Cluster –II: Common with B.Tech in (a) ComputerSci. & Engg. (b) Information Technology (c) Electronics & Communication Engg. (d) Electrical Engineering (e) Electrical & Electronics Engineering (f) Electronics Engg.

Bachelor of Technology inComputerSci. & Engg.(Credit Based)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

Scheme of Studies/Examination

Semester I (w.e.f. session 2018-2019)

S.No.	CourseNo./ Code	Subject	L:T:P	Hours/ Week	Credits	ExaminationSchedule(Marks)				Duration of exam(Hours)
						Major Test	MinorTest	Practical	Total	
1A	BS-115A	Semiconductor Physics	3:1:0	4	4	75	25	0	100	3
1B	BS-101A	Chemistry	3:1:0	4	4	75	25	0	100	3
2A	ES-105A	ProgrammingforProblemSolving	3:0:0	3	3	75	25	0	100	3
2B	HM-101A	English	2:0:0	2	2	75	25	0	100	3
3	BS-133A	Calculus&LinearAlgebra	3:1:0	4	4	75	25	0	100	3
4A	ES-109A	EngineeringGraphics&Design	1:2:0	3	3	75	25	0	100	3
4B	ES-111LA	ManufacturingProcessesWorkshop	0:0:3	3	1.5	-	40	60	100	3
5A	BS-141A	Biology	2:1:0	3	3	75	25	0	100	3
5B	ES-101A	BasicElectricalEngineering	4:1:0	5	5	75	25	0	100	3
6A	BS-117LA	Semiconductor Physics Lab	0:0:3	3	1.5	--	20	30	50	3
6B	BS-103LA	ChemistryLab	0:0:3	3	1.5	--	20	30	50	3
7A	ES-107LA	ProgrammingforProblemSolvingLab	0:0:2	2	1	--	20	30	50	3
7B	ES-103LA	BasicElectricalEngineeringLab	0:0:2	2	1	--	20	30	50	3
8A	ES-113LA	EngineeringGraphics&DesignPractice	0:0:3	3	1.5	--	20	30	50	3
8B	HM-103LA	LanguageLab	0:0:2	2	1	--	20	30	50	3
		Total	12:5:8/ 12:3:10	25/25	21.0/ 20.0	375/ 300	185/ 200	90/ 150	650A/ 650B	

Note: A branch will study either the subjects corresponding to Sr. No. Marked A or corresponding to Sr. No. marked B in one particular semester.
Induction Program (Three weeks duration) is a part of scheme of first year in 1st semester for all branches.

Cluster –II: Common with B.Tech in (a) ComputerSci. & Engg. (b) Information Technology (c) Electronics & Communication Engg. (d) Electrical Engineering (e) Electrical & Electronics Engineering (f) Electronics Engg.

Bachelor of Technology in ComputerSci. &Engg.(Credit Based)
KURUKSHETRA UNIVERSITY, KURUKSHETRA
Scheme of Studies/Examination
Semester II (w.e.f. session 2018-2019)

S.No.	CourseNo./ Code	Subject	L:T:P	Hours/ Week	Credits	ExaminationSchedule(Marks)				Duration of exam(Hours)
						Major Test	MinorTest	Practical	Total	
1A	BS-115A	Semiconductor Physics	3:1:0	4	4	75	25	0	100	3
1B	BS-101A	Chemistry	3:1:0	4	4	75	25	0	100	3
2A	ES-105A	ProgrammingforProblemSolving	3:0:0	3	3	75	25	0	100	3
2B	HM-101A	English	2:0:0	2	2	75	25	0	100	3
3	BS-134A	Probablity& Statistics	3:1:0	4	4	75	25	0	100	3
4A	ES-109A	EngineeringGraphics&Design	1:2:0	3	3	75	25	0	100	3
4B	ES-111LA	ManufacturingProcessesWorkshop	0:0:3	3	1.5	-	40	60	100	3
5A	BS-141A	Biology	2:1:0	3	3	75	25	0	100	3
5B	ES-101A	BasicElectricalEngineering	4:1:0	5	5	75	25	0	100	3
6A	BS-117LA	Semiconductor Physics Lab	0:0:3	3	1.5	--	20	30	50	3
6B	BS-103LA	ChemistryLab	0:0:3	3	1.5	--	20	30	50	3
7A	ES-107LA	ProgrammingforProblemSolvingLab	0:0:2	2	1	--	20	30	50	3
7B	ES-103LA	BasicElectricalEngineeringLab	0:0:2	2	1	--	20	30	50	3
8A	ES-113LA	EngineeringGraphics&DesignPractice	0:0:3	3	1.5	--	20	30	50	3
8B	HM-103LA	Language Lab	0:0:2	2	1	--	20	30	50	3
		Total	12:5:8/ 12:3:10	25/ 25	21.0/ 20.0	375/ 300	185/200	90/150	650A/ 650B	

Note: A branch will study either the subjects corresponding to Sr. No. Marked A or corresponding to Sr. No. marked B in one particular semester.

BS-115 A	Semiconductor Physics						
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	1	-	4	75	25	100	3h

Purpose	To introduce the fundamentals of solid state physics and its applications to the students.
	Course Outcomes
CO1	To make the students aware of basic terminology of crystal structure.
CO 2	Introduce the elementary quantum mechanics, which will be useful in understanding the concepts of solid state physics.
CO 3	Discussion of classical free electron theory, quantum theory and Band theory of solids.
CO 4	Basics and applications of semiconductors.

Unit - I

Crystal Structure: Crystalline and Amorphous solids, Crystal Structure: lattice translation vector, symmetry operations, space lattice, basis; Unit cell and Primitive cell, Fundamental types of lattices: two-dimensional and three dimensional Bravais lattices; Characteristics of Unit cells: Simple Cubic (SC), Body Centred Cubic (BCC), Face Centred Cubic (FCC), Hexagonal Close Packed (HCP) structure; Simple crystal structures: Sodium Chloride, Cesium Chloride, Diamond, Cubic Zinc Sulfide; Miller Indices, Bonding in Solids, Point defects in crystals: Schottky and Frenkel defects.

Unit – II

Quantum Theory: Need and origin of Quantum concept, Wave-particle duality, Phase velocity and group velocity, Uncertainty Principle and Applications; Schrodinger's wave equation: time-dependent and time –independent; Physical Significance of wave function ψ.

Unit – III

Free Electron Theory: Classical free electron theory: electrical conductivity in metals, thermal conductivity in metals, Wiedemann-Franz law, success and drawbacks of free electron theory; Quantum free electron theory: wave function, eigen values; Fermi-Dirac distribution function, Density of states, Fermi energy and its importance, Thermionic Emission (qualitative).

Band theory of Solids: Bloch theorem, Kronig-Penney Model (qualitative), E versus k diagram, Brillouin Zones, Concept of effective mass of electron, Energy levels and energy bands, Distinction between metals, insulators and semiconductors, Hall effect and its Applications.

Unit –IV

Semiconductors: Conduction in Semiconductors, Intrinsic Semiconductors: Conductivity of charge carriers, Carrier concentration in intrinsic semiconductors; Extrinsic Semiconductors: n-type semiconductors, p-type semiconductors, charge carrier concentration in extrinsic semiconductors.

Semiconductor Devices: The p-n junction, Current-voltage characteristics of p-n junction; The Transistor: Bipolar Junction Transistor (BJT), Field Effect Transistor (FET), Metal-Semiconductor Junction (Ohmic and Schottky); Semiconductor Laser.

Suggested Books:

1. Applied Physics for Engineers, Wiley India Pvt. Ltd.
2. Introduction to Solid State Physics, John Wiley & Sons. .
3. Concepts of Modern Physics (5th edition), Tata McGraw-Hill Publishing Company Limited.
4. Solid State Physics, New Age International (P) Limited.
5. A Textbook of Quantum Mechanics, McGraw Hill Education (India) Private Limited.
   Introduction to Nanotechnology, John Wiley & Sons.

Note: The paper setter will set the paper as per the question paper templates provided.

BS-117LA	Semiconductor Physics Lab						
L	T	P	Credit	Practical	Minor Test	Total	Time
-	-	3	1.5	30	20	50	3h
Purpose	To give the practical knowledge of handling the sophisticated instruments.						
Course Outcomes							
CO	To make the students familiar with the experiments related with Semiconductor Physics.						

Note: Student will be required to perform at least 10 experiments out of the following list.

1. To study the V-I characteristics of a p-n diode.
2. To find the flashing and quenching potential of Argon and to find the capacitance of unknown capacitor.
3. To find the value of Planck's constant by using photoelectric cell.
4. To find the temperature coefficient of resistance by using Pt resistance thermometer by post office box.
5. To find the ionization potential of Argon/Mercury using a thyratron tube.
6. To study the variation of magnetic field with distance and to find the radius of coil by Stewart and Gee's apparatus.
7. To study the characteristics of (Cu-Fe, Cu-Constantan) thermocouple.
8. To find the value of Hall Coefficient of semiconductor.
9. To find the value of e/m for electrons by Helical method.
10. To find the band gap of intrinsic semiconductor using four probe method.
11. To calculate the hysteresis loss by tracing a B-H curve.
12. To find the frequency of ultrasonic waves by piezoelectric methods.
13. To verify Richerdson thermionic equation.

Suggested Books:

1. C.L.Arora, B. Sc. Practical Physics, S. Chand.
2. B.L. Worshnop and H, T, Flint, Advanced Practical Physics, KPH.
3. S.L. Gupta & V. Kumar, Practical Physics, PragatiPrakashan.

BS-101A	Chemistry						
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	1	-	4	75	25	100	3h

Purpose	To familiarize the students with basic and applied concept in chemistry
CO1	An insight into the atomic and molecular structure
CO2	Analytical techniques used in identification of molecules
CO3	To understand Periodic properties
CO4	To understand the spatial arrangement of molecules

UNIT - I

Atomic and molecular structure (10 lectures)

Molecular orbitals of diatomic molecules (N_2, O_2, CO) Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and energy level diagrams of $[Co(NH_3)_6]$, $[Ni(CO)_4]$, $[PtCl_2(NH_3)_2]$ and magnetic properties of metal complexes. Band structure of solids and the role of doping on band structures.

UNIT - II

Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy(basic concept). Fluorescence and its applications in medicine.Vibrational and rotational spectroscopy of diatomic molecules.Applications.Basic concepts of Nuclear magnetic resonance and magnetic resonance imaging, Diffraction and scattering.

UNIT - III

Use of free energy in chemical equilibria (4 lectures)

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies.Free energy and emf.Cell potentials, the Nernst equation and applications.

Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries (H_2O, NH_3, PCl_5, SF_6, CCl4, $Pt(NH_3)_2Cl_2$

UNIT - IV

Stereochemistry (6 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis.

Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule(paracetamol and Aspirin)

Suggested Books:

1) University chemistry, by B. M. Mahan, Pearson Education
2) Chemistry: Principles and Applications, byM. J. SienkoandR. A. Plane
3) Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S.Krishnan
5) Physical Chemistry, by P. W. Atkins
6)Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore,5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Note: The paper setter will set the paper as per the question paper templates provided.

BS-103LA	Chemistry Lab						
L	T	P	Credit	Practical	Minor Test	Total	Time
-	-	3	1.5	30	20	50	3h

LIST OF EXPERIMENTS

1. To Determine the surface tension of a given liquid
2. To determine the relative viscosity of a given liquid using Ostwald's viscometer
3. To identify the number of components present in a given organic mixture by thin layer chromatography
4. To determine the alkalinity of a given water sample
5. Determination of the strength of a given HCl solution by titrating it with standard NaOH solution using conductometer
6. Synthesis of a drug (paracetamol/Aspirin)
7. Determination of chloride content of a given water sample
8. To determine the calcium & magnesium or temporary & permanent hardness of a given water sample by EDTA method
9. To determine the total iron content present in a given iron ore solution by redox titration
10. Determination of the partition coefficient of a substance between two immiscible liquids
11. To find out the content of sodium, potassium in a given salt solution by Flame Photometer
12. To find out the λmax and concentration of unknown solution by a spectrophotometer
13. To find out the flash point and fire point of the given oil sample by Pensky Martin apparatus
14. To determine the amount of dissolved oxygen present in a given water sample
15. To find out the pour point and cloud point of a lubricating oil
16. Determination of the strength of a given HCl solution by titrating it with standard NaOH solution using pH meter
17. Using Redwood Viscometer find out the viscosity of an oil sample

Note: Atleast 9 experiments to be performed from the list.

ES-105A	Programming for Problem Solving						
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3h
Purpose	To familiarize the students with the basics of Computer System and C Programming						
Course Outcomes							
CO 1	Describe the overview of Computer System and Levels of Programming Languages.						
CO 2	Learn to translate the algorithms to programs (in C language).						
CO 3	Learn description and applications of conditional branching, iteration and recursion.						
CO 4	To use arrays, pointers and structures to formulate algorithms and programs.						

UNIT – I

Overview of Computers: Block diagram and its description, Number systems, Arithmetic of number systems, Computer Hardware: Printers, Keyboard and Mouse, Storage Devices.

Introduction to programming language: Different levels of PL: High Level language, Assembly language, Machine language; Introduction to Compiler, Interpreter, Debugger, Linker, Loader, Assembler.

Problem Analysis: Problem solving techniques, Algorithms and Flowchart representation.

UNIT – II

Overview of C: Elements of C, Data types; Storage classes in C; Operators: Arithmetic, relational, logical, bitwise, unary, assignment and conditional operators, precedence & associativity of operators.

Input/output: Unformatted & formatted I/O function in C.

Control statements: if statement, switch statement; Repetition: for, while, and do-while loop; break, continue, goto statements.

UNIT – III

Arrays: Definition, types, initialization, processing an array, String handling.

Functions: Definition, prototype, parameters passing techniques, recursion, built-in functions, passing arrays to functions, returning arrays from functions.

UNIT – IV

Pointers: Declaration, operations on pointers, pointers and arrays, dynamic memory allocation, pointers and functions, pointers and strings.

Structure & Union: Definition, processing, passing structures to functions, use of union.

Data files: Opening and closing a file, I/O operations on files.

Suggested Books:

1. Brian W. Kernighan Dennis Ritchie, "C Programming Language" Pearson Education India.
2. SubrataSaha,Subhodip Mukherjee:Basic Computation & Programming with 'C'-Cambridge University Press.
3. Ajay Mittal, "Programming in C - A Practical Approach", Pearson.
4. E Balagurusamy :Programming in ANSI C,TMH Education.
5. PradipDey and ManasGhose, "Computer Fundamental and Programming in C", Oxford Pub.
6. ForouzanBehrouz, "Computer Science: A Structured Programming Approach Using C", Cengage Learning.
7. Ashok Kamthane, "Programming in C, 3e", Pearson Education India..
8. YashwantKanetker, "Let us C", BPB Publications.
9. A K Sharma, " Fundamentals of Computers & Programming" DhanpatRai Publications
10. Rajaraman V., "Computer Basic and C Programming", Prentice Hall of India Learning.

Note: The paper setter will set the paper as per the question paper templates provided.

ES-107LA	Programming for Problem Solving Lab						
L	T	P	Credit	Practical	Minor Test	Total	Time
-	-	2	1	30	20	50	3h
Purpose	To Introduce students with problem solving using C Programming language						
Course Outcomes							
CO 1	To formulate the algorithms for simple problems						
CO 2	Implementation of arrays and functions.						
CO 3	Implementation of pointers and user defined data types.						
CO 4	Write individual and group reports: present objectives, describe test procedures and results.						

LIST OF PROGRAMS

1. Write a program to find the sum of individual digits of a positive integer.
2. Write a program to generate the first n terms of the Fibonacci sequence.
3. Write a program to generate all the prime numbers between 1 and n, where n is the input value given by the user.
4. Write a program to find the roots of a quadratic equation.
5. Write a function to generate Pascal's triangle.
6. Write a program for addition of Two Matrices
7. Write a program for calculating transpose of a matrix.
8. Write a program for Matrix multiplication by checking compatibility
9. Write programs to find the factorial of a given integer by using both recursive and non-recursive functions.
10. Write a function that uses functions to perform the count the lines, words and characters in a given text.
11. Write a program to explores the use of structures, union and other user defined variables
12. Write a program to print the element of array using pointers
13. Write a program to implement call by reference
14. Write a program to print the elements of a structure using pointers
15. Write a program to read a string and write it in reverse order
16. Write a program to concatenate two strings
17. Write a program to check that the input string is a palindrome or not.
18. Write a program which copies one file to another.
19. Write a program to reverse the first n characters in a file.

Note: At least 10 programs are to be performed & executed from the above list.

HM-101 A	English						
L	T	P	Credit	Major Test	Minor Test	Total	Time
2	-	-	2	75	25	100	3h

Course Outcomes	
CO 1	Building up the vocabulary
CO 2	Students will acquire basic proficiency in English including writing skills

UNIT- 1

Vocabulary Building

1.1 The concept of Word Formation
1.2 Root words from foreign languages and their use in English
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to formderivatives.
1.4 Synonyms, antonyms, and standard abbreviations.

UNIT- 2

Basic Writing Skills

2.1 Sentence Structures
2.2 Use of phrases and clauses in sentences
2.3 Importance of proper punctuation
2.4 Creating coherence
2.5 Organizing principles of paragraphs in documents
2.6 Techniques for writing precisely

UNIT- 3

Identifying Common Errors in Writing

3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions
3.6 Redundancies
3.7 Clichés

UNIT- 4

Nature and Style of sensible Writing

4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion
4.6 Comprehension
4.7 Précis Writing
4.8 Essay Writing

Suggested Books:

(i) Practical English Usage. Michael Swan. OUP. 1995.
(ii) Remedial English Grammar. F.T. Wood. Macmillan.2007
(iii)On Writing Well. William Zinsser. Harper Resource Book. 2001
(iv) Study Writing. Liz Hamp-Lyons and Ben Heasly.Cambridge University Press. 2006.
(v) Communication Skills. Sanjay Kumar and PushpLata.Oxford University Press. 2011.
(vi) Exercises in Spoken English. Parts.I-III. CIEFL, Hyderabad. Oxford University Press

Note: The paper setter will set the paper as per the question paper templates provided.

HM-103LA	Language Lab						
L	**T**	**P**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
-	**-**	**2**	**1**	**30**	**20**	**50**	**3h**

OBJECTIVES

1. Listening Comprehension
2. Pronunciation, Intonation, Stress and Rhythm
3. Common Everyday Situations: Conversations and Dialogues
4. Communication at Workplace
5. Interviews
6. Formal Presentations

BS-133 A	Calculus and Linear Algebra						
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	1	-	4	75	25	100	3 h
Purpose	To familiarize the prospective engineers with techniques in calculus, sequence & series, multivariable calculus, and linear algebra.						

Course Outcomes	
CO1	To introduce the idea of applying differential and integral calculus to notions of improper integrals. Apart from some applications it gives a basic introduction on Beta and Gamma functions.
CO 2	To introduce the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
CO 3	To develop the essential tool of matrices and linear algebra in a comprehensive manner.
CO 4	To familiarize the student with vector space as an essential tool in most branches of engineering.

UNIT-I (12 hrs)

Calculus:

Evaluation of definite and improper integrals: Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Rolle's Theorem, Mean value theorems, Indeterminate forms and L'Hospital's rule.

UNIT-II (8 hrs)

Matrices

Matrices, vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.

UNIT-III (10 hrs)

Vector spaces

Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank nullity theorem, composition of linear maps.

UNIT-IV (10 hrs)

Vector spaces

Eigenvalues, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigenbases. Diagonalization; Inner product spaces.

Suggested Books:

1.ErwinKreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

2. Erwin Kreyszig and SanjeevAhuja, Applied Mathematics- I, Wiley India Publication, Reprint 2015.

3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

5. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

6. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

7. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

8. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

9. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.

10. S. Lipschutz and M. Lipson, Schaum's outline of Linear Algebra,, McGraw Hill Education; 3 edition (1 July 17).

Note: The paper setter will set the paper as per the question paper templates provided.

BS-134 A	Probability & Statistics						
L	T	P	Credit	Major Test	Minor Test	Total	Time
4	1	-	4.5	75	25	100	3 h
Purpose	To familiarize the prospective students with techniques of probability and statistics.						
Course Outcomes							
CO1	Probability theory provides models of probability distributions(theoretical models of the observable reality involving chance effects) to be tested by statistical methods which has various engineering applications, for instance, in testing materials, control of production processes, robotics, and automatization in general, production planning and so on.						
CO 2	To develop the essential tool of statistics in a comprehensive manner.						
CO 3	To familiarize the student with the problem of discussing universe of which they in which complete enumeration is impractical, tests of significance plays a vital role in their hypothesis testing.						

UNIT-I (10 Hrs)

Basic Probability: Introduction, additive law of probability, Conditional Probability, Independent Events, Bayes' Theorem.

Random Variables: Discrete random variables, probability distribution, Probability mass function and distribution function, Expectation, Moments, Variance and standard deviation of discrete random variables.

UNIT-II (10 Hrs)

Continuous Probability distribution:

Continuous random variables, probability distribution, Probability density function and distribution function, Expectation, Moments, Variance and standard deviation of Continuous random variables.

Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions.

UNIT-III (10 hrs)

Basic Statistics:

Measures of Central tendency: Mean, median, quartiles, mode, Geometric mean, Harmonic mean, Measures of dispersion: Range, Quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, Skewness and Kurtosis, Correlation, Coefficient of correlation, methods of calculations, Lines of regression, Rank correlation.

UNIT-IV (10 hrs)

Applied Statistics:

Curve fitting by the method of least squares: Introduction, Fitting of a straight line, fitting of second degree curve, fitting of a polynomial of degree m, fitting of a geometric or power curve of the form $y = ax^b$, fitting of an exponential curve of the form $y = ab^x$.

Test of significance: Basic terminology, Large sample test for single proportion, difference of proportions, single mean, difference of means, Small samples test for single mean, difference of means, Chi-square test for goodness of fit.

Suggested Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed.,Wiley, 1968.
5. N.P. Bali and and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
8. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

Note: The paper setter will set the paper as per the question paper templates provided.

Course code	ES-109A							
Coursetitle	EngineeringGraphics&Design							
Scheme and Credits	L	T	P	Credits	Major Test	Minor Test	Total	Time
	1	2	0	3	75	25	100	3h

Course Outcomes

Objective- To expose students to the basics of Engineering Drawing , graphics and Projections.	
CO-1	To learn about construction of various types of curves and scales.
CO-2	To learn about orthographic projections of points, lines and planes.
CO-3	To Learn about the sectional views and development of Right regular solids
CO-4	To Learn about the construction of Isometric Projections and conversion of Isometric views to Orthographic views and vice-versa.

UNIT - I

IntroductiontoEngineeringDrawing:

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

UNIT - II

Orthographic Projections:

PrinciplesofOrthographicProjections-Conventions-Projections ofPointsandlinesinclined tobothplanes;Projectionsofplanesinclined to one principalPlane.

ProjectionsofRegular Solids:

Solid with axis inclinedtobothePlanes;

UNIT - III

Sections andSectionalViewsofRightRegular Solids:

Sectional views of simple right regular soilds like prism, pyramid, Cylinder and Cone. Development ofsurfacesofRightRegularSolids-Prism,Pyramid,CylinderandCone;

UNIT - IV

Isometric Projections:

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of IsometricViews to Orthographic Views and Vice-versa, Conventions;

Suggested Books:

1. Engineering Graphics using AUTOCAD 2000: T. Jeyapoovan, Vikas Publishing House.
2. Engineering Drawing: Plane and Solid Geometry: N.D. Bhatt and V.M.Panchal, Charotar Publishing House.
3. Engineering Drawing: Amar Pathak, Dreamtech Press, New Delhi.
4. Thomas E.French, Charles J.Vierck, Robert J.Foster, "Engineering drawing and graphic technology", McGraw Hill International Editions.
5. Engineering Graphics and Drafting: P.S. Gill, Millennium Edition, S.K. Katariaand Sons.
6. A Primer on Computer aided Engineering Drawing-2006, published by VTU, Belgaum.
7. A.Yarwood, Introduction to AutoCAD 2017, Published by CRC Press.
8. O. Ostrowsky, Engineering Drawing with CAD applications, Butterworth Heinemann,1999.
9. BSI, Technical production documentation (TPD) – specification for defining, specifying and graphically reporting products, BS8888, 2002.
10. CorrespondingsetofCADSoftwareTheoryandUserManuals.

Note: The paper setter will set the paper as per the question paper templates provided.

Course code	ES-113LA							
Coursetitle	EngineeringGraphics&Design Practice							
Scheme and Credits	L	T	P	Credits	Practical	Minor Test	Total	Time
	-	-	3	1.5	30	20	50	3h
Pre-requisites(if any)	-							

Aim: To make student practice on engineering graphics and designsoftwaresand provide exposuretothevisualaspectsofengineeringdesign.	
CO-1	To give an overview of the user interface and toolboxes in a CAD software.
CO-2	To understand to customize settings of CAD software and produce CAD drawing.
CO-3	To practice performing various functions in CAD softwares.
CO-4	To Learn about solid modelling and demonstration of a simple team design project.

Module 1:OverviewofComputerGraphics:
Listingthecomputertechnologiesthatimpactongraphicalcommunication,Demonstrating Knowledgeofthetheory ofCADsoftware[suchas:TheMenuSystem,Toolbars(Standard, ObjectProperties,Draw,Modify andDimension),DrawingArea(Background,Crosshairs, CoordinateSystem),Dialogboxes andwindows,Shortcutmenus(Button Bars),The CommandLine(whereapplicable),TheStatusBar,Differentmethodsofzoom asusedin CAD,Selectanderaseobjects.; IsometricViewsoflines,Planes, Simpleandcompound Solids];
Module2:Customization &CAD Drawing:
Setupofthedrawingpageandtheprinter,includingscalesettings,Settingup ofunitsanddrawing limits;ISOand ANSIstandardsforcoordinatedimensioningandtolerancing; Orthographic constraints, Snap to objects manually and automatically; Producingdrawingsbyusingvariouscoordinateinputentrymethodstodrawstraightlines,Applyingvari ouswaysofdrawingcircles;
Module3:Annotations,layering&other functions:
Applyingdimensionstoobjects,applyingannotationstodrawings;Settingupanduseof Layers,layerstocreatedrawings,Create,editandusecustomizedlayers; Changingline lengthsthroughmodifyingexisting lines(extend/lengthen);Printingdocumentstopaper usingtheprintcommand;orthographicprojection techniques;Drawingsectionalviewsof compositerightregulargeometricsolids andprojectthetrueshapeof thesectionedsurface; Drawing annotation,Computer-aideddesign(CAD)softwaremodelingof partsand assemblies.Parametricandnon-parametricsolid,surface,and wireframemodels.Partediting andtwo-dimensionaldocumentationofmodels.Planarprojectiontheory,includingsketching of perspective,isometric,multi-view,auxiliary,andsectionviews.Spatialvisualization exercises.Dimensioning guidelines,tolerancingtechniques; dimensioningandscalemulti viewsofdwelling;
Module4:Demonstration ofasimpleteamdesign project:
Geometryandtopologyofengineeredcomponents:creation ofengineeringmodelsandtheir presentationinstandard2Dblueprintform andas3Dwire-frameandshadedsolids;meshed topologiesforengineeringanalysisandtool-path generationforcomponentmanufacture; geometricdimensioningandtolerancing;Useof solid-modelingsoftwareforcreating associativemodels atthecomponentand assemblylevels;floorplans thatinclude: windows,doors,andfixturessuchasWC,bath,sink,shower,etc.Applying colourcodingaccordingto buildingdrawingpractice;Drawingsectionalelevation showingfoundation toceiling; IntroductiontoBuildingInformationModeling (BIM).
Suggested Books(ES-113L):

1. Chris McMahon and Jimmie Browne, CAD/CAM – Principle Practice and Manufacturing Management, Addison Wesley England, Second Edition, 2000.
2. Chougule N.K.; CAD/CAM /CAE, Scitech Publications India Pvt. Ltd.
3. Vikram Sharma; Computer Aided Design and Manufacturing, S.K. Kataria and Sons.
4. Rogers, D.F. and Adams, A., Mathematical Elements for Computer Graphics, McGraw Hill Inc, NY, 1989
5. Ibrahim Zeid, CAD/CAM theory and Practice, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1992.
6. M.P. Groover, Automation, Productions systems and Computer-Integrated Manufacturing by Prentice – Hall.
7. A Primer on Computer aided Engineering Drawing-2006, published by VTU, Belgaum.
8. A.Yarwood, Introduction to AutoCAD 2017, Published by CRC Press.
9. O. Ostrowsky, Engineering Drawing with CAD applications, Butterworth Heinemann,1999.
10. BSI, Technical production documentation (TPD) – specification for defining, specifying and graphically reporting products, BS8888, 2002.
11. (Correspondingsetof)CADSoftwareTheoryandUserManuals
12. Ibrahim Zeid, Mastering CAD/CAM, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
13. P. Radhakrishnan, S. Subramanayan and V.Raju, CAD/CAM/CIM, New Age International (P) Ltd., New Delhi.
14. Groover M.P. and Zimmers E. W., CAD/CAM: Computer Aided Design and Manufacturing, Prentice Hall International, New Delhi, 1992.
15. Dr. Sadhu Singh, Computer Aided Design and Manufacturing, Khanna Publishers, New Delhi, Second Edition, 2000.
16. Thomas E.French, Charles J.Vierck, Robert J.Foster, “Engineering drawing and graphic technology”, McGraw Hill International Editions.

Course code	ES-111LA							
Coursetitle	ManufacturingProcessesWorkshop							
Scheme and Credits	L	T	P	Credits	Practical	Minor Test	Total	Time
	0	0	3	1.5	60	40	100	3h
Pre-requisites (if any)								

Aim: To make student gain a hands on work experience in a typical manufacturing industry environment.	
CO-1	To familiarize with different manufacturing methods in industries and work on CNC machine.
CO-2	To learn working in Fitting shop and Electrical and Electronics shops,
CO-3	To practice working on Carpentry and Plastic moulding/glass cutting jobs.
CO-4	To gain hands on practice experience on Metal casting and Welding jobs.

ManufacturingProcessesWorkshop

Contents

1.ManufacturingMethods-casting,forming,machining,joining, advancedmanufacturing methods
2. CNCmachining, Additivemanufacturing
3. Fittingoperations&powertools
4. Electrical&Electronics
5. Carpentry
6. Plasticmoulding,glasscutting
7. Metalcasting
8. Welding(arc welding&gas welding), brazing

Suggested Books:

1. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology" , 7th edition, Pearson Education India Edition.
2. HajraChoudhury S.K., HajraChoudhury A.K. and Nirjhar Roy S.K., " Elements of Workshop Technology" , Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
3. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
4. Roy A. Lindberg, " Processes and Materials of Manufacture" , 4th edition, Prentice Hall India, 1998
5. Rao P.N., "Manufacturing Technology" , Vol. I and Vol. II, Tata McGraw-Hill House, 2017.

BS-141A	Biology						
L	T	P	Credit	Major Test	Minor Test	Total	Time
2	1	-	3	75	25	100	3h
Purpose	To familiarize the students with the basics of Biotechnology						
Course Outcomes							
CO1	Introduction to essentials of life and macromolecules essential for growth and Development						
CO2	Defining the basic concepts of cell division, genes and Immune system						
CO3	Introduction of basic Concept of ThermoGenetic Engg. & Biochemistry						
CO4	Introduction of basic Concept of Microbiology & Role of Biology in Different Fields						

Unit – I

Introduction to living world: Concept and definition of Biology; Importance of biology in major discoveries of life Characteristic features of living organisms; Cell ultra-structure and functions of cell organelles like nucleus, mitochondria,chloroplast, ribosomes and endoplasmic reticulum; Difference between prokaryotic and eukaryotic cell; Difference between animal and plant cell.

Classification of organisms: Classify the organisms on the basis of (a) Cellularity;- Unicellular and Multicellular organisms. (b) Energy and Carbon Utilization:- Autotrophs, Hetrotrophs and Lithotrops (c) Habitat (d) Ammonia excretion:- ammonotelic, 17ricotelic and ureotelic. (e) Habitat- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life

Unit-II

Introduction to Biomolecules: Definition, general classification and important functions of carbohydrates, lipids, proteins, nucleic acids (DNA& RNA: Structure and forms). Hierarch in protein structure: Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

Enzymes as biocatalysts: General characteristics, nomenclature and classification of Enzymes. Effect of temperature, Ph, enzyme and substrate concentrations on the activity of enzymes. Elementary concept of and coenzymes. Mechanism of enzyme action. Enzyme kinetics and kinetic parameters (Km and Vmax)

Unit-III

Genetics:-Mendel's laws of inheritance. Variation and speciation.Concepts of recessiveness and dominance. Genetic Disorders: Single gene disorders in human. **Human traits**: Genetics of blood groups, diabetes type I & II.

Cell Division:- Mitosis and its utility to living systems. Meiosis and its genetic significance.Evidence of nucleic acids as a genetic material. Central Dogma of molecular biology

4. Role of immune system in health and disease: Brief introduction to morphology and pathogenicity of bacteria, fungi, virus, protozoa beneficial and harmful for human beings.

Unit-IV

Metabolism:-Concept of Exothermic and endothermic reactions. Concept of standard free energy and Spontaneity in biological reactions. Catabolism (Glycolysis and Krebs cycle) and synthesis of glucose (Photosynthesis:- Light and Dark Reaction) of glucose. ATP as Energy Currency of the cell

Microbiology: Concept of species and strains, sterilization and media compositions, growth kinetics.

Role of Biology : Role of Biology in Agriculture, Medicine, Forensic science, Bioinformatics, Nanotechnology, Micro-electromechanical systems (Bio-MEMS) and Sensors (Biosensors).

Text Book:

1. Introduction to Biotechnology, By Deswal&Deswal, DhanpatRai Publications N.A

2.Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A global approach", Pearson Education Ltd, 2014.

3. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, "Outlines of Biochemistry", John Wiley and Sons, 2009.
D. L. Nelson and M. M. Cox, "Principles of Biochemistry", W.H. Freeman and Company, 2012.

4.G. S. Stent and R. Calendar, "Molecular Genetics", Freeman and company, 1978.

Note: The paper setter will set the paper as per the question paper templates provided

Suggested Books:

1. Molecular Biology of cell, 4th ed. Alberts, Bruce et al. Garland Science Publishing, New York.

2. Microbiology. Pelczar Jr., M.J.; Chan, E.C.S. and Krieg, N.R. Tata McGraw Hill, New Delhi.

3. Lehninger: Principles of Biochemistry, 3rd edition, by David L. Nelson and M.M. Cox. Maxmillan/ Worth publishers.
4. Genetics by Snusted& Simmons.
5. Molecular Biotechnology: Principles Application of Recombinant DNA. Glick, B. R. and Pasternak, J. J. ASM press WashingtonDC.
6. Kuby's Immunology, Goldsby, R A,.Kindt, T.J, Osborne, B.A.(2003) W. H. Freeman and company, New York.
7. Recombinant DNA 2nd Edition. Watson, James D. and Gilman, M. (2001) W.H Freeman and Company, NewYork.
8. Essentials of Molecular Biology 4thed, Malacinski, G. M. (2003) Jones &Bartlet Publishers, Boston.

ES-101A	BASIC ELECTRICAL ENGINEERING						
L	T	P	Credit	Major Test	Minor Test	Total	Time(Hrs)
4	1	-	5	75	25	100	3
Purpose	To familiarize the students with the basics of Electrical Engineering						
Course Outcomes							
CO1	Deals with steady state circuit analysis subject to DC.						
CO 2	Deals with AC fundamentals & steady state circuit response subject to AC.						
CO 3	Deals with introductory Balanced Three Phase System analysis and Single Phase Transformer.						
CO 4	Explains the Basics of Electrical Machines & Electrical installations						

Unit-I

D.C. circuits: Ohm's Law, junction, node, circuit elements classification: Linear & nonlinear, active & passive, lumped & distributed, unilateral & bilateral with examples. KVL, KCL, Loop and node-voltage analysis of resistive circuit.Star-Delta transformation for resistors.

Network Theorems: Superposition, Thevenin's, Norton's and Maximum power transfer theorems in a resistive network.

Unit-II

AC Fundamentals: Mathematical representation of various wave functions. Sinusoidal periodicsignal, instantaneous and peak values, polar & rectangular form of representation of impedances and phasor quantities. Addition & subtraction of two or more phasor sinusoidal quantities using component resolution method.RMS and average values of various waveforms.

A.C. Circuits: Behavior of various components fed by A.C. source (steady state response of pureR, pure L, pure C, RL, RC, RLC series with waveforms of instantaneous voltage, current & power on simultaneous time axis scale and corresponding phasor diagrams), power factor, active, reactive & apparent power. Frequency response of Series & Parallel RLC ckts.including resonance, Q factor, cut-off frequency & bandwidth. Generation of alternating emf.

Unit-III

Balanced Three Phase Systems: Generation of alternating 3- phaseemf). 3-phase balanced circuits, voltage and current relations in star and delta connections. Measurement of 3-phase power by two wattmeter method for various types of star & delta connected balanced loads.

Single Phase Transformer (qualitative analysis only): Concept of magnetic circuits.Relation between MMF & Reluctance.Hysteresis & Eddy current phenomenon.Principle, construction &emf equationPhasor diagram at ideal, no load and on load conditions. Losses & Efficiency, regulation. OC & SC test, equivalent circuit, concept of auto transformer.

Unit-IV

Electrical Machines (qualitative analysis only)**:** Construction and working of dc machine with commutateor action, speed control of dc shunt motor. Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Basics of Single-phase induction motor, capacitor start capacitor run Single-phase induction motor working. Basic construction and working of synchronous generator and motor.

Electrical Installations (LT Switchgear): Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing.

Suggested Books:

1. Basic Electrical Engg: A complete Solution by Vijay Kumar Garg, Wiley India Ltd.
2. Electrical Engg. Fundamentals by Rajendra Prasad, PHI Pub.
3. Basic Electrical Engg.by S.K. Sahdev, Pearson Education
4. Electrical Engg. Fundamentals:byBobrow, Oxford Univ.Press
5. Basic Electrical Engg. By Del Toro.
6. Saxena&Dasgupta: Fundamentals of Electrical Engg (Cambridge University Press).

Note: The paper setter will set the paper as per the question paper templates provided.

ES-103LA	BASIC ELECTRICAL ENGINEERING LAB						
L	T	Practical	Credit	Minor Test	(Practical)	Total	Time (Hrs)
-	-	2	1	20	30	50	3

Purpose	To familiarize the students with the Electrical Technology Practicals

Course Outcomes	
CO1	Understand basic concepts of Network theorems
CO 2	Deals with steady state frequency response of RLC circuit parameters solution techniques
CO 3	Deals with introductory Single Phase Transformer practicals
CO 4	Explains the constructional features and practicals of various types of Electrical Machines

LIST OF EXPERIMENTS

1. To verify KVL and KCL.
2. To verify Superposition theorem on a linear circuit with at least one voltage & one current source.
3. To verify Thevenin's Theorem on a linear circuit with at least one voltage & one current source.
4. To verify Norton's Theorem on a linear circuit with at least one voltage & one current source.
5. To study frequency response of a series R-L-C circuit on CRO and determine resonant frequency& Q- factor for various Values of R, L, and C.
6. To study frequency response of a parallel R-L-C circuit on CRO and determine resonant frequency& Q -Factor for various values of R, L, and C.
7. To perform O.C. and S.C. tests on a single phase transformer.
8. To perform direct load test on a single phase transformer and plot efficiency v/s load characteristic.
9. To perform speed control of DC shunt motor.
10. To perform starting & reversal of direction of a three phase induction motor.
11. Measurement of power in a 3 phase balanced system by two watt meter method.
12. Study of Cut sections of DC Machines, Induction Motor
13. To study components of various LT Switchgears

Note: At least 9 out of the listed experiments to be performed during the semester.

KURUKSHETRA UNIVERSITY KURUKSHETRA

Bachelor of Technology (Electrical & Electronics Engineering) (Credit Based)

Scheme of Studies/Examination (Modified)

Semester III (w.e.f. session 2019-2020)

Sr. No.	Course No.	Subject	L:T:P	Hours/Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1	***EE-201A**	**Electric Circuit Theory**	3:1:0	4	4	75	25	0	100	3
2	BS-201A	Optics & Waves	3:0:0	3	3	75	25	0	100	3
3	***EE-205A**	**Electrical Machines - I**	3:1:0	4	4	75	25	0	100	3
4	EEN-205A	Analog Electronics	3:0:0	3	3	75	25	0	100	3
5	EEN -209A	Signals and Systems	3:1:0	4	4	75	25	0	100	3
6	***EE-211A**	**Electrical Machines Lab – I**	0:0:2	2	1	-	40	60	100	3
7	EEN -207A	Analog Electronics Lab	0:0:2	2	1	-	40	60	100	3
8	EEN -211A	Signal and Systems Lab	0:0:2	2	1	-	40	60	100	3
9	**EEN-215A	Industrial Training-I	2:0:0	2	-	-	100	-	100	3
10	***MC-901A	Environmental Sciences	3:0:0	3	-	75	25	0	100	3
		Total		**29**	**21**	**375**	**245**	**180**	**800**	

* Subjects Common with III Semester. B.Tech. [Electrical Engg.] Scheme, K.U.K.

**EEN-215A is a mandatory credit-less course in which the students will be evaluated for the industrial training undergone after 2nd semester and students will be required to get passing marks to qualify.

***MC-901A is a mandatory credit-less course in which the students will be required to get passing marks in the major test.

KURUKSHETRA UNIVERSITY KURUKSHETRA
Bachelor of Technology (Electrical & Electronics Engineering) (Credit Based)
Scheme of Studies/Examination (Modified)
Semester IV (w.e.f. session 2019-2020)

S. No.	Course No.	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1	BS-207A	Applied and Computational Mathematics	3:0:0	3	3	75	25	0	100	3
2	HM-903A	Soft Skills & Interpersonal Communication	3:0:0	3	3	75	25	0	100	3
3	***EE- 206A**	**Electrical Machines – II**	3:1:0	4	4	75	25	0	100	3
4	***EE-208A**	**Power Electronics**	3:0:0	3	3	75	25	0	100	3
5	EEN-210A	Digital Electronics	3:0:0	3	3	75	25	0	100	3
6	EEN -202A	Basics of Analog Communication	3:0:0	3	3	75	25	0	100	3
7	***EE-214A**	**Electrical Machines Lab - II**	0:0:2	2	1	-	40	60	100	3
8	***EE-216A**	**Power Electronics Lab**	0:0:2	2	1	0	40	60	100	3
9	EEN-218A	Digital Electronics Lab	0:0:2	2	1	-	40	60	100	3
10	**MC-902A	Constitution of India	3:0:0	3	-	75	25	0	100	3
		Total		**28**	**22**	**450**	**270**	**180**	**900**	

* Subjects Common with IV Semester. B.Tech. [Electrical Engg.] Scheme, K.U.K.

**MC-202A is a mandatory credit-less course in which the students will be required to get passing marks in the major test.

Note: All the students have to undergo 4 to 6 weeks Industrial Training after 4th semester which will be evaluated in 5th semester.

EE-201A	Electric Circuit Theory						
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	1	-	4	75	25	100	3h

Purpose	To familiarize the students with electric network function and network synthesis.
Course Outcomes	
CO1	Apply network theorems for the analysis of electrical circuits.
CO 2	Obtain the transient and steady-state response of electrical circuits.
CO 3	Analyse circuits in the sinusoidal steady-state (single-phase and three-phase).
CO 4	Analyse two port circuit behavior.

Unit-I

Solution of First and Second order networks:

Solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

Unit-II

Electrical Circuit Analysis Using Laplace Transforms

Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros, series and parallel resonances

Unit-III

Two Port Network and Network Functions:

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

UNIT-IV

Network Synthesis:

Hurwitz polynomials**,** Properties of Hurwitz polynomials**,** Positive real functions, procedure of testing of PR functions, concept and procedure of network synthesis, properties of expressions of driving point immitances of LC networks. LC Network synthesis: Foster's I & II Form, Cauer's I & II form, RC & RL Network.

Suggested Books:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.

Note: The paper setter will set the paper as per the question paper templates provided.

BS – 201A	Optics and Waves						
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3h

Purpose	To introduce the fundamentals of wave and optics for the applications in Engineering field.
Course Outcomes	
CO1	Familiarize with basic phenomenon used in propagation of waves.
CO 2	Introduce the fundamentals of interference, diffraction, polarization and their applications.
CO 3	To make the students aware to the importance of Laser in technology.

Unit - I

Waves: Travelling waves, Characteristics of waves, Mathematical representation of travelling waves, General wave equation, Phase velocity, Light source emit wave packets, Wave packet and Bandwidth, Group velocity and real light waves.

Propagation of light waves: Maxwell's equations, Electromagnetic waves and constitutive relations, Wave equation for free-space, Uniform plane waves, Wave polarization, Energy density, the pointing vector and intensity, Radiation pressure and momentum, Light waves at boundaries, Wave incident normally on boundary, Wave incident obliquely on boundary: law of reflection, Snell's law and reflection coefficients.

Unit - II

Interference: Principle of Superposition, Conditions for Sustained interference, Young's double slit experiment, Division of wave-front: Fresnel's Biprism and its applications, Division of amplitude: Interference due to reflected and transmitted light, Wedge-shaped thin film, Newton's rings and its applications, Michelson Interferometer and its applications.

Unit – III

Diffraction: Types of diffraction, Fraunhofer diffraction at a single slit, Plane transmission diffraction grating: theory, secondary maxima and secondary minima, width of principal maxima, absent spectra, overlapping of spectral lines, determination of wavelength; Dispersive power and resolving power of diffraction grating.

Polarization: Polarization of transverse waves, Plane of polarization, Polarization by reflection, Double refraction, Nicol Prism, Quarter and half wave plate, Specific Rotation, Laurent 's half shade polarimeter, Biquartz polarimeter.

Unit – IV

Laser: Stimulated Absorption, Spontaneous and Stimulated Emission; Einstein's Coefficients and its derivation, Population Inversion, Direct and Indirect pumping, Pumping schemes, Main components of Laser, Gas lasers (He-Ne, CO2), Solid state lasers (Ruby, Neodymium, semiconductor), Dye laser, Characteristics of Laser, Applications of Laser.

Text/Reference Books:

1. P.K. Diwan, Applied Physics for Engineers, *Wiley India Pvt. Ltd*., *India*
2. N. Subrahmanyam, B. Lal, M.N. Avadhanulu, A Textbook of Optics, *S. Chand & Company Ltd*., *India.*
3. A. Ghatak, Optics, *McGraw Hill Education (India) Pvt. Ltd., India*.
4. E. Hecht, A.R. Ganesan, Optics, *Pearson India Education Services Pvt. Lt., India.*

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

EE-205A	Electrical Machines-I						
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	1	-	4	75	25	100	3h

Purpose	**To familiarize the students with electric machines and transformer.**
Course Outcomes	
CO1	**To understand concept ,working, operation, maintenance of single phase transformer**
CO 2	**To understand concept ,working, operation, maintenance of three phase transformer & conversion from three phase to multiple phases**
CO 3	**To understand construction ,working, operation of D.C. Generator**
CO 4	**To understand concept ,working, operation, testing of D.C. Motor**

UNIT – I

TRANSFORMERS:

Principle, construction of core, e.m.f. equation, winding &tank, cooling, operation, testing of single phase transformer, equivalent circuit, phasor diagram, parameters determination, P.U representation of parameters, regulation, losses & efficiency, separation of iron losses, parallel operation,all-day efficiency, Sumpner's test, specifications of transformer, maintenance of transformer, difference between power transformer and distribution transformer.

UNIT – II

Three phase transformer: Types and their comparative features, Zig-zag connection.
Auto-Transformer: Principle, construction, comparison with two winding transformers, applications.
Nature of magnetizing current: plotting of magnetizing current from B-H curve, inrush current.
Phase-Conversion: Three to two phase, three to six phase and three to twelve phase conversions. Introduction to three windings transformer, tap-changing & phase- shifting transformers.

UNIT – III

D.C. Generator-Principle & construction of D.C. generator, simplex lap,wave winding, E.M.F. equation, types, voltage build up, armature reaction, compensating winding, function of commutator, methods of improving commutation, load characteristics, parallel operation.
Excitation System—Purpose and requirements of excitation system, brushless excitation system.

UNIT- IV

D.C. Motor-

Principle of DC motors, function of commutator in DC motors, torque and output power equations, load characteristics, losses, starting, starters, speed control, braking, testing , Swinburne test, Hopkinson test, Ward Leonard Method, efficiency & applications.

Suggested Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
4. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
5. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

Note: The paper setter will set the paper as per the question paper templates provided.

EEN- 205A	Analog Electronics						
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3h

Purpose	To familiarize the students with rectifier, oscillator and amplifier circuits.
	Course Outcomes
CO1	Understand the characteristics of transistors.
CO 2	Design and analyse various rectifier and amplifier circuits.
CO 3	Design sinusoidal and non-sinusoidal oscillators.
CO 4	Understand the functioning of OP-AMP and design OP-AMP based circuits.

Unit-I

Diode circuits:

P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.

Unit-II

BJT circuits:

Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits

Unit-III

MOSFET circuits: MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers

Oscillators : Barkhausen criteria, Wein Bridge, RC phase shift, Colpitts & Hartley oscillator . Multivibrators using transistor, crystal oscillator.

Unit-IV

Differential, multi-stage and operational amplifiers: Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

Suggested Books:

1.A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
2.J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3.J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
4.P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.

Note: The paper setter will set the paper as per the question paper templates provided.

EEN- 209A	Signals & Systems						
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	1	-	4	75	25	100	3h

Purpose	To familiarize the students with signal and system.
	Course Outcomes
CO1	Introduce and classify signals and systems based on their properties.
CO 2	To understand the basic concepts of random variables and Linear time invariant systems.
CO 3	To understand the basic concepts of fourier and laplace transform.
CO 4	Understand sampling theorem and its implications.

Unit-I

Introduction to Signals:

Continuous and discrete time signals, deterministic and stochastic signals, periodic and aperiodic signals, even and odd signals, energy and power signals, exponential and sinusoidal signals and singular functions. Signal representation in terms of singular functions, orthogonal functions and their use in signal representation.

Introduction to Systems:

Linear and non-linear systems, time invariant and time varying systems ,lumped and distributed systems, deterministic and stochastic systems, casual and non-causal systems, analog and discrete/digital memory and memory less systems.

Unit-II

Linear Time Invariant Systems: Introduction to linear time invariant (LTI) systems, properties of LTI systems,convolution integral, convolution sum, causal LTI systems described by differential and difference equations. Concept of impulse response.

Unit-III

Fourier and Laplace Transform:

Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT). Parseval's Theorem. Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior.

Unit-IV

Sampling and Reconstruction:

The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems.

Suggested Books:

1. Oppenheim, Willsky, Nawab, Signals and Systems, Prentice Hall India, 2nd Edition, 2009
2. Simon Haykins – "Signal & Systems", Wiley Eastern
3. Tarun Kumar Rawat, Signals and Systems, Oxford University Press.

Note: The paper setter will set the paper as per the question paper templates provided.

EE -211A	Electrical Machines Lab-I						
L	T	P	Credit	Practical	Minor Test	Total	Time
-	-	2	1	60	40	100	3h

LIST OF EXPERIMENTS:

1. To find turns ratio, polarity & mark dot convention of a 1-phase transformer.
2. To perform open & short circuit tests on a 1-phase transformer& find parameters.
3. To perform Sumpner's Back to Back test on 1-phase transformer& find parameters.
4. Parallel operation of two 1-phase transformers and observe load sharing.
5. To convert three phase supply to 2-phase by Scott-connection, compare line currents theoretically& practically for unbalanced load.
6. To perform load test on DC shunt generator & find efficiency& observe speed at different load.
7. Speed control of DC shunt motor by armature & field control method, draw graph between speed & field current.
8. To perform Swinburne's test of DC shunts motor and find efficiency.
9. To perform Hopkinson's test of DC shunts M/Cs.
10. To perform Ward Leonard method for speed control DC shunts motor.
11. To make various types of three phase connections , using three single phase transformers, study relevant features
12. Characteristics for compound, series shunt generators.

Note: At least eight experiments should be performed from above list.

EEN -207A	Analog Electronics Lab						
L	T	P	Credit	Practical	Minor Test	Total	Time
-	-	2	1	60	40	100	3h

List of Experiments:

1. To Design a simple common emitter (CE) amplifier Circuit and find its gain and frequency response.
2. To Design a differential amplifier and calculate its gain and frequency response
3. To design RC coupled Single stage amplifier and determination of the gain , frequency response.
4. To design a Emitter follower and determination of the gain, input and output impedances.
5. To design and test the performance of RC Phase shift Oscillator.
6. To design and test the performance of Hartley Oscillators.
7. To design and test the performance of Colpitt Oscillators.
8. To design an astable multivibrator using 555 timer.
9. To design a monostable multivibrator using 555 timer.
10. To design Schmitt trigger using op-amp and verify its operational characteristics.

Note: At least eight experiments should be performed from above list.

EEN -211A	Signal and Systems Lab						
L	T	P	Credit	Practical	Minor Test	Total	Time
-	-	2	1	60	40	100	3h

LIST OF EXPERIMENTS

1) To demonstrate some simple signal.
2) To explore the effect of transformation of signal parameters (amplitude-time-scaling and time-shifting).
3) To explore the various properties of the impulse signals.
4) To visualize the complex exponential signal and real sinusoids.
5) To identify a given system as linear or non-linear.
6) To explore the time variance and time invariance property of a given system.
7) To explore causality and non-causality property of a system.
8) To visualize the relationship between the continuous-time Fourier series and Fourier transform of a signal.
9) To visualize the relationship between the discrete-time Fourier series and Fourier transform of a signal.
10) To visualize the relationship between continuous-time and discrete-time Fourier transform of a signals.
11) To demonstrate the time domain sampling of band limited signals (Nyquist theorem).
12) To demonstrate the time domain sampling of non-band limited signals and anti aliasing filter.
13) To demonstrate the signal reconstruction using zero-order hold and first-order hold filters.
14) To demonstrate the sampling in frequency domain (Discrete Fourier Transform).
15) To demonstrate the spectral analysis using Discrete Fourier Transform.

Note: At least eight experiments should be performed from above list.

EEN-215A	INDUSTRIAL TRAINING-I							
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Practical**	**Total**	**Time (Hrs.)**
2	**0**	**0**	**--**	**--**	**100**	**--**	**100**	3 h

Purpose	To provide comprehensive learning platform to students where they can enhance their employ ability skills and exposure to the industrial environment.
Course Outcomes	
CO1	Capability to acquire and apply fundamental principles of engineering.
CO 2	Become updated with all the latest changes in technological world.
CO 3	Capability and enthusiasm for self-improvement through continuous professional development and life-long learning
CO 4	Awareness of the social, cultural, global and environmental responsibility as an engineer.

Note: EEN-215A is a mandatory non-credit course in which the students will be evaluated for the industrial training undergone after 2nd semester and students will be required to get passing marks to qualify.

The candidate has to submit a training report of his/her work/project/assignment completed in the industry during the training period. The evaluation will be made on the basis of submitted training report and viva-voce/presentation.

MC-901A	Environmental Sciences						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**0**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To learn the multidisciplinary nature, scope and importance of Environmental sciences.						
Course Outcomes (CO)							
CO1	The students will be able to learn the importance of natural resources.						
CO2	To learn the theoretical and practical aspects of eco system.						
CO3	Will be able to learn the basic concepts of conservation of biodiversity.						
CO4	The students will be able to understand the basic concept of sustainable development.						

UNIT 1

The multidisciplinary nature of environmental studies, Definition, Scope and Importance, Need for public awareness, Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

(a) Forest Resources: Use and over-exploitation, deforestation, case studies. Timber eztraction, mining, dams and their effects on forests and tribal people.
(b) Water Resources: Use & over-utilization of surface & ground water, floods, drought, conflicts over water, dams-benefits and problems.
(c) Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
(d) Food Resources: World Food Problems, changes caused by agriculture and overgazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
(e) Energy Resources: Growing energy needs, renewable & non-renewable energy sources, use of alternate energy sources. Case studies.
(f) Land Resources: Land as a resource, land, degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyle.

UNIT II

Ecosystem-Concept of an ecosystem. Sturcture and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological Succession, Food Chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest Ecosystem, (b) Grassland Ecosystem, (c) Desert Ecosystem and (d) Aquatic Ecosystems (ponds, streams, lakes, rivers, oceans, esturaries

Field Work: Visit to a local area to document Environment assets-river/forest/grassland/hill/mountain, Visit to a local polluted site-Urban /Rural Industrial/Agricultural, Study of common plants, insects and birds, Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

UNIT III

Biodiversity and its conservation: Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversityof global, National and local levels. India as a mega-diversity nation Hot spots of Biodiversity, Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts, Endangered and endemic species of India, Conservation of Biodiversity-In situ and Ex-Situ conservation of biodiversity.

Environmental Pollution Definition: Cause, effects and control measures of (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards

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

UNIT IV

Social Issues and the Environment. From unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people: Its problems and concerns, Case Studies: Environmental ethics-issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies: Wasteland Reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public Awareness, Human population and the Environment, Population growth, variation among nations, Population explosion-Family Welfare Programme, Environment and human health. Human rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human Health, Case Studies, Drugs and their effects; Useful and harmful drugs, Use and abuse of drugs, Stimulant and depressan drugs, Concept of drug de-addiction, Legal position on drugs and laws related to drugs.

Suggested Books

- Environmental Studies- Deswal and Deswal. Dhanpat Rai and Co.
- Environmental Science and Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India.
- Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
- Environmental Science- Botkin and Keller. 2012. Wiley , India

Note: The Examiner will be given the question paper template to set the question paper.

BS-207A	APPLIED AND COMPUTATIONAL MATHEMATICS						
LECTURE	TUTORIAL	PRACTICAL	CREDIT	MAJOR TEST	MINOR TEST	TOTAL	TIME
3	-	-	3	75	25	100	3 H
Purpose	The objective of this course is to familiarize the prospective Engineers with ordinary and partial differential equations, Laplace Transform which allow deterministic mathematical formulations of phenomena in engineering processes and to study numerical methods for the approximation of their solution. More precisely, the objectives are as under:						
Course Outcomes							
CO 1	To introduce the Ordinary & Partial Differential Equations, its formation and solutions for multivariable differential equations originated from real world problems.						
CO 2	To study some extended topics in calculus essential for computations w.r.t. parameter variations ,vectors and field theory.						
CO 3	Introduction about the concept of Laplace transform and how it is useful in solving the definite integrals and initial value problems.						
CO 4	To introduce the tools of numerical methods in a comprehensive manner those are used in approximating the solutions of various engineering problems.						

UNIT-1

ORDINARY & PARTIAL DIFFERENTIAL EQUATIONS

ODE: First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.
Second order linear differential equations with constant coefficients.

PDE: Formation of Partial Differential Equations, Solutions of first order linear and non-linear PDEs, Charpit's method, Solution to homogenous linear partial differential equations (with constant coefficients) by complimentary function and particular integral method.

UNIT-2

ADVANCE CALCULUS

Multivariable Calculus: Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar and) Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere .

Vector Calculus: Gradient, divergence and Curl and their properties, Directional derivative. Line integrals, surface integrals, volume integrals, Theorems of Green, Gauss and Stokes (without proof).

UNIT-3

LAPLACE TRANSFORM

Laplace Transform, Laplace Transform of Elementary Functions, Basic properties of Laplace Transform, Laplace transform of periodic functions, finding inverse Laplace transform by different methods, Convolution theorem, solving ODEs by Laplace Transform method.

UNIT-4

NUMERICAL TECHNIQUES

Solution of polynomial and transcendental equations: Bisection method, Newton-Raphson method and Regula-Falsi method, Lagrange's formulae.

Numerical Differentiation using Newton's forward and backward difference formulae, Numerical integration: Trapezoidal rule and Simpson's 1/3rd rule, Taylor's series, Runge-Kutta method for solving first and second order equations.

Textbooks/References:

1. Erwin Kreyszig and Sanjeev Ahuja, Applied Mathematics-II, Wiley India Publication, Reprint, 2015.
2. W. E. Boyce and R. C. Di Prima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India,
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. G.F. Simmons and S.G. Krantz, Differential Equations, Tata McGraw Hill, 2007.
6. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall.
7. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.
8. Manish Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.
9. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
10. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
11. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
12. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
13. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
14. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Note: The Examiner will be given the question paper template to set the questions.

HM- 903A	Soft Skills & Interpersonal Communication						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Course Outcomes (CO)							
CO1	Develop basic understanding of Communication						
CO2	Understand the process of communication and speaking						
CO3	Develop the Personality concepts and its implementation						
CO4	Develop the basic of Group Discussion and interviews						

UNIT-I

Communication**:** Introduction Verbal, Non-Verbal, kinesics, proxemics, chronemics, Types of communication, extrapersonal communication, intrapersonal communication, intrapersonal communication, mass communication,Creativity in communication, Role of communication, flow of Communication and its need, Persuasive communication and negotiation;Time management in Persuasive communication, Importance of Persuasive Communication

UNIT-II

Barriers in the way of communication, noise, intrapersonal barriers, interpersonal barriers,organizational barriers, Extrapersonal barriers, Basics of communication:importance of communication,process of communication, objectives and characteristics of communication,Communication skills: Accent, Intonation, Phonetics, Speaking skills, Confidence, clarity, Fluency,Quality,pronunciation

UNIT-III

Personality Development; what is personality? Role of personality,Heredity, Environment, situation, Basics of personality, Soft skills; Needs and training, Activity in soft skills, Organizational skill;introduction and its need

,basics principles for Organization skills,Stress management;Introduction, Stress at home and office, Stress prevention, analyze the model of stress.

UNIT-IV

Group discussion, form of Group discussion, strategy for Group discussion, discussing problems and solution, Oral presentation, introduction, planning, Occasion, Purpose, Modes of delivery, Resume making;Purpose of Resume, Resume design and structure, contents in Resume, types of resume, Job interview, introduction, objective of Interview, types of interview, stages of interview,Face to face interview and campus interview

Text Books:

1.Technical Communication Principles and Practice by Meenakshi Raman and Sangeeta Sharma by Oxford Publication

Reference Books:

1. Personality Development and soft skills by Barun K. Mitra, Oxford Publication
2. Communication Skills For Engineers by C.Muralikrishna and Sunita Mishra, Pearson Pub.

Note: Separate paper **template** will be provided to the paper setter for setting the question paper of end term semester examinations.

EE-206A	Electrical Machines-II						
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	1	-	4	75	25	100	3h

Purpose	To familiarize the students with the basics of Electrical Machines
Course Outcomes	
CO1	Understand the concepts of rotating magnetic fields.
CO 2	Understand the operation of ac machines.
CO 3	Analyse performance characteristics of ac machines.
CO 4	Analyse synchronous machine

UNIT-I

Induction Machines:

Basic concept of Induction machines: winding factors, generated e.m.f. and m.m.f distribution, a.c. winding, rotating magnetic field.

3-phase Induction Motor: Construction, features, production of torque, phasor diagram, equivalent circuit, performance analysis, torque -slip characteristics, running, light and blocked rotor test, load test on 3-ph I.M.

UNIT-II

Single phase induction motors:-

Constructional features & double revolving field theory, equivalent circuit, determination of parameters. Split phase, starting methods, types& applications.

Starting of 3-ph I.M. Starting methods of squirrel cage and wound rotor induction motor.

Induction Generator-Operation, applications, advantages.

UNIT-III

Three Phase Synchronous Generators:

Principle, construction, EMF equation, armature winding, armature reaction, equivalent circuit, voltage regulation - synchronous reactance method , Rothert's m.m.f method, Potier triangle method, Output power equation, power angle curve, two reactance theory, slip test, Transient and subtransient reactance, synchronization, parallel operation.

UNIT-IV

Three Phase Synchronous Motor: Construction, Principle of operation, Equivalent circuit, torque, power developed, starting, V-curve, Hunting-causes , effects & reduction , synchronous condenser applications. Comparison between induction motor and synchronous motor, high startig torque motors.

Suggested Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
4. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
5. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.

Note: The paper setter will set the paper as per the question paper templates provided.

EE-208A	Power Electronics						
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3h

Purpose	To familiarize the students with the Converter and Power switching device

Course Outcomes	
CO1	Understand the differences between signal level and power level devices.
CO 2	Analyse controlled rectifier circuits.
CO 3	Analyse the operation of DC-DC choppers.
CO 4	Analyse the operation of voltage source inverters.

UNIT-I

Power switching devices :

Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT.

UNIT-II

Thyristor rectifiers

Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with Rload and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor.

UNIT-III

DC-DC buck converter:

Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage.

DC-DC boost converter:

Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage.

UNIT-IV

Single-phase voltage source:

Power circuit of single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and unipolar sinusoidal modulation, modulation index and output voltage.

Suggested Books:

1. M. H. Rashid, "*Power electronics: circuits, devices, and applications*", Pearson Education India, 2009.
2. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.
3. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2007.
4. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.

Note: The paper setter will set the paper as per the question paper templates provided.

EEN-210A	Digital Electronics						
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3h

Purpose	To familiarize the students with the logic device.
	Course Outcomes
CO1	To understand fundamentals of Digital techniques, Binary codes.
CO 2	To design basic circuits using Gates and MSI Devices
CO 3	To understand design of synchronous and Asynchronous sequential circuits A/D and D/A convertors
CO 4	Concept of Digital logic families, programmable logic devices

Unit-I

Fundamentals of Digital Techniques:

Digital signal, review of number systems, binary codes, BCD, Excess-3, Gray, EBCDIC, ASCII, logic gates-AND, OR, NOT, NAND, NOR, EX-OR, Boolean algebra, Error detection and correction, hamming code.

Unit-II

Combination Design using Gates:

Design using gates, K- map and Quine-Mccluskey methods of simplification.

Combinational design using MSI Devices

Multiplexers and Demultiplexers and their uses as logic elements, Decoders, Adders/Subtracters, BCD arithmetic circuits, Encoders, Decoders/Drivers for display devices.

Unit-III

Design of Sequential circuits:

Flip flops: S-R, J-K, T,D, master slave, edge triggered, shift registers, sequence generators, counters-asynchronous and synchronous, ring counters and Johnson Counter.

D/A &A/D Converters:

D/A converters- weighted resistor and R-2 R ladder, specifications for D/A converters, A/D converters: Sample and hold circuits, Quantization, Parallel-comparator, successive approximation, counting type, dual slope ADC,
specifications of ADCs.

Unit-IV

Digital logic families:

Logic families: TTL, ECL, MOS, and CMOS logic families. Tristate logic, interfacing of CMOS and TTL families.

Programmable logic devices: ROM, PLA, PAL, FPGA and CPLDS.

Suggested Books:

1. Modern Digital Electronics (Edition III) : R.P. Jain, TMH.
2. Digital Integrated Electronics: Taub& Schilling, MGH
3. Digital Principles and Applications: Malvino & Leach, MG

Note: The paper setter will set the paper as per the question paper templates provided.

EEN-202A	Basic of Analog Communication						
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3h

Purpose	To familiarize the students with the communication and Modulation technique.

Course Outcomes	
CO1	Basics of communication & noise generation.
CO 2	Amplitude modulation, concept of SSB waves & DSBSC,VSB Modulation
CO 3	Concept of TDM, FDM, PAM and Digital communication.
CO 4	Concept of Pulse code modulation, differential pulse code modulation

Unit-I

Introduction to Communication Systems:

The essentials of a communication system, modes and media's of communication, introduction to wired and wireless media, classification of signals and systems, Fourier Analysis of signals.

Introduction to noise:

External noise, internal noise, S/N ratio, noise figure, Noise in reactive circuits.

Unit-II

Modulation Techniques: Basic constituents of Communication Systems, need of modulation, Amplitude modulation, spectrum AM Wave , modulation index, DSBSC modulation, Collector modulation, Square law modulation methods of generating SSB Signals, vestigial side band modulation, Detection of AM Signal; Diode detector, Square Law Detector. Time Constant RC in diode detector. Diode detector with filter. FDM, Power relations in AM wave.

UNIT III

Angle Modulation : Frequency and phase modulation, spectrum of FM Wave, modulation index and Bandwidth of FM Signal, NBFM and WBFM, Comparison between FM and PM Signals, FM and AM signals, AM and NBFM signals, FM generation methods, Demodulation methods; slope detector, ratio detector, Foster-Secley discriminator. Pre-emphasis & De-emphasis, effect of noise on carrier; noise triangle.

UNIT IV

Transmitter & Receiver: Classification of radio transmitters, Block diagram of FM transmitter, Privacy devices Armstrong FM transmitter, Simple FM transmitter using Reactance modulator. Classification of radio receivers, TRF receives, superheterodyne receivers, Image Signal rejection, frequency mixers. Tracking and alignment of receivers, Intermediate frequency, AGC, AFC, SSB receiver.

Suggested Books:

1. Principle of communication of engineering : By Umesh Sinha.
2. Communication system By R.Singh & S. D. Sapre (TMH)
3. Electronics communication system By George Kenddy (TMH)
4. Communication system B**y** Taub Schilling.(TMH)

Note: The paper setter will set the paper as per the question paper templates provided.

EE -214A	Electrical Machines Lab-II						
L	T	P	Credit	Practical	Minor Test	Total	Time
-	-	2	1	60	40	100	3h

LIST OF EXPERIMENTS:

1) To perform load test on a 3-phase induction motor & DC generator set and to determine the efficiency of induction motor.
2) Determine mechanical losses by light running of a 3-phase induction motor.
3) Study and starting of 1-phase induction motor. To perform light running and block rotor test and to determine the parameters of the equivalent circuit.
4) To perform the open circuit test and block rotor test on 3-phase induction motor and draw the circle diagram.
5) To perform & study effect of rotor resistance on a poly phase slip ring induction motor.
6)To calculate regulation by synchronous impedance method:-
a) Conduct open and short circuit test on a three phase alternator.
b) Determine and plot variation of synchronous impedance with If
c) Determine SCR
d) Determine regulations for 0.8 lagging power factor, 0.8 leading power factor and unity PF.
7) To plot V curves of a synchronous machine.
a) Determination of Xo of a synchronous machine.
b) Measurement Xd&Xq (Direct axis and Quardrature axis reactance) by slip test
8) To measure Xq of synchronous machine (negative sequence reactance).
9) To calculate regulation by ZPF method.
10) To perform and study parallel operation of synchronous generators.

Note: At least eight experiments should be performed from above list.

EE -216A	Power Electronics Lab							
L	T	P	Credit	Practical	Minor Test	Total	Time	
-	-	2	1	60	40	100	3h	

LIST OF EXPERIMENTS:

1. To Plot the firing characteristics of given silicon control rectifier.
a. By varying the gate current Ig keeping forward voltage Vak fixed.
b. By varying forward voltage Vak keeping gate current fixed.
2. To study the V-I characteristics of given UJT. To plot graph between Ve and Ie . To find negative resistance from the graph.
3. To plot V-I characteristics of given Triac in I and III quadrant.
4. To plot the drain characteristics of given F.E.T & to evaluate the parameter rd, Idss.
5. To study the UJT based relaxation oscillator & to evaluate the dynamic resistance.
6. To study & draw the characteristics of DC-DC chopper power circuit
7. To study the characteristics of single phase fully controlled converter circuit.
8. To study the characteristics of 3-phase fully controlled converter power circuit.
9. To study single phase Mc Murray Inverter power circuit.
10. To study single phase cyclo-converter circuit.

Note: At least eight experiments should be performed from above list.

EEN -218A	Digital Electronics Lab						
L	T	P	Credit	Practical	Minor Test	Total	Time
-	-	2	1	60	40	100	3h

LIST OF EXPERIMENTS:

1) Study of TTL gates- AND, OR, NOR, NAND, NOT, EX-OR, EX-NOR.
2) Design & realize a given function using K-Map and verify its performance.
3) To verify the operation of multiplexer &Demultiplexers.
4) To verify the operation of comparator.
5) To verify the truth tables of S-R, J-K, T& D type flip flops
6) To verify the operation of bi-directional shift register.
7) To design & verify the operation of 3-bit synchronous counter.
8) To design and verify the operation of synchronous UP/DOWN decade counter using JK flip flop & drive a seven segment display using the same.
9) To design and verify the operation of asynchronous UP/DOWN decade counter using JK flip flop & drive a seven segment display using the same.
10) To design and realize sequence generator for a given sequence using JK Flip flop.
11) Study of CMOS NAND & NOR gates and interfacing between TTL and CMOS gates.
12) Design a 4-bit shift register and verify its operation of a ring counter and a Johnson counter.

Note: At least ten experiments should be performed from above list.

MC-902A	Constitution of India					
Lecture	Tutorial	Practical	Major Test	Minor Test	Total	Time
3	-	-	75	25	100	3 Hrs.
Purpose	To know the basic features of Constitution of India					
Course Outcomes						
CO1	The students will be able to know about salient features of the Constitution of India.					
CO2	To know about fundamental duties and federal structure of Constitution of India.					
CO3	To know about emergency provisions in Constitution of India.					
CO4	To know about fundamental rights under constitution of India.					

UNIT-I

1. Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India. Salient features and characteristics of the Constitution of India.
2. Scheme of the fundamental rights

UNIT - II

3. The scheme of the Fundamental Duties and its legal status. The Directive Principles of State Policy – Its importance and implementation. Federal structure and distribution of legislative and financial powers between the Union and the States.
4. Parliamentary Form of Government in India – The constitution powers and status of the President of India

UNIT - III

5. Amendment of the Constitutional Powers and Procedure. The historical perspectives of the constitutional amendments in India.
6. Emergency Provisions: National Emergency, President Rule, Financial Emergency. Local Self Government – Constitutional Scheme in India.

UNIT-IV

7. Scheme of the Fundamental Right to Equality. Scheme of the Fundamental Right to certain Freedom under Article 19.

8. Scope of the Right to Life and Personal Liberty under Article 21.

Text Books

1. Constitution of India. Prof.Narender Kumar (2008) 8th edition. Allahabad Law Agency.

Reference Books:

1. The constitution of India. P.M. Bakshi (2016) 15th edition. Universal law Publishing.

KURUKSHETRA UNIVERSITY KURUKSHETRA

Bachelor of Technology(Electrical & Electronics Engineering)(Credit Based)

Scheme of Studies/Examination

SemesterV(w.e.f. session2020-21 onwards)

S. No.	Course No.	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	***EE-301A**	**Power System – I**	3:1:0	4	4	75	25	0	100	3
2	***EE-305A**	**Control Systems**	3:1:0	4	4	75	25	0	100	3
3	EENP**	Program Elective - I	3:0:0	3	3	75	25	0	100	3
4	***EE-309A**	**Microprocessors**	3:0:0	3	3	75	25	0	100	3
5	EENO**	Open Elective - I	3:0:0	3	3	75	25	0	100	3
6	***EE-313A**	**Power System Lab - I**	0:0:2	2	1	-	40	60	100	3
7	***EE-315A**	**Microprocessors Lab**	0:0:2	2	1	0	40	60	100	3
8	***EE-317A**	**Control Systems Lab**	0:0:2	2	1	0	40	60	100	3
9	***EEN-319A	Industrial Training-II	2:0:0	2	-	-	*100	-	*100	3
10	****MC-903A	Essence of Indian Traditional Knowledge	3:0:0	3	-	100	-	0	100	3
		Total		**28**	**20**	**375**	**245**	**180**	**800**	

****The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.**

***EEN-319A is a mandatory credit-less course in which the students will be evaluated for the industrial training undergone after 4th semester and students will be required to get passing marks to qualify.

****MC-903A is a mandatory credit-less course in which the students will be required to get passing marks in the major test.

Course No.	Program Elective I
*EEP-329A	Digital Signal Processing
*EEP-307A	Electrical Machine Design
EENP-305A	Electromagnetic Field Theory
*EEP-318A	Computer Architecture

Course No.	Open Elective I
*EEO-325A	Computer Networks
EENO-303A	Big Data Analysis
EENO-305A	VLSI Circuits
EENO-307A	Power Plant Engineering

* Subjects Common with Vth Semester. B.Tech. [Electrical Engg.] Scheme, K.U.K.

KURUKSHETRA UNIVERSITY KURUKSHETRA

Bachelor of Technology (Electrical & Electronics Engineering) (Credit Based)
Scheme of Studies/Examination
Semester VI (w.e.f. session 2020-21 onwards)

S. No.	Course No.	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	***EE-302A**	**Power System – II**	3:1:0	4	4	75	25	0	100	3
2	HM-901A	Organizational Behavior	3:0:0	3	3	75	25	0	100	3
3	EENP**	Program Elective - II	3:0:0	3	3	75	25	0	100	3
4	EENO**	Open Elective - II	3:0:0	3	3	75	25	0	100	3
5	***EE-310A**	**Electrical Measurements and Measuring Instrumentation**	3:0:0	3	3	75	25	0	100	3
6	***EE-312A**	**Power System Lab - II**	0:0:2	2	1	-	40	60	100	3
7	***EE-314A**	**Measurements and Instrumentation Lab**	0:0:2	2	1	-	40	60	100	3
8	***EE-316A**	Electronic Design Lab	0:0:4	4	2	-	40	60	100	3
		Total		**24**	**20**	**375**	**245**	**180**	**800**	

**** The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section. Note: All the students have to undergo 4 to 6 weeks Industrial Training after 6th semester which will be evaluated in 7th semester.**

Course No.	Program Elective II
*EEP-304A	Power System Protection
*EEP-306A	Electrical Energy Conservation and Auditing
*EEP-308A	Biomedical Signal & Image Processing

Course No.	Open Elective II
*EEO-320A	Electrical Materials
*EEO-322A	Strength of Materials
EENO-306A	Internet of Things

* Subjects Common with VIth Semester. B.Tech. [Electrical Engg.] Scheme, K.U.K.

EE-301A	Power System -I						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**1**	**0**	**4**	**75**	**25**	**100**	**3**
Program Objective (PO)	To enable students to analyses power system networks, network parameters, modeling of transmission line						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the concepts of power systems.						
CO2	Understand the various power system components						
CO3	Understand various compensation techniques						
CO4	Determine methods of generation of overvoltage						

UNIT- I

Evolution of Power Systems: Typical power system, Modern trends in power system transmission. Underground and overhead system, Effects of increase in Voltage on transmission line efficiency, Radial and ring main system. Different types of distributors; Relative copper consumption in various systems. Conductor size and Kelvin's Law

UNIT- II

Transmission line modelling & compensation: Short, medium and long lines. Power Transfer, Voltage profile and Reactive Power. Characteristics of transmission lines. Surge Impedance Loading. Series and Shunt Compensation of transmission lines. Travelling-wave Equations

UNIT- III

Overhead Transmission Lines: Overhead Transmission Lines: Electrical and Magnetic Fields around conductors, Corona loss, Bundled conductors Parameters of lines. Capacitance and Inductance calculations for simple configurations. Skin effects, Proximity effect

UNIT IV

Generation of Over-voltages: Synchronous Machines: Steady-state performance characteristics. Operation when connected to infinite bus. Steady state, transient and sub-transient equivalent circuits.
Generation of Over-voltages: Lightning and Switching Surges. Protection against Over- voltages, Insulation Coordination. Propagation of Surges. Voltages produced by traveling surges

Text Books/References:

1. Power System analysis and Stability by S.S. Vadhera
2. Electrical Power System by C.L. Wadhwa
3. Electrical Power System by Ashfaq Hussain
4. Elements of Power System Analysis by W.D. Stevenson
5. Electric Power System by B.M. Weddy
6. The transmission and Distribution of Electric energy by H. Cotton
7. Modern Power System Analysis by I.J. Nagrath and D.P. Kothari

EE-305A	Control Systems						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**1**	**0**	**4**	**75**	**25**	**100**	**3**
Program Objective (PO)	To enable students to analyses basic of control system, time and frequency domain analysis of various system						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the Mathematical models of physical systems						
CO2	Understand the concept of stability and its assessment for linear-time invariant systems						
CO3	Determine the state space variables and state equations						
CO4	Find the time and frequency response of system						

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UNIT I

Control Systems: Basics & Components: Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.

UNIT II

Time–Domain Analysis: Standard test signals, Time response of first and second order systems for standard test inputs, Application of initial and final value theorem, Design specifications for second-order systems based on the time-response, Concept of Stability, Routh-Hurwitz Criteria, Relative Stability analysis, Root-Locus technique, Construction of Root-loci.

UNIT III

Frequency Domain Analysis and Stability: Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

UNIT IV

State Space & Compensation Techniques: Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability.

Text/References:

1. Control System Engg. By Nagrath and Gopal.
2. Control System Engg. By K.Ogata.
3. Liner Control System by R.S. Chauhan, (Umesh Publications)
4. Feedback control system Analysis and Synthesis by D'Azzo and Houpias.
5. Control System by B.C. Kuo.

EEP-329A	Digital Signal Processing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of discrete time signals and digital filters .						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Represent signals mathematically in continuous and discrete-time, and in the frequency domain.						
CO2	Analyse discrete-time systems using z-transform						
CO3	Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms.						
CO4	Design digital filters for various applications						

UNIT-1

Discrete-time signals and systems

Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.

UNIT-2

Z-transform

Z Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z transform, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.

UNIT-3

Discrete Fourier Transform

Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems.

UNIT-4

Design of Digital filters

Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Band-stop and High-pass filters.

Text/Reference Books:

1. S. K. Mitra, "Digital Signal Processing: A computer based approach", McGraw Hill, 2011.
2. A.V. Oppenheim and R. W. Schafer, "Discrete Time Signal Processing", Prentice Hall, 1989.
3. J. G. Proakis and D.G. Manolakis, "Digital Signal Processing: Principles, Algorithms And Applications", Prentice Hall, 1997.
4. L. R. Rabiner and B. Gold, "Theory and Application of Digital Signal Processing", Prentice Hall, 1992.
5. J. R. Johnson, "Introduction to Digital Signal Processing", Prentice Hall, 1992.

EEP-307A	Electrical Machine Design						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of designing of various electrical machine						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the construction and performance characteristics of electrical machines.						
CO2	Understand the various factors which influence the design: electrical, magnetic and thermal loading of electrical machines						
CO3	Understand the principles of electrical machine design and carry out a basic design of an ac machine						
CO4	Use software tools to do design calculations						

UNIT 1

Introduction

Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

UNIT 2

Transformers

Sizing of a transformer, main dimensions, output equation for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

UNIT 3

Induction Motors

Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of polyphase machines, magnetizing current, short circuit current

UNIT4

DC MACHINES: Output equation, choice of specific loadings, choice of poles and speed, Design of core length, armature diameter, depth of armature core, air gap length, cross section of armature conductors, armature slots.

COMPUTER AIDED DESIGN: Computerization of design procedures, development of computer programs & performance predictions, optimization techniques & their application to design problems.

Text / References:

1. A. K. Sawhney, “A Course in Electrical Machine Design”, Dhanpat Rai and Sons, 1970.
2. M.G. Say, “Theory & Performance & Design of A.C. Machines”, ELBS London.
3. S. K. Sen, “Principles of Electrical Machine Design with computer programmes”, Oxford and

EENP-305A	Electromagnetic Field Theory						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	To familiarize the students with the concepts of Electric and Magnetic Fields and make them understand the phenomenon of propagation of electromagnetic waves.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Basics of electrostatics including dielectric properties will be covered.						
CO2	Basics of Magneto-statics and Maxwell's equations will be covered.						
CO3	Fundamentals of uniform plane waves and their propagation in different mediums will be covered.						
CO4	Fundamentals of Transmission Lines and different modes of wave propagation in waveguides will be covered.						

UNIT 1

Electric Field and Current: Introduction to vectors: Addition, Subtraction, Multiplication and Differentiation. Coordinate Systems: Rectangular, Cylindrical & Spherical. Coulomb's law. Electric Field Intensity, Electric Potential, Field of a Line Charge, Field of a Sheet of Charge, Electric Flux Density, Electric Dipole, Current Density, Continuity of Current, Gauss's Law and Applications, Electric Field behaviour in Dielectrics, Boundary Conditions at Interface between Two Dielectrics, Method of Images, Capacitance of Two Wire Line, Poisson's and Laplace's Equations, Uniqueness Theorem.

Unit-II

Magnetic Field and Maxwell Equations: Biot - Savart Law, Ampere's Law, Magnetic Vector potentials, Force on a moving charge, Differential Current Element, Force and Torque on a Closed Circuit, Magnetic Boundary Conditions, The Magnetic Circuit, Faraday's Law, Maxwell's Equations in Point and Integral form for Free Space, Good Conductors & Lossy Dielectrics for Sinusoidal Time Variations & Static Fields, Retarded Potentials.

Unit-III

The Uniform Plane Wave: Plane Waves & its Properties, Wave Equation for Free Space and Conducting Medium, Propagation of Plane Waves in Lossy Dielectrics, Good Dielectrics & Good Conductors. The Pointing Vectors and Power Considerations, Skin Effect, Reflection of Uniform Plane Waves (Normal & Oblique Incidence).

Unit-IV

Transmission Lines and Wave Guides: The Transmission Line Equations, Graphical Methods, Smith Chart, Time – domain and Frequency – domain Analysis. Reflection in Transmission Lines, SWR, TE, TM, TEM waves, TE and TM modes in Rectangular and Circular Waveguides, Cut-off & Guided Wavelength. Wave Impedance and Characteristic Impedance, Dominant Modes, Power Flow in waveguides, Excitation of waveguides, Dielectric waveguides.

Text/Refrence Books:

1. Hayt W H., Engineering Electromagnetics, Tata McGraw Hill, 6th Edition.
2. Jordan E C & Balamain K G, Electromagnetic Waves and Radiating Systems, PHI.2

David K. Chang, Field and Electromagnetics, Addison Wesley.

EEP-318A	Computer Architecture						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various types of electrical measurements and measuring instruments.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the concepts of microprocessors, their principles and practices.						
CO2	Write efficient programs in assembly language of the 8086 family of microprocessors						
CO3	Organize a modern computer system and be able to relate it to real examples						
CO4	To study the different types of memory organization						

UNIT-1

Introduction to computer organization

Architecture and function of general computer system, CISC Vs RISC, Data types, Integer Arithmetic - Multiplication, Division, Fixed and Floating point representation and arithmetic, Control UNIT operation, Hardware implementation of CPU with Micro instruction, microprogramming, System buses, Multi-bus organization.

UNIT-2

Memory organization

System memory, Cache memory - types and organization, Virtual memory and its implementation,

Memory management UNIT, Magnetic Hard disks, Optical Disks. Introduction to pipelining, Instruction level pipelining (ILP), compiler techniques for ILP, Data hazards, Dynamic scheduling,

UNIT-3

Input – output Organization

Accessing I/O devices, Direct Memory Access and DMA controller, Interrupts and Interrupt Controllers, Arbitration, Multilevel Bus Architecture, Interface circuits - Parallel and serial port. Features of PCI and PCI Express bus.

UNIT-4

16 and 32 microprocessors

80x86 Architecture, IA – 32 and IA – 64, Programming model, Concurrent operation of EU and BIU, Real mode addressing, Segmentation, addressing modes of 80x86, Instruction set of 80x86, I/O addressing in 80x86

Text/Reference Books

1. V. Carl, G. Zvonko and S. G. Zaky, "Computer organization", McGraw Hill, 1978.
2. B. Brey and C. R. Sarma, "The Intel microprocessors", Pearson Education, 2000.
3. J. L. Hennessy and D. A. Patterson, "Computer Architecture A Quantitative Approach", Morgan Kauffman, 2011.
4. W. Stallings, "Computer organization", PHI, 1987.

EE-309A	Microprocessors						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of microprocessors and programing						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Do assembly language programming						
CO2	Do interfacing design of peripherals like I/O, A/D, D/A, timer etc						
CO3	Develop systems using different microcontrollers						
CO4	Understand the architecture of 8051						

UNIT 1

Fundamentals of Microprocessors: Fundamentals of Microprocessor Architecture. 8-bitMicroprocessor and Microcontroller architecture, Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. Overview of the 8051 family.

UNIT 2

The 8051 Architecture: Internal Block Diagram, CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles.

UNIT 3

Instruction Set and Programming: Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set, Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, and Subroutine instructions

UNIT 4

Memory and I/O Interfacing: Memory and I/O expansion buses, control signals, memory wait states. Interfacing of peripheral devices such as General Purpose I/O, ADC, DAC, timers, counters, and memory devices. Application: LED, LCD and DC Motor interfacing

Text / References:

1. M. A.Mazidi, J. G. Mazidi and R. D. McKinlay, "The8051Microcontroller and Embedded Systems: Using Assembly and C",Pearson Education, 2007.
2. K. J. Ayala, "8051 Microcontroller", Delmar Cengage Learning,2004.
3. R. Kamal, "Embedded System", McGraw Hill Education,2009.
4. R. S. Gaonkar, ", Microprocessor Architecture: Programming and Applications with the 8085", Penram International Publishing, 1996

EEO-325A	Computer Networks						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various computer networks and their programming						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To develop an understanding of modern network architectures from a design and performance perspective						
CO2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).						
CO3	To provide an opportunity to do network programming						
CO4	To provide a WLAN measurement ideas.						

UNIT 1

Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

UNIT 2

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA

UNIT 3

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

UNIT 4

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Suggested reference books

1. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.
2. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, UNITed States of America.

EENO-303A	Big Data Analysis						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	To provide knowledge of Big Data Analytics and Distributed File Systems.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To learn in details the concepts of big data						
CO2	Expose the criteria of big data analytics and big data storage						
CO3	To explore knowledge of big data compression techniques						
CO4	To explore learning of big data tools and state-of-the-art knowledge with implementation for big data						

UNIT 1

Big Data: Background, definition and features of big data, big data value, development of big data, challenges of big data, NoSQL databases, technologies related to big data including cloud computing, Internet of Things, data center, Hadoop, relationship between IoT and big data, relationship between hadoop and big data, big data generation and acquisition includes data collection, data transmission, data pre-processing, big data applications.

UNIT 2

Big Data Analytics and Storage: Big data analysis, big data analytic methods and tools, Pig, Hive, Flume, Mahout, Big data storage, distributed storage system for massive data, storage mechanism for big data GFS, HDFS, HBase, MongoDB, Cassandra, big data storage deduplication techniques, fixed-size and variable-size blocks based deduplication, content defined chunking, frequency based chunking, byte and multibyte indexing techniques, Cloud storage.

UNIT 3

Big Data Compression: Big data delta compression, Xdelta implementation, Message Digest (MD5), Secure Hash Algorithm (SHA-1/SHA-256), Gear Hash, Tiger Hash, Rabin and Incremental Secure Fingerprint based deduplication, lossless duplicate and similar data elimination approaches, Parallel deduplication and compression using PCOMPRESS, Scalable Decentralized Deduplication Store (SDDS) using Cassandra.

UNIT 4

Big Data Processing: Installation procedure with system requirements for Apache Hadoop, Cassandra, Spark, Pig, Hive, HBase, MongoDB large scale distributed storage systems, Map Reduce programming model working, YARN architecture, Apache Pig and Hive architecture, Single node and Multi-nodes Hadoop Cluster Set up and running a Big Data example, NoSQL implementation.

Text/Reference Books:

1. "Big Data" by Viktor Mayer-Schönberger, Kenneth Cukier, ISBN:978-0544002692, Eamon Dolan/Houghton Mifflin Harcourt 2013.
2. “Big Data Now”, by O’Reilly Media Inc., ASIN: B0097E4EBQ, O’Reilly 2012.
3. “Hadoop Operation”, by Eric Sammer, ISBN: 978-1449327057, O’Reilly 2012.
4. “MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems”, by Donald Miner, Adam Shook, ISBN:978-1449327170, O’Reilly 2012.
5. “Programming Hive”, by Edward Capriolo, ISBN: 978-1449319335,O’Reilly 2012.
6. “HBase: the Definitive Guide”, by Lars George, ISBN: 978-1449396107, O’Reilly 2011.

EENO-305A	VLSI Circuits						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	To make students aware about the CMOS logic design						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To understand Transistor-Level CMOS Logic Design.						
CO2	To learn Estimation and Optimization of combinational circuits using RC delay models and logical efforts						
CO3	To design models of moderately sized CMOS circuits that realize specified digital functions.						
CO4	To make an understanding of the characteristics of CMOs circuit construction.						

UNIT-I

Introduction to MOS Transistor Theory: nMOS, pMOS Enhancement Transistor, MOSFET as a Switch, Threshold voltage, Body effect. MOS Device Design Equations, Basic DC equations, Short Channel Effects and Device Models – Scaling Theory, Threshold Voltage Variation, Mobility Degradation with Vertical Field, Velocity Saturation, Hot Carrier Effects, Output Impedance Variation with Drain- Source Voltage, MOS Device Models, Small Signal AC Characteristics and Modeling of MOS Transistors using SPICE.

UNIT-II

Introduction, Voltage Transfer Characteristic (VTC), Noise Immunity and Noise margins, Resistive-Load Inverter, Inverters with n-Type MOSFET Load and CMOS Inverter, DC Characteristics of CMOS Inverter, Calculation of VIL, VIH, VOL, VOH and Vth, Design of CMOS Inverters, Supply Voltage Scaling in CMOS Inverters, Power and Area considerations.

UNIT-III

Switching Characteristics of CMOS Inverter- Delay-Time Definitions, CMOS Propagation Delay, Calculation of Delay times, Estimation of Interconnect parasitic- Interconnect Capacitance Estimation, Interconnect Resistance Estimation, Layout of an Inverter, Calculation of Interconnect Delay- RC Delay Models, The Elmore Delay, Buffer Chains, Low Swing Drivers, Power Dissipation-Switching, Short-Circuit and Leakage Components of Energy and Power, Power-Delay Product, Power Distribution and Performance Optimization of Digital Circuits by Logical Effort Sizing; CMOS Ring Oscillator Circuit.

UNIT-IV

COMBINATIONAL MOS LOGIC CIRCUITS- CMOS Logic Circuits (NAND, NOR and Complex Logic Gates, Multiplexers etc.), CMOS Transmission Gates (Pass Gates), Pseudo nMOS logic, Dynamic CMOS logic, Clocked CMOS logic and CMOS Domino logic. Sequential MOS logic circuits-Behavior of Bistable Elements, The SR Latch Circuit, Clocked Latch and Flip-Flop Circuits, CMOS D-Latch and Edge-Triggered Flip-Flop.

Subsystem design process- design of 4-bit shifter, arithmetic building blocks like adders, multipliers and ALU.

Text/Reference Books:

1. Sung-Mo Kang & Yusuf Leblebici, “CMOS Digital Integrated Circuits – Analysis and Design”, 3rd Edition, Tata McGraw-Hill, New Delhi, 2003.
2. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, “Digital Integrated Circuits: a design perspective”, 2nd Edition, Pearson Education, 2003.
3. David A. Hodges, Horace G. Jackson, Resve A. Saleh, “Analysis and Design of Digital Integrated Circuits: In Deep Submicron Technology”, McGraw, 2003.
4. David A. Johns and Ken Martin, “Analog Integrated Circuit Design” John Wiley and Sons Inc., 1997.
5. Neil Weste and David Harris, “CMOS VLSI Design: A Circuits and Systems Perspective”, 4th Edition, Addison-Wesley, 2010

EENO-307A	Power Plant Engineering						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	0	0	3	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of different types of power plants for power generation.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Illustrate working of coal and gas based power plants and their combined operations						
CO2	Illustrate working of nuclear fission reaction based power plants and types of reactors						
CO3	Illustrate working of different non-conventional power plants like geothermal, ocean energy based and biogas based power generation.						
CO4	Evaluate cost of power generation and to know about economics of power generation.						

UNIT 1

Coal and Gas Based Power Plants: Working of Coal based thermal power plants, basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, steam turbines, condensers, steam and heating rates, sub-systems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and co-generation systems.

Combined Operation of Power Plants: Gas turbine and combined cycle power plants, components of gas turbine power plants, combined cycle power plants.

UNIT 2

Nuclear Power Plants and Nuclear Reactors: Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants.

UNIT 3

Non-Conventional Power Generation: Hydroelectric power plants, classification Hydroelectric power plants, typical layout and components, principles of wind power generation, tidal power generation, solar PV cells for power generation and geothermal power generation ,biogas power plant and Fuel cells.

UNIT 4

Economic Considerations: Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.

Text Books:

1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill,2008.
2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill,2010.
3. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nded., McGraw Hill,1998.
4. Non-Conventional energy sources by Rai G D, Khanna Publishers.

EE-313A	Power System Lab-I						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time(Hrs)**
0	**0**	**2**	**1**	**60**	**40**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various relays, insulators and transmission line modelling						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To understand various types of relay						
CO2	To study parallel operation of alternator						
CO3	To understand the concept of various insulators						
CO4	To understand the concept of transmission line modeling						

LIST OF EXPERIMENTS

1. Experiment to find out the dielectric strength of transformer oil.
2 Experiment to find zero sequence component of three phase line.
3 Draw the characteristics of thermal overload relay.
4. Experiment to study an IDMT over current relay & plot it's characteristic curves i.e. graph between current & time.
5 Experiment to study differential relay characteristics.
6 Experiment to measure the ABCD parameters of a given transmission line, also study Ferranti effect.
7 Experiment to study Parallel operation of two alternators.
8 Experiment to plot the power angle characteristics of given transmission line.
9 Experiment to find the string efficiency of a string insulator with/without guard rings.
10 Experiment to study the characteristics of transmission line for t-network & pie- network.
11 Testing of a current transformer & find Ratio Error & Phase angle error for various burdens.
12 To study various types of distance relay.
13 Experiment to study fault current using sequence impedance network.

NOTE: At least 10 experiments are to be performed with at least 8 from above list, remaining 2 may either be performed from the above list or designed & set by concerned institution as per the scope.

EE-315A	Microprocessors Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time(Hrs)**
0	**0**	**2**	**1**	**60**	**40**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of microprocessor kit, assembly language.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To understand the 8086 Trainer Kit						
CO2	To study the ramp, triangular waveform						
CO3	To understand the RAM location						
CO4	To generate the various waveform						

LIST OF EXPERIMENTS

1. a) Familiarization with 8086 Trainer Kit.
b) Familiarization with Digital I/O, ADC and DAC Cards.
c) Familiarization with Turbo Assembler and Debugger S/Ws.
2. Write a program to arrange block of data in
a) Ascending and b) Descending order.
3. i) Program for finding largest number from an array. ii) Program for finding smallest number from an array.
4. Write a program to find out any power of a number such that Z = XN, Where N is programmable and X is unsigned number.
5. Write a program to generate:
(i) Sine wave form (ii) Ramp waveform (iii) Triangular waveform using DAC card.
6. Write a program to measure frequency/time period:
(i) Sine wave form (ii) Ramp waveform (iii) Triangular waveform using DAC card.
7. Copy a byte in TCON to register R2 using at least four different methods.
8. Store the no. 8DH in RAM location 30 H to 34 H.
9. Write a program load the unsigned no. found in internal RAM location 5H,26H& 27 H together and put the result in RAM locations 31H MSB and 30H LSB.
10. Find the address of first two internal RAM locations between 20H and 60H which contain consecutive nos. if so, set the carry to1, and else clear the flag.

NOTE: At least 10 experiments are to be performed with at least 8 from above list, remaining 2 may either be performed from the above list or designed & set by concerned institution as per the scope.

EE-317A	Control Systems Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time(Hrs)**
0	**0**	**2**	**1**	**60**	**40**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various controller and compensation technique.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To understand the various simulator						
CO2	To study the various compensation technique						
CO3	To study the speed control of dc motor						
CO4	To study the various error detector.						

LIST OF EXPERIMENTS:

1. Experiment to study linear system simulator.

2. To study the stroboscope & measure the shaft speed

2. Experiment to study light intensity control using P & PI controller with provision for and transient speed control.

3. Experiment to study D.C motor speed control.

4. Experiment to study the stepper motor characteristics and its control through microprocessor kit.

5. Experiment to study Temperature control system.

6. Experiment to study Compensation design.

7. Experiment to study Digital control system.

8. Experiment to study Synchros.
10. Experiment to study AC Position control system.
11. Experiment to study Potential Metric Error detector.

NOTE: At least 10 experiments are to be performed with at least 8 from above list, remaining 2 may either be performed from the above list or designed & set by concerned institution as per the scope.

EE-302A	Power System-II						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**1**	**0**	**4**	**75**	**25**	**100**	**3**
Program Objective (PO)	To enable students to analyses power system networks, faults in power system, transient and bus impedance algorithm						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the concepts of per unit system						
CO2	Understand the various faults in power system						
CO3	Understand the transients in power system						
CO4	Determine methods of impedance matrix calculation.						

UNIT-I

Introduction: Characteristics & representation of components of a power system, synchronous machines, transformers, lines cables & loads. Single line diagram of a power system Flow of zero sequence current, zero sequence impedance diagrams of power system with different types of connections of three phase transformers.

Per unit system: Per unit method of representing quantities, Advantages and disadvantages of per unit system, determination of base impedance, per unit impedance of two winding transformer.

UNIT-II

Symmetrical faults: calculation of fault currents, use of current limiting reactors.

Unsymmetrical faults: Types of transformation in power system analysis, symmetrical components transformation, sequence impedance of power system elements, Sequence network of power system analysis of unsymmetrical short faults, Network analysis & its application to interconnected system.

UNIT-III

Transients in Power Systems: Transient electric phenomenon, lighting & switching surges, traveling waves, Surge impedance and velocity of propagation, reflection & refraction of waves, reflection & refraction of waves with different line termination, equivalent circuit for travelling wave studies, Bifurcated line, Travelling wave on a line terminated by inductance, capacitance

UNIT-IV

Bus Impedance and admittance matrices: Building algorithms for bus impedance matrix, modification of bus impedance matrix for change of reference bus and for network changes, formation of bus admittance matrix and modification of three-phase network elements, treatment under balanced and unbalanced excitation, transformation matrices, and unbalanced elements.

Reference Books:

1. Elements of Power System Analysis by W.D. Stevenson.
2. Electric Power System by B.M. Weddy.
3. The transmission & Distribution of Electric Energy by H. Cotton.
4. Power System & Protection by S.S. VADHERA

HM-901A	Organizational Behavior						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various methods adopted in organizational behavior.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To study the structure of organization						
CO2	Understand the behavior of individual						
CO3	To study the group behavior in an organization.						
CO4	Understand the human resource management policies.						

UNIT-1

Introduction to organization, organization and managers, manager' roles and skills, behavior at work, introduction to organization behaviour, major behavioural science disciplines contributing to OB, challenges and opportunities managers have in applying OB concepts, OB model (including motivation models) and levels of OB model

UNIT-2

Introduction to individual behaviour, values, attitudes, job satisfaction, personality, perception and individual decision making, learning, motivation at work, managing emotions and stress (Meaning-Definition Stress and job performance relationship Approaches to stress management (Coping with stress)

UNIT-3

Introduction to group behaviour, foundations of group behaviour, concept of group and group dynamics, types of groups, formal and informal groups, theories of group formation, group norms, group cohesiveness, group decision making, inter group behaviour, concept of team vs. group, types of teams, building and managing effective teams, leadership theories and styles, power and politics, conflict and negotiation.

UNIT-4

Foundations of organization structure, organization design, organization culture, organization change, managing across cultures, human resource management policies and practices, diversity at work.

Books Recommended:

1. Robbins, S. P/ Judge, T. A/ Sanghi, S., Organizational Behavior, Pearson Publication
2. Aswathappa, K., Organisational Behaviour– Text and Problem, Himalaya Publication
3. Pardeshi, P. C., Organizational Behaviour & Principles & Practice of Management, Nirali publication

EEP-304A	Power System Protection						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of different types of circuit breaker, Relay and different types of protection scheme.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Study the arc formation and interruption.						
CO2	Understand the various types of circuit breaker						
CO3	Understand the different types of relays						
CO4	Study various types of protection scheme.						

UNIT 1

Neutral grounding: Need for neutral grounding, various types of neutral grounding
Circuit Interruption: Circuit interruption, theory of arc formation and it's excitation in DC, AC circuits, restriking & recovery voltage, interruption of capacitive & inductive currents. Rupturing capacity & rating of circuit breakers. Resistance switching

UNIT 2

Circuit-Breakers: Classification of circuit-breakers, Oil circuit breaker, Air blast circuit breaker, SF6 circuit breaker, Vacuum circuit breaker, HVDC circuit breaker. Auto-restoring of high capacity & H.V. circuit breakers. Breaker operating mechanisms, Types of circuit breaker mountings and enclosure, comparison between different types of circuit breaker

UNIT 3

Protective System: features of good protective system, elements of relay, terms connected with relay, Electromagnetic attraction and induction relays, Overcurrent Relay, Differential relay, distance or impedance relay, static relays: Need, Essential components of static relay, comparison with electromagnetic relay

UNIT 4

Transformer Protection: Buchholz protection, Differential protection, restricted earth fault protection
Alternator protection: Stator and rotor protection, Merz Price Protection, Balance earth fault protection
Bus bar Protection: Differential overcurrent protection, Frame leakage protection
Transmission line protection: Time graded protection, Current graded protection, and Differential protection

Reference Books:-

1. Power System Protection & Switchgear, Ravinder Nath, New Age
2. Power System Protection & Switchgear, Badri Ram, MGH
3. Protection & Switchgear, Bhalja, Maheshwari, Oxford
4. Switch gear and protection, J.B. Gupta, Katson Books

EEP-306A	Electrical Energy Conservation and Auditing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of energy conservation act, tariff and energy auditing.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Study the different energy conservation act						
CO2	Understand the various tariff and load management						
CO3	Understand the different types of energy auditing						
CO4	Study various types of motors.						

UNIT-I

Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features.

UNIT-II

Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity.

UNIT-III

Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement. Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit.

UNIT-IV

Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities, assessment of cooling towers.

Suggested Books:

1. Albert: Plant Engineers & Managers Guide to Energy Conservation.
2. Wayne C. Turner Energy management handbook, John Wiley and Sons.
3. Guide to Energy Management, Cape Hart, Turner and Kennedy
4. Cleaner Production – Energy Efficiency Manual for GERIAP, UNEP, Bangkok prepared by National Productivity Council
5. M. K. Lahiri : Saving of Electricity by System Management. M.K. Lahiri Publication
6. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (available online)

EEP-308A	Biomedical Signal & Image Processing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	To make students aware about the fundamentals and various techniques of biomedical image processing and to develop the algorithms for image analysis and diagnosis in medical imaging						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To understand image fundamentals and acquisition techniques						
CO2	To learn Image Enhancement in Spatial and Frequency domain						
CO3	To learn Morphological Image Processing and Image Segmentation.						
CO4	To learn image compression and representation.						

UNIT-I

Fundamentals of Digital Image: Image formation, visual perception, CCD & CMOS Image sensor, Image sampling: Two dimensional Sampling theory, Nonrectangular grid and Hexagonal sampling, Optimal sampling, Image quantization, Non uniform Quantization, Image formats. Types of pixel Operations, Types of neighborhoods, adjacency, connectivity, boundaries, regions, 2D- convolution, Color models.

UNIT-II

Image Enhancement in Spatial and Frequency domain: Basic gray level transformations, histogram processing, Smoothing operations, Edge Detection-derivative based operation, filtering in frequency domain, 2D-DFT, Smoothing frequency domain filters, Sharpening frequency domain filters, Homomorphic filtering.

UNIT-III

Morphological Image Processing: Dilation and Erosion, Opening and Closing, Hit-or-Miss transformation, Boundary Extraction, Region filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening, Skeletons, Pruning.

Image Segmentation: Detection of discontinuities, Point-line- edge detection, Linear and Circular Hough Transform, Basic Global and Adaptive Thresholding, Region Based segmentation, K-Means Clustering

UNIT-IV

Image Compression: Fundamentals of Image compression models, Lossless compression: variable length coding, LZW coding, Arithmetic coding, Lossy compression: Wavelet and DCT coding, Predictive coding. Representation and Description: Image features, Feature extraction, Chain code, Moments

Text Books:

1. Digital Image Processing, Gonzalez and Woods- Pearson Education
2. Digital Image Processing, S. Sridhar – Oxford University Press.
3. Fundamentals of Digital Image Processing, A.K. Jain .P.H.I.
4. Digital Image Processing, William Pratt- John Wiley.
5. Feature Extraction and Image Processing, Mark S. Nixon and Alberto S. Aguado.
6. Digital Image Processing and Analysis, Chanda Majumder- Printice Hall India.
7. Medical image processing, Geoff Dougherty editor, springer.

EEO-320A	Electrical Materials						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various types of electrical engineering materials.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the concepts of conductors						
CO2	To study the various types of insulators						
CO3	Classify the different types of magnetic materials						
CO4	To study the different types of processes.						

UNIT-I

Conductors, Properties of conductors, ACSR, High resistivity materials and their properties, Alloys, Soldering and brazing materials, superconductivity, super conductor materials and their applications.

UNIT-II

Insulators, classifications of insulators, dialectical materials, glass and ceramics, refractory materials and their uses, optical fibers, laser and opto-electronics materials, semiconductor materials, properties of semiconductor materials, thermosetting and thermoplast materials.

UNIT-III

Classification of material, Dia, Para, and Ferro magnetic materials-curie law and curie Weiss law (qualitative study).Ferromagnetism-Qualitative study of domain theory – Hysteresis phenomena. Hard and soft magnetic material and their applications. Ferrites, Structure and property.

UNIT-IV

Processes used in Plano technology e.g. Lapping, polishing, cleaning, masking, photolithography, diffusion, oxidation and metallization, welding, wire bonding, packaging and encapsulation, Heating- induction and dielectric, Electron beam welding and cutting, annealing, cold &Hot rolling.

REFERENCES :

1. SP Seth “A course in Electrical Engg. Material” (Dhanpat Rai & Sons).
2. Dekker, “Electrical Engg. Materials” (PHI).
3. PL Kapoor,”A text book of Electrical Engg. Material” (Khanna Publishers).

EEO-322A	Strength of Materials						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of calculation of strength of different types of geometry.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To understand the nature of stresses developed in simple geometries						
CO2	To calculate the elastic deformation occurring in various simple geometries						
CO3	To calculate the moment of inertia in various simple geometries						
CO4	To calculate the torsion and stress in various simple geometries						

UNIT-1

Deformation in solids- Hooke's law, stress and strain- tension, compression and shear stresses- elastic constants and their relations- volumetric, linear and shear strains- principal stresses and principal planes- Mohr's circle.

UNIT-2

Beams and types transverse loading on beams- shear force and bend moment diagrams- Types of beam supports, simply supported and over-hanging beams, cantilevers. Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, point and distributed loads.

UNIT-3

Moment of inertia about an axis and polar moment of inertia, deflection of a beam using double integration method, computation of slopes and deflection in beams, Maxwell's reciprocal theorems.

UNIT-4

Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection of helical springs.

Text Books:

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001.
2. R. Subramanian, Strength of Materials, Oxford University Press, 2007.
3. Ferdinand P. Been, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGraw Hill Publishing Co. Ltd., New Delhi 2005.

EENO-306A	Internet of Things						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	To make students aware about the Internet of Things architecture(IoT) and IoT sensor's application in IoT						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To understand basics of Internet of Things architecture.						
CO2	To understand the role of cloud and fog in IoT						
CO3	To understand the role of sensors in IoT						
CO4	To understand Software Hardware Frameworks						

UNIT-I

Introduction to Internet of Things(IoT): IoT definition, Characteristics, IoT Complete Architectural Stack – IoT enabling Technologies, Protocols for IoT – Infrastructure protocol (IPV4/V6/RPL), Identification (URIs), Transport (Wifi, Lifi, BLE), Discovery, Data Protocols, Device Management Protocols. Cloud Computing Introduction: Service Models, Deployment Models, Virtualization Concepts, Different Cloud Platforms – Amazon AWS, Microsoft Azure, Google and IBM Cloud. IoT and the Cloud, Role of Cloud Computing in IoT.

UNIT-II

FOG COMPUTING: Fog Computing-Definition-Characteristics-Application Scenarios - Issues – Fog Computing and Internet of Things-Pros and Cons-Myths of Fog Computing -Need and Reasons for Fog Computing Fog Computing and Edge Computing-IoT , FOG, Cloud-Benefits, Fog architecture , Fog Protocol-Fog Kit- Proximity Detection Protocols- DDS/RTPS computing protocols

UNIT-III

Sensors for IoT Applications: Generations of IoT Sensors: Industrial sensors – Description & Characteristics–First Generation – Description & Characteristics–Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics.

UNIT-IV

Software Hardware Frameworks: Software: open Framework - "Arduino" Language (C/C++) - Hardware: Desktop / Laptop / Raspberry Pi - How to approach a programming problem? Sensors and Hardware for IoT, Understanding hardware platforms – Arduino, Raspberry Pi, Node MCU. Sensors and Software: Understanding Processing Code Structure, variables and flow control, Interfacing to the Real World

References:

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", Springer
2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-On-Approach)", VPT, 2014.
3. John Rhoton, Cloud Computing Explained: Handbook for Enterprise Implementation 2013 edition.
4. Raj kumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Mastering Cloud Computing: Foundations and Applications Programming, Morgan Kaufmann, Elsevier publication, 2013
5. Making Sense of Sensors: End-to-End Algorithms and Infrastructure Design by Omesh Tickoo, Ravi Iyer 2016
6. Programming Interactivity, Second Edition By Josha Noble, 2012
7. Programming the Raspberry Pi: Getting Started with Python 2E, 2016

EE-310A	Electrical Measurements and Measuring Instrumentation						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various types of electrical measurements and measuring instruments.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To study the generalized instruments.						
CO2	To study the various types of measuring instruments						
CO3	Understand the concept of wattmeter and energy meter						
CO4	To study the different types of bridge.						

UNIT-1

MEASURING SYSTEM FUNDAMENTALS: Classification of instruments (Absolute & Secondary Instruments: indicating, recording &integrating instruments: based upon Principle of operation). Generalized instrument (Block diagram, description of blocks). Three forces in electromechanical indicating instrument (Deflecting, controlling & damping forces). Comparison between gravity & spring controls: comparison of damping methods & their suitability bearing supports, pivot-less supports (simple & taut-band). Scale information, instrument cases (covers).

UNIT – II

MEASURING INSTRUMENTS: Construction, operating principle, Torque equation, shape of scale, use as Ammeter or as Voltmeter (Extension of Ranges). Advantages & disadvantages, errors (both on AC/ DC) of PMMC types, electrodynamic type, moving iron type (attraction, repulsion & combined types). Hot wire type & Induction type, electrostatic type instruments. Introduction of Q meter

UNIT – III

WATTMETERS & ENERGY METERS: Construction, operating principle, torque equation, shape of scale, errors, Advantages & disadvantages of Electrodynamics & induction type watt meters; single phase induction type Energy meter, Compensation & creep in energy meter.

POWER FACTOR METERS: Construction, operating principle, torque equation, advantages & disadvantages of Single phase power factor meters (Electrodynamics & moving iron types)

UNIT – IV

LOW & HIGH RESISTANCE MEASUREMENTS: Kelvin's double bridge method, Difficulties in high resistance measurements, Measurement of high resistance by direct deflection, loss of charge method, Megaohm Bridge & meggar.

A. C. BRIDGES: General balance, Circuit & Phasor diagram, applications, advantages/disadvantages of: Maxwell's inductance, inductance-capacitance, Hays, Anderson, Owens, De-Sauty's, Schering & Weins Bridges.

REFERENCE BOOKS:

1. A Course in Elect. & Electronics Measurement & Instrumentation by A.K. Sawhney; Khanna Pub.
2. Electronics & Electrical Measurement & Instrumentation by J.B. Gupta, Kataria& Sons.
3. Electronics Instrumentation & Measurement technique, W.D. Copper &A.dHelfrick.
4. Measuring Systems by E.O. Doeblin; TMH.

EE-312A	Power System Lab -II						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time(Hrs)**
0	**0**	**2**	**1**	**60**	**40**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of programming in power system.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To develop the program for Y- bus and Z-bus						
CO2	To develop the program load flow analysis.						
CO3	To develop the program for different mathematical operation.						
CO4	To develop the program for Gauss Seidal method.						

List of Experiments:

1. Develop a program to do the following mathematical operations:
   i) Transpose of a matrix
   ii) Multiplication of two matrices
   iii) Addition & subtraction of two matrices.
2. Write a program to formulate Y-Bus by non- singular transformation Y Bus = [A], T[= y] [A].
3. Develop a program to solve a set of 4 simultaneous liner equations using Gaussian Elimination
   method.
4. Develop a program to calculate Z bus of a given network using building algorithm. Assume that no mutual coupling is involved in between the different elements.
5. The Gauss Seidel method to find the solution of following equations
   X1 + X1X2 + X3 = 10
   X1 + X2 + X3 = 6
   X1 X2 – X3 = 2
6. You have given with a 6 bus system. Apply load flow technique using Gauss Seidel method to solve up to two iterations.
7. Develop a program to find Eigen Values for given Matrix.
8. Develop a program to determine the bus impedance matrices for the given power system network.
9. Develop a program to determine the admittance matrices for the given power system network.
10. To conduct the load flow analysis of power system networks (not more than 6 bus) on any dedicated using Newton Raphson method.

Note: At least seven experiments should be performed from above list on any dedicated software platform. Remaining three experiments may either be performed from above list or designed & set by concerned institution as per scope of syllabus.

EE-314A	Measurements and Instrumentation Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time(Hrs)**
0	**0**	**2**	**1**	**60**	**40**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various types of instruments and measurement of resistance, inductance and capacitances						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To understand the different types of meters.						
CO2	To measure the low and high resistance						
CO3	To calculate the inductance and capacitance using bridge.						
CO4	To measure the energy and power .						

LIST OF EXPERIMENTS:

1. To identify the meters from the given lot w.r.t application.
2. To convert & calibrate a D'Arsonnal type galvanometer into a voltmeter & an ammeter.
3. To calibrate an energy meter with the help of a standard wattmeter & a stop watch
4. To measure power & p.f. in 3-phase circuit by 2-watmeter method using P. T and C.T.
5. To measure capacitance by De Sauty's bridge.
6. To measure inductance by Maxwell's bridge.
7. To measure frequency by Wien's bridge.
8. To measure magnitude & phase angle of a voltage by rectangular type potentiometer.
9. To measure magnitude & phase angle of a voltage by polar type potentiometer.
10. To measure low resistance by Kelvin's Double bridge.
11. To measure high resistance by loss of charge method.
12. To measure R,L,C, by Q metre

Note: At least seven experiments should be performed from above list. Remaining three experiments may either be performed from above list or designed & set by concerned institution as per scope of syllabus.

EEN-316A	Electronic Design Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time(Hrs)**
0	**0**	**2**	**1**	**60**	**40**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of design of various types of electronics circuit.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To study the characteristics of different types diode.						
CO2	To plot the characteristics of different types of BJT.						
CO3	Design of half and full wave rectifier.						
CO4	Characteristics of special devices-UJT and SCR						

List of Experiments:

1. V-I Characteristics of Silicon and Germanium diodes and measurement of static and dynamic resistances
2. Zener diode characteristics and its application as voltage regulator
3. Design, realization and performance evaluation of half wave rectifiers without filters and with LC & pi section filters
4. Design, realization and performance evaluation of full wave rectifiers without filters and with LC & pi section filters
5. Plotting the characteristics of BJT in Common Base configuration and measurement of h-parameters
6. Plotting the characteristics of BJT in Common Emitter configuration and measurement of h-parameters
7. Plotting the characteristics of JFET in CS configuration and measurement of Trans-conductance and Drain resistance
8. BJT biasing circuits
9. FET biasing circuits
10. Common Emitter BJT Amplifier and measurement of Gain, bandwidth, input and output impedances
11. Common Source FET Amplifier and measurement of Gain, bandwidth, input and output impedances
12. Emitter Follower / Source Follower circuits and measurement of Gain, bandwidth, input and output impedances
13. Characteristics of special devices-UJT and SCR

Note: At least seven experiments should be performed from above list on any dedicated software platform. Remaining three experiments may either be performed from above list or designed & set by concerned institution as per scope of syllabus.

KURUKSHETRA UNIVERSITY KURUKSHETRA

Bachelor of Technology(Electrical & Electronics Engineering)(Credit Based)
Scheme of Studies/Examination
SemesterVII(w.e.f.session2021-2022)

S. No.	Course No.	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1	HM- 904A	IntellectualPropertyRightsfor Technology Development& Management	3:0:0	3	3	75	25	0	100	3
2	EENP*	Program Elective - III	3:0:0	3	3	75	25	0	100	3
3	EENP*	Program Elective - IV	3:0:0	3	3	75	25	0	100	3
4	EENO*	Open Elective - III	3:0:0	3	3	75	25	0	100	3
5	EEN-401LA	Project Stage-I	0:0:6	3	3	-	40	60	100	3
6	**EEN-403A	Industrial Training-III	2:0:0	2	-	-	*100	-	*100	3
		Total		**17**	**15**	**300**	**140**	**60**	**500**	

***The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.**

**EEN-403A is a mandatory credit-less course in which the students will be evaluated for the industrial training undergone after 6th semester and students will be required to get passing marks to qualify.

Program Elective-III	
Course No.	**Course Name**
EENP-401A	Industrial Electrical System
EENP-403A	Digital Control System
EENP-405A	High Voltage Engineering

Program Elective-IV	
Course No.	**Course Name**
EENP-407A	Electric Drives
EENP-409A	Wind and Solar Energy
EENP-411A	Computational Electromagnetic

Open Electives-III	
Course No.	**Course Name**
EENO-401A	Electronic Devices
EENO-403A	Data Structure & Algorithms
EENO-405A	Signal and Image Processing

KURUKSHETRA UNIVERSITY KURUKSHETRA

Bachelor of Technology (Electrical & Electronics Engineering) (Credit Based)
Scheme of Studies/Examination
Semester VIII (w.e.f. session 2021-2022)

S. No.	Course No.	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam. (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	EENP*	Program Elective-V	3:0:0	3	3	75	25	0	100	3
2	EENP*	Program Elective-VI	3:0:0	3	3	75	25	0	100	3
3	EENO*	Open Elective-IV	3:0:0	3	3	75	25	0	100	3
4	EENO*	Open Elective-V	3:0:0	3	3	75	25	0	100	3
5	EEN-402LA	Project Stage-II	0:0:12	12	6	-	40	60	100	3
		Total		**26**	**20**	**300**	**140**	**60**	**500**	

Program Elective- V		**Program Elective-VI**	
Course No.	**Course Name**	**Course No.**	**Course Name**
EENP-402A	Power Quality & FACTS	EENP-408A	HVDC Transmission System
EENP-404A	Control System Design	EENP-410A	Power System Dynamics and Control
EENP-406A	Electrical & Hybrid Vehicles	EENP-412A	Advanced Electric Drives

Open Elective- IV		**Open Elective-V**	
Course No.	**Course Name**	**Course No.**	**Course Name**
EENO-402A	Analog & Digital Communication	EENO-408A	Mobile Communication & Networks
EENO-404A	Wavelets Transform	EENO-410A	Thermal and Fluid Engineering
EENO-406A	Embedded System	EENO-412A	Automobile Engineering

***The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.**

HM- 904A	Intellectual Property Rights for Technology Development & Management						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	0	0	3	75	25	100	3
Program Objective (PO)	The objective of this course is to familiarize the students with the basic concepts of Intellectual Property Rights for technology development & management and new developments in the field of IPR						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand basics of Intellectual Property Rights and importance of IPR						
CO2	Understand law of copy rights and law of patents						
CO3	Learn about industrial designs & their protection law and trade marks						
CO4	Learn about Trade Secrets and new developments in the field of IPR						

UNIT- I

Introduction: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT- II

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, Patent and kind of inventions protected by a patent, ownership rights and transfer. Case studies of patents.

UNIT- III

Industrial Designs: Introduction, need to protect industrial design, **industrial designs protection law.**

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT IV

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation. Unfair competition: Misappropriation right of publicity, false advertising.

New developments: New developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

Text Books/References:

1. P. Ganguli; Intellectual property right – Unleashing the knowledge economy, Tate McGraw Hill Publishing company ltd.

2. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000.

3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010

4. Deborah. E. Bouchoux; Intellectual property right, Cengage learning.

5. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006

EENP-401A	Industrial Electrical System						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	To provide knowledge about various concepts of industrial electrical systems and their automation						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand residential and commercial electrical systems						
CO2	Understand various types of illumination systems and lighting schemes used for a residential and commercial premises						
CO3	Understand various concepts of industrial electrical systems						
CO4	Understand the concept related to industrial electrical system automation						

UNIT- I

Residential and Commercial Electrical Systems: Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components

UNIT- II

Illumination Systems: Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting

UNIT- III

Industrial Electrical Systems I : HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

UNIT IV

Industrial Electrical Systems II : DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks

Industrial Electrical System Automation: Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation

Text Books/References:

1. S. L. Uppal and G. C. Garg, "Electrical Wiring, Estimating &Costing", Khanna publishers, 2008.

2. K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.

3. S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997. Web site for IS Standards.

4. H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008

.EENP-403A	Digital Control System						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	To enable students to design and analyze discrete time (digital) control system						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Represent discrete time systems under the form of z-domain transfer functions and state-space models. Also able to obtain the model of discrete-time systems by pulse transfer function						
CO2	Analyze stability, transient response and steady state behaviour of linear discrete time systems, analytically and numerically using tools such as MATLAB and Simulink						
CO3	Design sampled data control systems.						
CO4	Describe Discrete state space model and test controllability and observability of systems						

UNIT- I

Introduction to digital control: Introduction, Discrete time system representation, Mathematical modelling of sampling process, Data reconstruction.

Modelling discrete-time systems by pulse transfer function

Revisiting Z-transform, Mapping of s-plane to z-plane, Pulse transfer function, Pulse transfer function ofclosed loop system, Sampled signal flow graph

UNIT- II

Stability analysis of discrete time systems: Jury stability test, Stability analysis using bi-linear transformation, Time response of discrete systems, Transient and steady state responses, Time response parameters of a prototype second order system.

UNIT- III

Design of sampled data control systems: Root locus method, Controller design using root locus, Root locus-based controller design using MATLAB, Nyquist stability criteria, bode plot, Lead compensator design using Bode plot, Lag compensator design using Bode plot, Lag-lead compensator design in frequency domain.

UNIT IV

Discrete state space model: Introduction to state variable model, Various canonical forms, Characteristic equation, state transition matrix, Solution to discrete state equation. Controllability, observability and stability of discrete state space models: Controllability and observability, Stability, Lyapunov stability theorem.

Text Books/References:

1. B. C.Kuo, Digital Control Systems, Oxford University Press, 2nd Edition, Indian Edition, 2007.
2. K. Ogata, Discrete Time Control Systems,Prentice Hall, 2ne Edition, 1995.
3. M. Gopal, Digital Control and State Variable Methods, McGraw Hill, 2/e, 2003.
4. G. F. Franklin, J. D.Powell and M. L. Workman, Digital Control of Dynamic Systems, Addison Wesley, 1998, Pearson Education, 3rd Edition.
5. K. J.Astroms and B. Wittenmark, Computer Controlled Systems - Theory and Design, Prentice Hall, 3rd Edition, 1997.

EENP-405A	High Voltage Engineering

Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	To enable students to understand important concepts of high voltage engineering						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the concept of electrostatic field and effect of high electrostatic field over Gases, Liquid and solid dielectric						
CO2	Understand the concept of generation of high voltages and currents in the system						
CO3	Measure high voltages and currents in the system						
CO4	Perform Non-destructive and high voltage testing on various components of power system						

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UNIT I

Electrostatic Field and Field Stress Control: Electric field stresses, Numerical methods for Electric field computation, Finite Element Method, Charge simulation method.

Conduction and Break Down in Gases: Ionization processes, Townsend's criterion, breakdown in electronegative gases, time lags for breakdown, streamer theory, Paschen's law, break down in non-uniform field, and corona discharge

Break Down in Liquid Dielectrics: Conduction and breakdown in pure liquid and commercial liquid.

Break Down in Solid Dielectrics: Intrinsic breakdown, electromechanical breakdown breakdown of solid, dielectric and composite dielectrics.

UNIT II

Generation of High Voltages and Currents: Generation of high direct current voltages, generation of high alternating voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators..

UNIT III

Measurement of High Voltages and Currents: Measurement of high direct current voltages, measurement of high alternating and impulse Voltages measurement of high direct, alternating and impulse currents, Cathode Ray Oscillographs for impulse voltage and current measurements.

Insulation Coordination in Electric Power Systems: Principle of Isolation Coordination in High-Voltage & Extra-High Voltage Power System.

UNIT IV

Non-Destructive Testing: Measurement of direct current resistively, measurement of dielectric constant and loss factor, partial discharge measurements

High Voltage Testing: Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, testing of transformers, testing of surge arresters, radio interference measurements.

Text Books/References :

1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering, Tata Mc-Graw Hill.

2. C. L. Wadhwa, "High Voltage Engineering", Wiley Eastern Ltd.

3. E. Kuffel and W. S. Zacngal, High Voltage Engineering", Pergamon Press.

4. M. P. Chaurasia , "High Voltage Engineering", Khanna Publishers

5. R. S. Jha, "High Voltage Engineering", DhanpatRai& sons

6. M. Khalifa,' High Voltage Engineering Theory and Practice,' Marcel Dekker.

7. Subir Ray,' An Introduction to High Voltage Engineering' Prentice Hall of India

EENP-407A	Electric Drives						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of dynamics and controls of the electric drives.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the basic fundamentals of electric drives						
CO2	Analyse the dynamics of electric drive during starting and breaking						
CO3	Understand the concepts of power electronic control of DC drives						
CO4	Understand the concepts of power electronic control of AC drives						

UNIT-1

Fundamentals of Electric Drive: Electric Drives and its parts, advantages of electric drives, Classification of electric drives, Speed torque conventions and multi-quadrant operations, Constant torque and constant power operation, Types of load, Load torque: components, nature and classification.

Dynamics of Electric Drive: Dynamics of motor-load combination, Steady state stability of Electric Drive, Transient stability of electric Drive

Selection of Motor Power rating: Thermal model of motor for heating and cooling, classes of motor duty, determination of motor power rating for continuous duty, short time duty and intermittent duty., Load equalization

UNIT-2

Braking of drives: Purpose and types of electric braking, braking of dc, three phase induction and synchronous motors

Dynamics During Starting and Braking: Calculation of acceleration time and energy loss during starting of dc shunt and three phase induction motors, methods of reducing energy loss during starting. Energy relations during braking, dynamics during braking

UNIT-3

Power Electronic Control of DC Drives: Single phase and three phase-controlled converter fed separately excited dc motor drives (continuous conduction only), dual converter fed separately excited dc motor drive, rectifier control of dc series motor. Supply harmonics, power factor and ripples in motor current, Chopper control of separately excited dc motor and dc series motor.

. UNIT-4

Power Electronic Control of AC Drives: Three Phase induction Motor Drive: Static Voltage control scheme, static frequency control scheme (VSI, CSI, and cyclo – converter based) static rotor resistance and slip power recovery control schemes.

Three Phase Synchronous motor: Self-controlled scheme

Special Drives: Switched Reluctance motor, Brushless dc motor. Selection of motor for particular applications

Text/Reference Books:

1. G.K. Dubey, “Fundamentals of Electric Drives”, Narosa publishing House.
2. S.K.Pillai, “A First Course on Electric Drives”, New Age International.

3. V Subrahmanyam, “Electric Drives”, Mcgrawhill Education
4. M.Chilkin, “Electric Drives”,Mir Publishers, Moscow.
5. Mohammed A. El-Sharkawi, “Fundamentals of Electric Drives”, Thomson Asia, Pvt. Ltd. Singapore.
6. N.K. De and Prashant K.Sen, “Electric Drives”, Prentice Hall of India Ltd.
7. V.Subrahmanyam, “Electric Drives: Concepts and Applications”, Tata McGraw Hill.

EENP-409A	Wind and Solar Energy						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the detailed knowledge of working of solar and wind power plants.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the current energy scenario across the country and the world .Students will also be able to get knowledge about various types of energy resources available.						
CO2	Get knowledge about various types of Solar energy systems.						
CO3	Understand the concepts related to wind energy generation.						
CO4	Design hybrid energy systems.						

UNIT 1

Introduction: Energy demand of world and country and gap analysis, Fossil fuel based systems, Impact of fossil fuel based systems, Non conventional energy – seasonal variations and availability, Renewable energy – sources and features, Hybrid energy systems. Distributed energy systems and dispersed generation (DG).

UNIT 2

Solar thermal systems: Solar radiation spectrum, Radiation measurement, Technologies, Applications, Heating, Cooling, Drying, Distillation, Power generation; Costing: Life cycle costing (LCC), Solar thermal system.

Solar Photovoltaic systems : Operating principle, Photovoltaic cell concepts ,Cell, module, array, Series and parallel connections, Maximum power point tracking, Applications ,Battery charging, Pumping , Lighting,Peltier cooling , Costing: Life cycle costing ,Solar PV system

UNIT 3

Wind Energy: Wind power and its sources, Wind patterns and wind data, Site selection, criterion, momentum theory, Types of wind mills, Characteristics of wind generators, performance and limitations of energy conversion systems, Load matching, Life cycle costing - Wind system LCC

UNIT4

Hybrid Energy Systems: Need for Hybrid Systems, Range and type of Hybrid systems, Case studies of Diesel-PV, Wind-PV, Microhydel-PV, electric and hybrid electric vehicles.

Text Books / References:

1. Ashok V Desai, Non-Conventional Energy, Wiley Eastern Ltd, New Delhi
2. Mittal K M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, New Delhi
3. Ramesh R & Kumar K U, Renewable Energy Technologies, Narosa Publishing House, New Delhi
4. Wakil MM, Power Plant Technology, Mc Graw Hill Book Co, New Delhi

EENP-411A	Computational Electromagnetic						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	To understand the basics of electromagnetic fields. To understand the finite element methods and methods of moments. To study the applications of these methods in the wireless communication systems.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	This course defines capacitors, inductors and resistors in terms of its primary electric and magnetic quantities like electric charge, electric potential, electric current, electric and magnetic flux.						
CO2	It illustrates the concept of finite difference methods and finite element methods						
CO3	It also explains universal concepts in three-dimension real world, i.e., electro-magnetic wave propagation in free-space.						
CO4	The students will learn to define electric and magnetic fields, calculate electric and magnetic fields from stationary and dynamic charge and current distributions, solve simple electrostatic boundary problems, describe simple models for electromagnetic interaction with media, be able to choose adequate models and solution methods for specific problems, solve problems analytically and numerically, it also incorporates the understanding of method of moments and their applications.						

UNIT- I

Introduction to electromagnetic fields: review of vector analysis, electric and magnetic potentials, boundary conditions, Maxwell's equations, diffusion equation, Poynting vector, wave equation.

UNIT- II

Finite Difference Method (FDM): Finite Difference schemes, treatment of irregular boundaries, accuracy and stability of FD solutions, Finite-Difference Time-Domain (FDTD) method

UNIT- III

Finite Element Method (FEM): Variational and Galerkin Methods, shape functions, lower and higher order elements, vector elements, 2D and 3D finite elements, efficient finite element computations

.

UNIT- IV

Method of Moments (MOM): Integral formulation, Green's functions and numerical integration, other integral methods: boundary element method, charge simulation method Applications of these methods for EM simulation of waveguides, micro-striplines and other planar components, antennas, scatterers, radars.

Text Books / References:

1. M. V. K. Chari and S. J. Salon, Numerical methods in electromagnetism, Academic Press.
2. M. N. O. Sadiku, Numerical techniques in electro-magnetics, CRC Press.
3. N. Ida, Numerical modeling for electromagnetic non-destructive evaluation, Chapman and Hall.
4. S. R. H. Hoole, Computer aided analysis and design of electromagnetic devices, Elsevier Science Publishing Co.
5. J. Jin, The Finite Element Method in electromagnetics, 2nd Ed., John Wiley and Sons.
6. P. P. Silvester and R. L. Ferrari, Finite elements for electrical engineers, 3rd Ed., Cambridge University Press.

EENO-401A	Electronic Devices						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	To familiarize the students with semiconductor technology and operation of various electronic devices.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the basics of semiconductor and semiconductor technology.						
CO2	Know about various types of Semiconductor diodes						
CO3	Understand the concepts of bipolar transistor and field effect transistors.						
CO4	Know about special semiconductor devices and semiconductor power devices.						

UNIT 1

Semiconductors: Band structure of semiconductor, Electron & hole distribution, current transport in semiconductor & concept about mobility, Diffusion & recombination, the continuity equation & it solution and Hall effect.

Semiconductor technology : Introduction to technology of semiconductor devices , basic of ICs-Bipolar , MOS and CMOS type.

Unit-II

P-N Junction Diodes : Structures technology , V-I characteristics , charge control equation and transient response . Types of P-N junction diode: Tunnel , Zener , Shockley , schottky, varactor diode & circuit : rectifiers , clipping and clamping circuits.

Opto –Electronics : Basic of opto –Electronics , photo Diodes, photo transistor , P-N Junction solar cells , LED , laser and photovoltaic device .

Unit-III

Bipolar Transistor: Ebers-Mole model & charge control model, Transient behavior, small signal equivalent circuit Z parameter–h-parameter and hybrid – pai, switching and power transistor.

Field Effect Transistor: JFET operation and V-I characteristics, high frequency response , MOS capacitor theory , MOSFET types , MOSFET operation and V-I characteristics , equivalent circuit metal semiconductor junction and MOSFET.

Unit-IV

Special semiconductor Device : Metal semiconductor contact ,MIC structure surface charge transfer and charge coupled device and their applications.

Semiconductor power devices : Diodes, transistors, UJT, thyristor, DIAC, TRIAC,GTO,IGBT static characteristics. and principal of operation .

Text/Refrence Books:

1. B.G. Streetman : Solid State Electronic Devices (PHI)
2. S.M. Sze: Physics of Semiconductor Devices (WILEY)
3. D. Nagchoudhari : Semiconductor Devices(TMH)
4. P.S. Bimbhra : Power Electronics(KP)
5. Dubey G.K. : Thyristorised Power Controllers (NAIL)

EENO-403A	Data Structure & Algorithms						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of data structure and various algorithms used in data structure operations. Data structure and algorithms help in **understanding** the nature of the problem at a deeper level and thereby a better **understanding** of the world.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand and analyze the time and space complexity of an algorithm						
CO2	Understand operations on Stack, Queue (i.e.Priority Queue , D-Queue etc.) and link lists.						
CO3	Discuss various algorithm design techniques for developing algorithms						
CO4	Discuss various searching, sorting and graph traversal algorithms						

UNIT-1

Introduction to data structure and Algorithms: Performance analysis of Algorithm, time complexity, Big-oh notation, Elementary data organization, data structure operations, Recurrences, Arrays, Operation on arrays, representation of arrays in memory, single dimensional and multidimensional arrays, spare matrices, Character storing in C, String operations.

UNIT-2

Stack, Queue and Link List: Stack operation, PUSH and POP, Array representation of stacks, Operation associated with stacks Application of stacks, Recursion, Polish expression, Representation Queue, operation on Queue , Priority Queue , D-Queue , Singly and circularly linked list, Lists operations, Lists implementations

UNIT-3

Trees : Basic terminology, Binary Trees, Binary tree representation, Complete Binary Trees, Extended binary tree, representing binary tress in memory, linked representation of Binary trees, Traversing binary trees & Searching in binary trees, Inserting in binary search trees, Complexity of searching algorithm, Heaps, general trees, Threaded binary tree.

Graphs: Terminology & representations, Graphs & Multigraphs, Directed Graphs, Sequential representation of graphs, adjacency Matrices, Transversal, connected component and spanning trees,
Minimum Cost spanning tree, Prims and Kruskal Algorithm, BFS, DFS, Shortest path and transitive closure, Activity networks, topological sort and critical paths.

UNIT-4

Searching and Sorting: Linear search, binary Search, Internal and External sorting, Bubble sorting, selection sort, Insertion sort, quick sort, Two way merge sort, Heap sort, sorting on different keys, practical consideration for internal sorting, External Sorting, Storage Devices : Magnetic tapes, Disk Storage, Sorting with disks and Indexing techniques, introduction to B tree and B+ tree, File organization and storage management, Introduction to hoisting.

Text / Reference Books:

1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, Introduction to Algorithms, PHI.
2. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication.
3. Weiss, "Data Structure & Algorithm Analysis in C", Addision Wesley.
4. Basse, "computer Algorithms: Introduction to Design & Analysis", Addision Wesley.
5. Lipschutz, "Data structure, "Schaum series.
6. Aho, hopcropt, Ullman, “Data Structure & Algorithm", Addision Wesley.
7. Aho, Hopcraft, Ullman, “The Design and Analysis of Computer Algorithms” Pearson Education, 2008

EENO-405A	Signal and Image Processing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various methods to convert an image or signal into digital form and perform some operations on them, in order to get an enhanced image or signal to extract some useful information from them.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand basic concepts of digital signal processing and it's application.						
CO2	Understand the concepts of frequency transformations and also learn about the structures of discrete time systems.						
CO3	Understand fundamentals of digital image, image enhancement and compression						
CO4	Understand basic concepts of digital image processing						

UNIT 1

Introduction: Basic elements of DSP system, Advantages and disadvantage of DSP over analog processing, Application of Digital signal processing.

Z-Transform: Direct Z-Transform and importance of ROC, properties of Z-Transform, Inverse Z-transform methods, Rational Z-transform function representation, system function of LTI systems in Z-domain, one sided Z –Transform. Solution of difference equations. Analysis of LTI system in Z- domain, transient and steady- state response. Causality and stability. Pole- Zero Cancellations.

UNIT 2

FREQUENCY TRANSFORMATIONS : Introduction to DFT, Direct Computation of DFT ,Properties of DFT, Circular Convolution , Fast fourier Transform(FFT), decimation in time ,decimation in frequency algorithm, Use of FFT in Linear Filtering , Goetzel Algorithm, Chirp-Z Transform algorithm.

Structure of Discrete-Time Systems: Structure for FIR Systems-direct form, Linear Phase, Cascade form, Frequency-Sampling structures, Structures for IIR- Direct, Cascade, Parallel & transposed structure, signal flow graphs .

UNIT 3

Digital Image Fundamentals: Introduction, image model, sampling and Quantization, relationship between pixels, imaging geometry, photographic film, discrete, Fourier transform, properties of two dimensional Fourier transform.

Image Enhancement and Compression: Enhancement by point processing, spatial filtering and enhancement in the frequency domain, pseudo color image processing, image compression models, error free compression, image compression standards.

UNIT 4

Image Restorations: Degradation, models, diagonalizations of matrices, inverse filtering, interactive restorations, geometric transformations.

Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding, region orienting segmentation.

Representations and Recognition: Representations schemes, boundary descriptors, regional descriptors, morphology, recognition and interpretation, basics.

Text books / References:

1. Digital Signal Processing by J.G. Proakis and D.G. Manalakis-PHI
2. Digital Signal Processing by: A.V. Oppenheim and R.W. Schafer-PHI
3. Digital Signal Processing by S. K. Mitra –TMH.

4. Digital Signal Processing by Rabinar, Gold-PHI
6. Barrie W. Jervis , “digital signal processing (Pearson education India)
7. Digital Signal Processing by S. Salivahanan- TMH
8. Rafael c. Gonzalez and Richard E. Woods, digital image processing, Addison Wesley publishing company
9. William K. Pratt, digital image processing, John Wiley and sons
10. Jain, Fundamentals of digital image processing, PHI

EENP-402A	Power Quality & FACTS						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various power quality issues, their effects on power system and mitigation techniques used to remove them from the system.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Familiarize with sources of power quality issues, power quality standards & regulations						
CO2	Familiarize with various power quality issues in electrical supply system						
CO3	Understand various causes of power system harmonics, harmonic effects in the system and mitigation techniques						
CO4	Understand the working of FACTS devices and custom power devices to mitigate power quality issues						

UNIT 1

Power Quality Problems & Monitoring : Overview and Definitions of power quality, sources of pollution, international power quality standards, and regulations.

UNIT 2

Power Quality Problems : Surges, voltage sag and swell, over voltage under voltage, outage voltage, and phase angle imbalance, electric noise, harmonics, frequency deviation monitoring,

UNIT 3

Power System Harmonics: Harmonic analysis, harmonic sources – the static converters, transformer magnetization and non-linear machines, are furnaces, fluorescent lighting. Harmonic effect within the power system, interference with communication harmonic measurements, Harmonic Mitigation Techniques

UNIT 4

FACT Systems: Introduction – Terms & definition, Fact Controllers, Type of FACT devices i.e. SSC, SVC, TSC, SSS, TCSC, UPFC, Basic relationship for power flow control.

Introduction to Custom Power Devices-Network Reconfiguration devices; Load compensation and voltage regulation using DSTATCOM; protecting sensitive loads using DVR; Unified power Quality Conditioner. (UPQC), uninterruptible power suppliers

Text books/ References:

1. Roger C Dugan, McGrahan, Santoso&Beaty, “Electrical Power System Quality” McGraw Hill
2. Arinthom Ghosh & Gerard Ledwich, “Power Quality Enhancement Using Custom Power Devices” Kluwer Academic Publishers
3. C. Sankaran, “Power Quality” CRC Press
4. Narain G. Hingorani & Laszlo Gyugyi “Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems” Wiley

EENP-404A	Control System Design						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	The course is useful for the students to get an idea of ideal practices in the field of control systems design. Students will get in touch with recent trends in the field of modern control engineering. Here importance of designing the control systems is emphasized.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Define fundamental control system design specifications and basic principles of controller design						
CO2	Design modern controllers based on the state space techniques and recognize the importance of observability and controllability for system design.						
CO3	Understand concept of optimal control and robust control techniques.						
CO4	Understand concept of Lyapunov's stability Criteria and optimal control						

UNIT 1

Design of Feedback Control Systems : Introduction, Approaches to System Design, Cascade Compensation Networks, Phase-Lead Design Using the Bode Diagram, Phase-Lead Design Using the Root Locus, System Design Using Integration Networks, Phase-Lag Design Using the Root Locus, Phase-Lag Design Using the Bode Diagram, Design on the Bode Diagram Using Analytical Methods, Systems with a Pre-filter, Design for Deadbeat Response; Design Examples.

UNIT 2

Design of State Variable Feedback Systems: Introduction, State space representation of physical systems, State space models of some common systems like R-L-C networks, DC motor, inverted pendulum etc., Controllable Canonical Form, Observable Canonical Form, Diagonal Canonical Form, State transition matrix, Solution of state equations, Controllability and Observability, Full-State Feedback Control Design; Observer Design; Integrated Full-State Feedback and Observer; Tracking Reference Inputs; Internal Model Design; Design Examples

UNIT 3

Introduction to Robust Control and optimal control : Robust control system and system sensitivities to parameter perturbations, analysis of robustness, systems with uncertain parameters, considerations in design of robust control system, robust PID controller.

UNIT 4

Lyapunov's stability and optimal control: Positive/negative definite, positive/negative semi-definite functions, Lyapunav stability criteria, introduction to optimal control, Riccatti Equation, Linear Quadratic Regulator, Design Examples.

Text books / References:

1. Modern Control Engineering by K. Ogata, PHI.
2. Discrete Time Control Systems by K. Ogata, PHI.
3. Automatic Control Systems by B C Kuo, PHI.
4. Control Systems, Principles and Design by M. Gopal, MC Graw Hill, 2012.

EENP-406A	Electrical & Hybrid Vehicles						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	To provide knowledge of Electrical and hybrid vehicles to the students.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To learn about Electrical and Hybrid Vehicles.						
CO2	Understand about types of machinery used in Electric propulsion unit						
CO3	Understand about various methods of energy storage in Electric and hybrid vehicles						
CO4	Learn about sizing methodology of drive system and energy management strategies used in electric and hybrid vehicles						

UNIT 1

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles.

Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

UNIT 2

Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT 3

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

UNIT 4

Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Text / Reference Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003
3. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004

EENP-408A	HVDC Transmission System						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of high voltage direct current (HVDC) transmission system.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand about HVDC transmission systems, it's merits and demerits over EHVAC System.						
CO2	Understand about various control strategies of HVDC links, harmonics, it's effects & mitigation techniques.						
CO3	Understand about various types of faults in HVDC system and their protection schemes.						
CO4	Understand about MTDC systems, it's type, control & protection schemes.						

UNIT I

Merits and Demerits of HVDC over EHVAC, type of HVDC links, Analysis Of 3- phase bridge converter with grid control for $U \leq 60^o$ and $U > 60^o$, derivation of equivalent circuit of HVDC link.

UNIT II

Basic means of control of HVDC link, C.C.A., C.C. and C.E.A, Control Characteristics of a converter, Harmonics in HVDC Operation, types of filters used for harmonic elimination, characteristics harmonics, characteristic AC current harmonics, Non characteristics AC harmonics, harmful effects.

UNIT III

Protection aspects of a HVDC link, types of faults, over current protection, over voltage protection, ground and short circuit fault & their protection.

UNIT IV

Multi Terminal DC systems (MTDC): Types, control, protection and applications, Corona & R.I characteristics of HVDC link.

Suggested Text / Reference books:

1. K.P. Padyar, "HVDC Power Transmission Systems", Wiley Eastern Ltd.
2. E.W. Kimbark, "Direct Current Transmission", Vol.I, Wiley Intersect
3. J. Arrillage, "High Voltage Direct Current Transmission", Peter Peregrines
4. S. Rao," EHV-AC and HVDC transmission Engineering Practice", Khanna publishers

EENP-410A	Power System Dynamics and Control						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	This subject is designed to give a basic understanding of dynamic modeling of synchronous machines and associated governor, turbine and excitation system modeling to the students. This course will help the students to develop in-depth knowledge of modeling & control of large power systems.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the basic concept of power system dynamics, stability and control.						
CO2	Students will learn about development of various types of models used for synchronous machines.						
CO3	Understand the concept of modeling of synchronous machines & excitation systems.						
CO4	Analyze single machine system.						

UNIT I

Basic Concepts: Introduction to system dynamics, Power system stability states of operation and system security, system dynamics Problems, system model, analysis of steady State stability and transient stability, simplified representation of excitation control.

UNIT II

Modeling of Synchronous Machine: Synchronous machine – park's Transformation, analysis of steady state performance, per unit quantities, Equivalent circuits of synchronous machine, determination of parameters of equivalent circuits.

UNIT III

Excitation System: Modeling of excitation system, block diagram of excitation system, system representation by state equations, Dynamics of a synchronous generator connected to infinite bus, system model Synchronous machine model, stator equations, rotor equations, Synchronous machine model with field circuit , one equivalent damper winding on q axis (model 1.1), calculation of Initial conditions.

UNIT IV

Analysis of Single Machine System: Small signal analysis with block diagram representation, Characteristic equation and application of Routh Hurwitz criterion, synchronizing and damping torque analysis, small signal model, State equations.

Application of Power System Stabilizers: power system stabilizers, basic concepts in applying PSS, Control signals , Structure and tuning of PSS, Washout circuit , Dynamic compensator analysis of single machine infinite bus system with and without PSS.

Suggested Text / Reference books:

1. K. R. Padiyar," Power system dynamics "- B.S. Publications.
2. P.M. Anderson and A. A. Fouad, "Power system control and stability", IEEE Press
3. R. Ramanujam, "Power Systems Dynamics"- PHI Publications.
4. Padiyar K R, Power System Dynamics, Stability and Control, Interline Publishing, 1996.
5. Machowski J, Bialek J W, and Bumby J R, Power System Dynamics and Stability, John Wiley and Sons, 1997.
6. Prabha Kundur, Power System Stability and Control, Tata McGraw Hill Edn, 2006.

EENP-412A	Advanced Electric Drives						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	To impart knowledge about fundamentals of Electric drives and control, operational strategies of dc and ac motor drives as per different quadrant operations						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the basic fundamentals of electric drives						
CO2	Acquire knowledge of DC motor drive and its operational strategies						
CO3	Acquire knowledge of AC motor drives and its operational strategies. Students will also be able to know about open loop dynamic performance of AC & DC drives.						
CO4	Understand operations of various industrial drives. Students will also be able to acquire the knowledge of selection of drives as per practical operational industrial requirement.						

UNIT I

Introduction: Definition of electric drive, type of drives; Speed torque characteristic of driven unit/loads, motors, joint speed-torque characteristic; Classification and components of load torque; Review of power converters used in drives, multi-quadrant operation of electric drive, example of hoist operation in four quadrant.

UNIT II

DC Motor Drive and its Operational Strategies: Dynamic model of machine with armature voltage control only and converters with continuous conduction only; Closed loop control using single (speed) and two loops (speed, current), Implementation using circulating current type three phase dual converter and four quadrant transistorized chopper, Closed loop control of solid state DC drives

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UNIT III

AC Drives and its Operational Strategies: Induction Motor Drives. Starting & braking, VSI control, CSI control, Direct torque and flux control of induction motor, Variable frequency operation of three phase symmetrical induction machine, Scalar control methods for constant power and constant torque modes, Vector control of induction machine

Open-loop Dynamic Performance of AC & DC Drives: Starting & reversal time, Energy consumption & energy savings principle. Drives Application Engineering for Fan, Pump, Compressor, Lift-Elevator, Kiln, Winder-Un-Winder, Traction application. Synchronization and master-slave configuration.

UNIT IV

Self controlled synchronous motor drive, Vector control of synchronous motor, Switched reluctance motor drive, Brushless DC motor drive, Permanent magnet drives, Switched Reluctance Motors, performance characteristics, Stepper motor and switch reluctance motor drives, solar and battery powered drives

Suggested Text / Reference books:

1. G.K.Dubey, Power semi conductor controlled drives, Prentice Hall, January 1989
2. G.K.Dubey, Fundamentals of Electrical Drives, 2nd Revised edition, Alpha Science International Ltd, 15 October 2001
3. B.K. Bose, Power electronics and variable frequency drives, Wiley-Blackwell, 21 September 1996
4. Bose B.K., Modern Power Electronics & AC Drives, PHI Pvt. Ltd., (2001)

5. Mohan, N., Electric Drives: An Integrative Approach, MNPERE (2001).
6. Mohan, N., Advanced Electric Drives: Analysis, Control, and Modeling Using Simulink, MNPERE (2001).
7. Krishnan, R., Electric Motor & Drives: Modeling, Analysis & Control, PHI Pvt. Ltd. (2001).
8. Leonard, W., Control of Electric Drives, Springer-Verlag, New York, (1985)
9. Miller, T.J.E., Brushless Permanent Magnet and Reluctance Motor Drives, Oxford Science, Oxford (1989).

EENO-402A	Analog & Digital Communication						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	To make students aware about various analog and digital modulation techniques used in communication system						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the Amplitude Modulation in communication system.						
CO2	Comprehend the Frequency & Phase modulation						
CO3	Realize the Pulse Modulation Techniques						
CO4	Get the Digital Modulation Techniques and their use in communication system.						

UNIT-I

Elements of communication system and its limitations, Amplitude modulation and detection, Generation and detection of DSB-SC, SSB and vestigial side band modulation, carrier acquisition AM transmitters and receivers, Super hetrodyne Receiver, IF amplifiers, AGC circuits, Frequency Division multiplexing

UNIT-II

Angle Modulation: Basic definition, Narrow-Band and wideband frequency modulation, transmission bandwidth of FM signals, Generation and detection of frequency modulation, Generation and detection of Phase Modulation.

Noise: External noise, internal noise, noise calculations, signal to noise ratio.

UNIT-III

Pulse Modulation: Introduction, sampling process, Analog Pulse Modulation Systems, Pulse Amplitude Modulation (PAM), Pulse width modulation (PWM) and Pulse Position Modulation (PPM).

Waveform coding Techniques: Discretization in time and amplitude, Quantization process, quantization noise, Pulse code Modulation, Differential Pulse code Modulation, Delta Modulation and Adaptive Delta Modulation

UNIT-IV

Digital Modulation Techniques: Types of digital modulation, waveforms for amplitude, frequency and phase shift keying, coherent and non-coherent methods for the generation of ASK, FSK and PSK. Comparisons of above digital modulation techniques.

Time Division Multiplexing: Fundamentals, Electronic Commutator, Bit/byte interleaving, TI carrier system, synchronization and signaling of TI, TDM and PCM hierarchy, synchronization techniques.

Text / Reference Books:

1. B.P. Lathi, “Modern Digital and Analog Communication Systems”, 4th Edition, Oxford University Press.
2. G.Kennedy and B. Davis,” Electronic Communication Systems” 4th Edition, McGraw Hill
3. R.P. Singh & S.D. Sapre, “Communication Systems Analog and Digital”, 3th Edition, McGraw Hill.
4. John G. Proakis, "Communication Systems Engineering 2nd Edition, Pearson Education, 2015
5. H. Taub, D L Schilling, Gautam Saha, “Principles of Communication”, 4th Edition, McGraw Hill.
6. (Schaum's Outline Series) H P HSU & D Mitra, “Analog and Digital Communications”, McGraw Hill 3rd Edition.
7. Simon Haykin, “Communication Systems”, 5th Edition, Wiley India.
8. T.L. Singal, “Analog & Digital Communication”, McGraw Hill

EENO-404A	Wavelets Transform						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	0	0	3	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various types of Wavelets transform and their application for data compression and other uses.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the concept of continuous & descrete wavelet transform and orthogonal wavelet decomposition						
CO2	Learn about MRA, Orthonormal wavelets and their relationship with filter banks						
CO3	Understand the use of wavelets transform for Data compression & video coding						
CO4	Understand the various applications of wavelets transform						

UNIT 1

Continuous Wavelet Transform: Introduction, Definition of the CWT, the VWT as a Correlation, Constant-Factor Filtering Interpretation and Time-Frequency Resolution, the VWT as an Operator, Inverse CWT, Problems.

Introduction to Discrete Wavelet Transform and Orthogonal Wavelet Decomposition: Introduction, Approximation of Vectors in Nested Linear Vector Subspaces, Examples of an MRA, Problems.

UNIT 2

MRA, Orthonormal Wavelets, and their Relationship to Filter Banks: Introduction, Formal Definition of an MRA, Construction of General Orthonormal MRA, a wavelet Basic for the MRA, Digital Filtering Interpretation, Examples of Orthogonal Basic Generating Wavelets, Interpreting Orthonormal MRAs for Discrete-Time signals, Miscellaneous Issues Related to PRQME Filter Banks, generating Scaling Functions and wavelets from Filter Coefficient, Problems.

UNIT 3

Wavelet Transform and Data Compression: Introduction, Transform Coding, DTWT for Image Compression, Audio Compression, Video Coding Using Multi-resolution Techniques: a Brief Introduction.

UNIT 4

Applications of Wavelet Transforms: Introduction, Wavelet denoising speckles Removal, Edge Detection and Object Isolation, Image Fusion, Object Detection by Wavelet Transform of Projections, Communication application.

Text Books / References:

1. James S. Walker, “A Primer on Wavelets and their Scientific Applications”, CRC Press, (1999).
2. Rao, “Wavelet Transforms”, Pearson Education, Asia.
3. C. Sidney Burrus, Ramesh A. Gopinath, “Introduction to Wavelets and Wavelets Transforms”, Prentice Hall, (1997).

EENO-406A	Embedded System						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	0	0	3	75	25	100	3
Program Objective (PO)	To introduce the students to concepts of embedded systems. To offer them a level of confidence in microcontroller based system design. To introduce them to the concepts of ARM architectures and RTOS.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand various concepts of embedded system						
CO2	Learn about 8051 Microcontroller						
CO3	Understand the operating system of Embedded system and also learn about higher embedded system						
CO4	Learn about communication basics and interfacing of various devices to the microcontroller						

UNIT 1

Introduction to embedded system: Embedded System, Embedded versus external memory devices, CISC and RISC processors, Harvard and Von Neumann Architecture, Application of Embedded System, Embedded operating system, Design Parameters of embedded and its Significance, Design life cycle, Hardware fundamentals, Digital circuit parameter, O.C and Tristate outputs, I/O sink and Source, Custom single purpose processor Optimization, FSMD, data path & FSM , General purpose Processor and ASIP'S

UNIT 2

8051 Microcontrollers: 8051 microcontrollers-Assembly language, Architecture of 8051, Registers, Addressing Modes, Instruction Set, I/O ports, memory organization, Programs showing use of I/O Pins, Interrupts, Interrupt Programming, Timer and counters, Serial Communication, Programming of serial communication.

UNIT 3

Introduction to operating system and basics of higher embedded system: Introduction to RTOS, Tasks, Data, Semaphores and shared data, Operating system services, Message queues, Mailboxes, Advanced processor (Only architecture), 80386, 80486, Introduction to ARM, features, architecture, instruction set

UNIT 4

Communication basics and interfacing of various devices the microcontroller: Microprocessor interfacing I/O addressing, direct memory access (DMA), Arbitration, multilevel bus architecture, serial protocol, parallel protocols and wireless protocol, Real world interfacing: LCD, Stepping motor, ADC, DAC, LED, Pushbuttons, Keyboard, Latch connection, PPI

Text / Reference Books:

1. Embedded system Design-Frank Vahid/ Tony Givargis. John Willey
2. Microcontroller (Theory and applications) Ajay V Deshmukh, Tata , McGraw-Hill
3. An Embedded Software Primer-David E.Simon, Pearson Education
4. The 8051 Microcontroller and embedded systems-Muhammad Ali Mazidi and Janice Gillispie.
5. Microcontrollers (Architecture, Implementation & Programming) Kenneth Hinz, DanielTabak,Tata McGraw-Hill
6. 8051 Microcontrollers & Embedded Systems 2nd edition Sampath Kr. Katson books

EENO-408A	Mobile Communication & Networks						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	0	0	3	75	25	100	3
Program Objective (PO)	To introduce the students to the concepts of Wireless & Mobile communication and networks. Study of this subject will also provide knowledge to students about various mobile telephony generations such as 1G, 2G, 3G, 4G systems etc. and their abilities and limitations.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Familiarize with fundamentals of mobile communication systems.						
CO2	Familiarize with the role of equalization in Mobile communication and also learn about different types of Equalizers. Students will also able to know about different types of multiplexing and multiple access techniques used in mobile communication system.						
CO3	To learn about the concept of GSM in real time applications (in mobile telecommunication)						
CO4	Familiarize with Wireless and Mobile Networks and higher generation cellular standards						

UNIT 1

Evolution of mobile radio communication fundamentals. General Model of Wireless Communication Link, Types of Signals, Cellular Infrastructure, Cellular System Components, Antennas for Cellular Systems, Operation of Cellular Systems, Channel Assignment, Frequency reuse, Channel Assignment strategies, Handoff Strategies Cellular Interferences, Sectorization; Wireless Channel and Radio Communication, Free Space Propagation Model, Channel Noise and Losses, Fading in Land Mobile Systems, Multipath Fading, Fading Effects on Signal and Frequency, Shadowing.

UNIT 2

Equalization Techniques: Transversal Filters, Adaptive Equalizers, Zero Forcing Equalizers, Decision Feedback Equalizers, and related algorithms.

Multiplexing and Multiple Access Techniques: FDMA, TDMA, CDMA, OFDMA, SCFDMA, IDMA Schemes and Hybrid Method of Multiple Access Schemes, RAKE Receiver; Multiple Access for Radio Packet Systems: Pure ALOHA, Slotted ALOHA, CSMA and their versions; Packet and Pooling Reservation Based Multiple Access Schemes.

UNIT 3

GSM system for mobile Telecommunication: General Packet Radio Service, Edge Technology; CDMA 2000, Wireless Local Loop, IMT 2000 and UMTS, Long Term Evolution (LTE), Mobile Satellite Communication, Introduction to Mobile Adhoc Networks, Li-Fi Communication, Ultra-Wideband Communication, Mobile data networks, Wireless Standards IMT 2000

UNIT 4

Wireless and Mobile Networks: Networks introduction, Network Coverage, Network topologies, Network Architecture, Network Technologies, Evolution of Cellular Networks (0G ~4G) , Wireless Area networks (WLANs) , Bluetooth and Personal Area networks (PANs), Adhoc networks

Higher Generation Cellular Standards: 3G Standards: evolved EDGE, enhancements in 4G standard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS, Introduction to 5G.

Text / Reference Books:

1. T.S. Rappaport, “Wireless Communication-Principles and practice”, Pearson Publications, Second Edition.
2. Misra, Wireless Communication & Network: 3G & Beyond, McGraw Hill Education
3. Jaganathan, Principles of Modern Wireless Communication System, McGraw Hill Education
4. Upena Dalal, “Wireless Communication and Networks”, Oxford Press Publications.
5. T L Singal ,“Wireless Communications ”, McGraw Hill Education.
6. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press.
7. S. Haykin & M. Moher, “Modern wireless communication”, Pearson, 2005.
8. “Mobile Communication”, Jochen Schiller, Pearson Education, 2nd Edition

9. G.Sasibhushana Rao, "*Mobile Cellular Communication*", Pearson, 2013.
10. W.C.Y. Lee - Mobile Cellular Communications, 2nd Edition, MC Graw Hill, 1995.
11. Yi-Bing Lin - Wireless and Mobile Network Architectures, 2nd Edition, Wiley, 2008.

EENO-410A	Thermal and Fluid Engineering						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	0	0	3	75	25	100	3
Program Objective (PO)	The objective of this course is to familiarize the students with the basic concepts of Thermo dynamics and Fluid engineering.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	State the thermodynamic system, properties and equilibrium. Describe the ideal and real gas laws.						
CO2	Analyze and solve the first and second law of thermodynamics problems.						
CO3	Understand the basic concepts of fluid and learn about fluid statics.						
CO4	Understand the basic concepts of fluid kinematics and analyse the laws of fluid dynamics and its applications.						

UNIT-I

Basic Concepts: Thermodynamics: Macroscopic and Microscopic Approach, Thermodynamic Systems, Surrounding and Boundary, Thermodynamic Property – Intensive and Extensive, Thermodynamic Equilibrium, State, Path, Process and Cycle, Quasi-static, Reversible and Irreversible Processes, Working Substance. Concept of Thermodynamic Work and Heat, Equality of Temperature, Zeroth Law of Thermodynamic and its utility.

Ideal and Real Gases: Concept of an Ideal Gas, Basic Gas Laws, Characteristic Gas Equation, Avagadro's law and Universal Gas Constant, P-V-T surface of an Ideal Gas. Vander Waal's Equation of state, Reduced Co-ordinates, Compressibility factor and law of corresponding states. Mixture of Gases, Bass, Mole and Volume Fraction, Gibson Dalton's law, Gas Constant and specific Heats, Entropy for a mixture of Gases.

UNIT II

First Law of Thermodynamics: Energy and its Forms, Energy and 1st law of Thermodynamics, Internal Energy and Enthalpy, 1st Law Applied to Non-Flow Process, Steady Flow Process and Transient Flow Process, Throttling Process and Free Expansion Process. Numerical

Second Law of Thermodynamics: Limitations of First Law, Thermal Reservoir Heat Source and Heat Sink, Heat Engine, Refrigerator and Heat Pump, Kelvin- Planck and Clausius Statements and Their Equivalence, Perpetual Motion Machine of Second Kind. Carnot Cycle, Carnot Heat Engine and Carnot Heat Pump, Carnot's Theorem and its Corollaries, Thermodynamic Temperature Scale, Numerical

UNIT III

Fluid Properties: Concept of fluid and flow, ideal and real fluids, continuum concept, Properties of fluid: mass density, weight density, specific volume, specific gravity, viscosity, causes of viscosity, surface tension, capillarity, vapour pressure, compressibility and bulk modulus, Newtonian and non-Newtonian fluids.

Fluid Statics: Pressure, Pascal's law, hydrostatic law, pressure measurement, manometers, hydrostatic forces on submerged plane and curved surfaces, buoyancy, stability of floating and submerged bodies, liquids in relative equilibrium. Problems.

UNIT IV

Fluid Kinematics: Eulerian and Lagrangian description of fluid flow; types of fluid flows, stream, streak and path lines; acceleration of a fluid particle, flow rate and continuity equation, differential equation of continuity in cartesian and polar coordinates, rotation and vorticity, circulation, stream and potential functions, flow net.

Fluid Dynamics: Concept of system and control volume, Euler's equation, Bernoulli's equation and its practical applications, venturimeter, orificemeter, orifices, mouthpieces, Impulse momentum equation, kinetic

energy and momentum correction factors.

Text / Reference Books:

1. Engineering Thermodynamics – C P Arora, Tata McGraw Hill
2. Engineering Thermodynamics – P K Nag, Tata McGraw Hill
3. Thermal Science and Engineering – D S Kumar, S K Kataria and Sons
4. Engineering Thermodynamics -Work and Heat transfer – G F C Rogers and Maghew Y. R. Longman
5. Introduction to Fluid Mechanics – R.W. Fox, Alan T. McDonald, P.J. Pritchard, Wiley Publications.
6. Fluid Mechanics – Frank M. White, McGraw Hill
7. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S.K. Kataria and Sons
8. Fluid Mechanics – Streeter V L and Wylie E B, Mc Graw Hill
9. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas, Tata McGraw Hill.
10. Mechanics of Fluids – I H Shames, Mc Graw Hill
11. Fluid Mechanics: Fundamnetals and Applications -YunusCengel and John Cimbala, McGraw Hill.
12. Fluid Mechanics: Pijush K. Kundu, Ira M. Cohen and David R. Rowling, Academic Press.

EENO-412A	Automobile Engineering						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	0	0	3	75	25	100	3
Program Objective (PO)	To make aware the students with the study of engineering which teaches manufacturing and mechanical-mechanisms as well operations of automobiles. It is an introduction to vehicle engineering which deals with motorcycles, cars, buses trucks etc. It includes branch study of mechanical, electronic, and safety elements. Some of the engineering attributes and disciplines that are of importance to the automotive engineer.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Students will be able to Develop a strong base for understanding future developments in the automobile industry						
CO2	Students will be able to Explain the working of various parts like engine, transmission, gear box etc.						
CO3	Students will be able to Describe how the brakes and the suspension systems operate						
CO4	Students will be able to Understand the steering geometry and emission control system.						

UNIT I

Introduction: Brief history of automobiles, Main components of an automobile, Brief description of each component. Brief description of constructional details and working of a four stroke I.C. Engine (S.I. Engines and C.I. Engines) including lately developed overhead cam shaft, Multi-cylinder engines, Introduction to recent developments in I.C. Engines- Direct injection systems, Multi-point fuel injection systems, Introduction, Brief description of different components of Transmission System.

Clutch: Introduction to Clutch and its different types, Principle of Friction Clutch, Clutch Lining and friction materials used in Friction Clutches, Torque transmitted, Brief description of Cone Clutch, Single Plate and Multiplate Clutches, Dry and wet clutches, Automatic clutch action, Centrifugal clutches, Electromagnetic clutches, Fluid Flywheel.

UNIT II

Gear Box: Gear Box Air resistance, gradient resistance and rolling resistance coming across a moving automobile, Tractive effort, Variation of tractive effort with speed, Performance curves (object and need of a gear box), Sliding mesh gear box, Control mechanism, Sliding type selector mechanism, Ball type selector mechanism, Steering column gear shift control, Constant mesh gear box, Synchromesh device, Automatic transmission in general, AP automatic gear box, Torque converter, Torque converter with direct drive, Lubrication of Gear Box.

Propeller Shaft: Functions and requirements of a propeller shaft, Universal joints, Constructional forms of universal joints, Flexible-ring joints, Rubber-bushed flexible joints. Constant-velocity joints. Differential : Principle of operation, Constructional details of a typical Differential unit, Traction control differentials, Multi-plate clutch type traction control device.

UNIT III

Brakes: Functions and methods of operation, Brake efficiency. Elementary theory of shoe brake, brake shoe adjustments, A modern rear-wheel brake, Disc brakes, Brake linkages, Leverage and adjustment of the brake linkage, Servo- and power operated brakes, Vacuum brake operation,' Hydraulic Brakes-constructional details and working, Direct action vacuum servos, Power-operated brakes, A dual power air brake system,

Suspension system: Suspension principles, Road irregularities and human susceptibility, Suspension

system, Damping, Double tube damper, Single tube damper, Lever arm type damper, Springs-Leaf springs, Coil and torsion springs, variable rate springs, Composite leaf springs, Rubber springs, Air springs, Adjustable and self-adjusting suspensions, Interconnected suspension system, Interconnected air and liquid suspensions, Independent suspension system, Different independent suspension layouts, McPherson strut type, Rear suspension-live axle, McPherson strut rear suspension.

UNIT IV

Steering Geometry: Castor, Camber, Kingpin inclination, Combined angle, Toe-in, Steering system-basic aims, Ackerman linkage, Steering linkages for independent suspension, Center point steering, Costarring or trailing action, Cornering power, Self-righting torque, Steering characteristics-over steer and under steer, Axle beam, Stub-axle construction, Steering column, Reversible and irreversible steering, Rack-and-pinion steering mechanism, Effect of toe-in on steering, Power steering, Vickers System. Recent trends in automobile engineering Multi fuel automobiles, Automobiles running on alternate sources of energy, Emission control through catalytic converter, Double catalytic converter, Aspects of pollution control in Automobiles.

Reference and Text Books:

1. The Motor Vehicle - By Newton, Steeds and Garretle Basic
2. Automobile Engineering - By Kirpal Singh
3. Automobile Engineering *' -By K.M. Gupta, Umesh Publications