehler and Gary Bradski, O'Reilly Media.
3. **Image Processing, Analysis, and Machine Vision**: Milan Sonka, Vaclav Hlavac, and Roger Boyle, Cengage Learning.
4. **Multiple View Geometry in Computer Vision**: Richard Hartley and Andrew Zisserman, Cambridge University Press.
5. **Deep Learning for Computer Vision with Python**: Adrian Rosebrock, PyImageSearch.

EEH-414: MATHEMATICS FOR AI AND ML

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Course Outcomes

CO1 Remembering & Understanding
Define and explain essential mathematical concepts in AI and ML, including vectors, matrices, probability, and optimization techniques.
CO2 Applying
Apply linear algebra, calculus, and probability theories to solve problems in machine learning algorithms.
CO3 Analyzing
Analyze machine learning models and identify the role of mathematical tools in their development and optimization.
CO4 Evaluating
Evaluate the performance of machine learning models using statistical methods and optimization techniques, applying the bias-variance tradeoff, and regularization.
CO5 Creating
Create solutions for real-world AI and ML problems by integrating mathematical concepts like statistical learning theory, numerical methods, and optimization algorithms.

UNIT-I: LINEAR ALGEBRA
Vectors, Matrices, Matrix Operations, Eigenvalues and Eigenvectors, Linear Transformations, Singular Value Decomposition (SVD), Determinants and their properties, Systems of Linear Equations, Orthogonality and Orthonormality, Applications in ML algorithms (e.g., Principal Component Analysis - PCA).

UNIT-II: CALCULUS AND OPTIMIZATION
Functions and Limits, Derivatives and Differentiation, Gradient Descent, Partial Derivatives, Optimization Techniques (Convexity, Gradient-based methods), Lagrange Multipliers, Taylor Series, Newton's Method, Convex Optimization and its significance in machine learning.

UNIT-III: PROBABILITY AND STATISTICS
Basic Probability Theory, Conditional Probability, Bayes' Theorem, Random Variables, Probability Distributions (Normal, Poisson, Binomial), Expectation and Variance, Central Limit Theorem, Sampling Methods, Hypothesis Testing, Maximum Likelihood Estimation (MLE), Confidence Intervals.

UNIT-IV: STATISTICAL LEARNING THEORY
Bias-Variance Tradeoff, Overfitting and Underfitting, Regularization (L1 and L2), Cross-validation, Bias and Consistency in Estimators, Evaluation Metrics (Accuracy, Precision, Recall, F1-score), Markov Chains and Hidden Markov Models (HMM), Expectation-Maximization (EM) Algorithm.

UNIT-V: NUMERICAL METHODS AND APPROXIMATION TECHNIQUES
Numerical Integration and Differentiation, Root Finding Algorithms, Interpolation Methods, Solving Ordinary Differential Equations (ODEs), Monte Carlo Methods, Gradient-based Optimization Algorithms, Convergence Analysis.

Text Books

1. Mathematics for Machine Learning: Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong,

Cambridge University Press.
2. Introduction to Probability and Statistics for Engineers and Scientists: Sheldon M. Ross, Elsevier.
3. Linear Algebra and Its Applications: David C. Lay, Pearson.
4. Pattern Recognition and Machine Learning: Christopher M. Bishop, Springer.
5. Convex Optimization: Stephen Boyd and Lieven Vandenberghe, Cambridge University Press.

References Books

1. Mathematical Methods in the Physical Sciences: Mary L. Boas, Wiley.
2. Probability and Statistics for Engineering and the Sciences: Jay L. Devore, Cengage Learning.
3. Machine Learning: A Probabilistic Perspective: Kevin P. Murphy, MIT Press.
4. Numerical Methods for Engineers: Steven C. Chapra, Raymond P. Canale, McGraw-Hill.
5. Applied Linear Algebra: Peter J. Olver, Chehrzad Shakiban, Prentice Hall.

EEH-514: Data Analytics

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

UNIT 1 Introduction to Data Science
Concept of Data Science, Traits of Big data, Web Scraping, Analysis vs Reporting

UNIT 2 Introduction to Programming Tools for Data Science
Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK, Visualizing Data: Bar Charts, Line Charts, Scatterplots, Working with data: Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs), Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction

UNIT 3 Mathematical Foundations
Linear Algebra: Vectors, Matrices, Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Correlation and Causation, Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem , Hypothesis and Inference: Statistical Hypothesis Testing, Confidence Intervals, Phacking, Bayesian Inference

UNIT 4 Machine Learning
Overview of Machine learning concepts – Over fitting and train/test splits, Types of Machine learning – Supervised, Unsupervised, Reinforced learning, Introduction to Bayes Theorem, Linear Regression- model assumptions, regularization (lasso, ridge, elastic net), Classification and Regression algorithms- Naïve Bayes, K-Nearest Neighbors, logistic regression, support vector machines (SVM), decision trees, and random forest, Classification Errors, Analysis of Time Series- Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural Networks Learning And Generalization, Overview of Deep Learning.

UNIT 5 Case Studies of Data Science Application
Weather forecasting, Stock market prediction, Object recognition, Real Time Sentiment Analysis.

LIST OF SUGGESTED BOOKS

1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media
3. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media
4. Jain V.K., "Data Sciences", Khanna Publishing House, Delhi.
5. Jain V.K., "Big Data and Hadoop", Khanna Publishing House, Delhi.
6. Jeeva Jose, "Machine Learning", Khanna Publishing House, Delhi.
7. Chopra Rajiv, "Machine Learning", Khanna Publishing House, Delhi.
8. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press http://www.deeplearningbook.org
9. Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Morgan Kaufmann Publishers

EEH-714: GENERATIVE AI AND LLMS

L	T	P	Credit	Assessment:	Type of course	Total No. of Teaching Hours
3	0	0	3	Mid Sem.40%+ End Sem.60% =100%	Core	42

Course Outcomes

CO1 Understanding the fundamental concepts of Generative AI and Large Language Models (LLMs).
CO2 Exploring different architectures of LLMs and their applications in real-world tasks.
CO3 Developing proficiency in training and fine-tuning LLMs for specific use cases.
CO4 Evaluating the ethical considerations and limitations of generative models.
CO5 Implementing and deploying generative models for natural language generation and understanding.

UNIT-I: INTRODUCTION TO GENERATIVE AI AND LLMs

Overview of Artificial Intelligence and Machine Learning, Introduction to Generative AI, Types of Generative Models, Deep Learning Fundamentals for Generative AI, Evolution of Language Models, Introduction to Large Language Models (LLMs), Historical Development and Applications of LLMs.

UNIT-II: ARCHITECTURES OF LLMs

Neural Networks and Transformers, Attention Mechanism, Self-Attention and Multi-Head Attention, Encoder-Decoder Architecture, GPT (Generative Pre-trained Transformer) Models, BERT (Bidirectional Encoder Representations from Transformers), T5 (Text-to-Text Transfer Transformer), Training LLMs (Pre-training and Fine-tuning), Hyperparameters and Optimization in LLMs.

UNIT-III: APPLICATIONS OF LLMs

Natural Language Generation (NLG) Tasks: Text Completion, Text Generation, Question Answering, Summarization, Language Translation, Text-based Creative Tasks (Storytelling, Poetry Generation), Conversational Agents (Chatbots, Virtual Assistants), Applications in Healthcare, Finance, Education, and Entertainment.

UNIT-IV: ETHICAL CONSIDERATIONS IN GENERATIVE AI

Bias in Generative Models, Ethical Issues with AI-generated Content, Misinformation and Fake News, Intellectual Property and Plagiarism Concerns, Privacy and Data Security, Responsible AI Practices, Fairness and Transparency in AI, Legal Implications of AI Content Generation, Safety Concerns in Deploying LLMs.

UNIT-V: ADVANCED TOPICS IN GENERATIVE AI

Zero-shot and Few-shot Learning, Reinforcement Learning with Human Feedback (RLHF), Multimodal Generative Models, Generative Adversarial Networks (GANs) vs. LLMs, Transfer Learning in LLMs, Fine-tuning Techniques, Efficient Training and Inference for Large Models, Future Trends in Generative AI.

Text Books

1. **Deep Learning**: Ian Goodfellow, Yoshua Bengio, and Aaron Courville, MIT Press.
2. **Transformers for Natural Language Processing**: Denis Rothman, Packt Publishing.
3. **Neural Networks and Deep Learning**: Michael Nielsen, Determination Press.
4. **Natural Language Processing with Transformers**: Lewis Tunstall, Leandro von Werra, and Thomas Wolf, O'Reilly Media.
5. **Generative Deep Learning**: David Foster, O'Reilly Media.

References Books

1. **Artificial Intelligence: A Modern Approach**: Stuart Russell and Peter Norvig, Pearson.
2. **Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow**: Aurélien Géron, O'Reilly Media.
3. **Pattern Recognition and Machine Learning**: Christopher M. Bishop, Springer.
4. **Deep Reinforcement Learning Hands-On**: Maxim Lapan, Packt Publishing.
5. **BERT, RoBERTa, and GPT-3: The New Language Models**: Steven L. Fernandes, Springer.

About the Program (B.Tech ECE)

Comprehensive Curriculum

Our courses are designed to provide a holistic understanding of both Electrical and Computer Engineering, bridging the gap between hardware and software in various applications.

Industry-Aligned Education

We have introduced several new courses in response to current global industry trends, ensuring our students are equipped with the latest knowledge and skills.

Versatile Skill Set

Graduates are prepared to adapt to evolving technology and Industry trends, making them valuable in a wide range of professional roles.

Core Areas of Focus

- o Computer Engineering
- o Electrical Engineering

Specialized Courses (examples)

- o Data Structures & Algorithms
- o Artificial Intelligence & Machine Learning
- o Robotics & Automation
- o Cyber Security
- o Power Electronics & Machine Drives
- o Control Systems
- o SCADA & Smart Grid Technologies
- o Microprocessors & Micro-controllers

Elective Courses (examples)

- o Cyber-Physical Systems
- o Cloud Computing
- o Deep Learning
- o Power System Automation
- o Advanced Protective Relays
- o Embedded Systems

Honors and Minors

Students can choose to earn honors in AI and ML or minors in other disciplines within the Faculty, broadening their academic and professional horizons.

About the Department

The Department of Electrical Engineering is committed to preparing students for the challenges and advancements in Electronics, Electrical, Communication, and Computer Engineering. Through a dynamic and well-structured curriculum, we aim to equip students with a versatile skill set, enabling them to thrive in both industry and academia.

About the Faculty of Engineering & Technology

Jamia Millia Islamia's Faculty of Engineering & Technology stands out as a premier hub for technical education. Hosting students from across the Nation, with adept Faculty and cutting edge research facilities, it consistently produces top-notch graduates serving the nation in government, corporate, and educational sectors globally.

With a focus on emerging fields like Data Science, AI, VLSI, and Nanoelectronics, coupled with curriculum updates in consultation with industry and academic experts, students emerge industry-ready. The faculty's strong industry connections and dedicated placement cell ensure that graduates are well-prepared to excel in their careers, with a high placement rate and opportunities for internships and industrial training.