Electrical & Electronics Engineering

(Detailed Syllabus of 6th Semester)

L: Lecture, T: Tutorial, P: Practical, C: Credit

SEMESTER VI

S.No.	CODE	SUBJECT	Periods per week			Scheme for Examination and Marks				Cradits
						PRE***		ESE**	Total Marks	
			L	T	P	Mid Sem	TA*			
1	EEE3221	Power Systems Protection and Switchgear	3	1	0	30	20	50	100	4
2	EEE3222	Power Electronics	3	1	0	30	20	50	100	4
3	EEE3223	Digital Signal Processing	3	1	0	30	20	50	100	4
4	EEE3224(1-5)	Professional Elective –I (EEE Annexure – I)	3	1	0	30	20	50	100	4
5	EEE3225	Power Systems Protection and Switchgear Lab	0	0	3	0	30	20	50	2
6	EEE3226	Power Electronics Lab	0	0	3	0	30	20	50	2
7	EEE3227	Digital Signal Processing Lab	0	0	3	0	30	20	50	2
8	PFD3205	Professional Development	2	0	0	0	15	10	25	1
TOTAL			**12**	**4**	**10**	**120**	**185**	**270**	**575**	**23**

*Teacher Assessment
**End Semester Examination
*** Progress Review Examination

Professional Elective-I (EEE Annexure - I)

S.No.	Courses	Name of the Courses
1	EEE3224 (1)	Electromagnetic Field Theory
2	EEE3224 (2)	Wind and Solar Electrical Systems
3	EEE3224 (3)	Electrical Machine Design
4	EEE3224 (4)	Signal processing and communication Engineering
5	EEE3224 (5)	Computer Organization and Architecture

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Semester: VI **Branch: Electrical and Electronics Engineering**
Subject: Power Systems Protection and Switchgear **Code: EEE3221**

Course Description:

The subject curriculum focuses on the study of fundamentals of power system protection, electromagnetic relays which are important one. It also covers the protection of feeders, transmission lines, transformers, generators and induction motors. The subject deals with the principles of circuit breaking and circuit breaker fundamentals. It also covers the working principle of protective switch gears like CT and PT. The topics covered in the curriculum are chosen in such a way that the students get a very good idea of the underlying principles of switchgear and protection.

Course Objectives:

On completion of the course, the students would be skilled enough to work with the following points

1. Explain the purposes of protection, in relation to major types of apparatus, protection principle, dangers and criteria.
2. Choose and justify a suitable protection system for a specified application.
3. Analyze and compare specified protection systems
4. Compare the different type of circuit breakers performance
5. Overall idea on Electrical switchyard/substation equipments

Syllabus:

UNIT-1:

Introduction: Main and back-up protection, Trip circuit & circuit Breaker, Current transformer & protection, Potential transformer, Isolator, Surge arrestor, instantaneous over current relay, I.D.M.T. Relay, Differential relay, Directional relay, generalized torque expression.

UNIT-2:

Generator protection: Various faults & abnormal operation conditions, stator & rotor faults, transverse differential protection, unbalanced loading, over speeding, loss of excitation, loss of prime mover.
Transformer Protection: Types of Faults, Over Current Protection, Percentage Differential Protection, Inrush Phenomenon, High Resistance Ground Faults in

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Transformers, Inter-turn Faults, Incipient Faults, Over-fluxing Phenomenon.

UNIT-3:

Bus-bar protection: Differential protection, frame leakage protection.
Transmission line protection: Over current protection of lines, three step distance protection, effect of power swings on distance relay, Directional comparison carrier current protection, phase comparison carrier current protection, carrier aided distance protection.
Feeder protection: Protection of ring main feeder, protection of parallel feeders.

UNIT-4:

Induction motor protection: Various faults & abnormal operation conditions, starting of induction motor, protection of small & large induction motor.
Numerical protection: Introduction, block diagram of numerical relay, numerical over current protection, numerical transformer protection, numerical distance protection of transmission line

UNIT-5:

Circuit Breakers: Phenomena of arc, properties of arc, Restriking voltage, recovery voltage, Rate of rise of Restriking voltage, Air Circuit breakers – Air break and Air blast Circuit breakers, Oil Circuit breakers, SF6 circuit breakers, Vacuum circuit breakers - principle of operation and constructional details. Advantages and disadvantages of different types of Circuit breakers

Text Books:

1. Power System Protection and Switchgear: Badri Ram, D. N. Vishwakarma, Tata McGraw Hill Publishing House Limited, New Delhi, 2005.

2. Electrical Power Systems: C.L. Wadhwa, New Age International Publishers Limited, 2006, New Delhi,6th Edition, 2010

3. Switchgear and protection: J. B. Gupta, Kataria and sons, 3rd edition.

Reference Books:

1. Switchgear Protection and Power Systems: Sunil, S.Rao, Khanna Publishers Limited, New Delhi, 12th Edition, 2008.

2. Fundamentals Of Power System Protection: Y. G. Parithankar & S. R. Bhide, 2nd edition, PHI.

3. Modern Power System Protection: Divyesh Oza, TMH Publication

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Course Outcomes:

After completion of this course module, students will able to:

1. Understand and analyze power system operation, stability, control and protection.
2. Overall idea about switchyard as well as sub-station operation, utility units and various protection and measuring equipments.
3. Design various protection schemes according to the abnormality conditions
4. Differentiate various protection zones starting from generation to load.

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Semester: VI **Branch: Electrical and Electronics Engineering**
Subject: Power Electronics **Code: EEE3222**

Course Description:

The subject deals with the conversion, control and switching of electrical energy for power applications and playing a major role in revolutionizing the industrial processes. It provides the essential link between the micro level of electronic controllers and megawatt level of industrial power and processes requirements. It has applications within the whole field of the electrical energy system

Course Objectives:

1. To understand and develop the firing circuit requirement for different power semiconductor devices used as switches.
2. Understand the conversions modes of power in electrical engineering
3. To analyze the impact of controlled converters with various kinds of load for single-phase as well as for three-phase applications.
4. To understand the concepts of different types of AC-DC, DC-DC & DC-AC controlled converters for Industrial applications.
5. Students should be able to identify various stages of AC drive and dc drive workings.

Syllabus:

UNIT-1: Power Semiconductor Devices

Concept of power electronics with applications, Various Power Electronics devices such as Power Bipolar Junction Transistor (BJT), TRIAC, GTO & IGBT, MOSFET, SCR, Triggering methods of SCR, Protection of SCR, Firing methods of SCR, Series and Parallel operation of SCR.

UNIT-2: Phase controlled converters

Principle of operation of single phase and three phase half wave, half controlled, full controlled converters with R, R-L and RLE loads, Effect of source inductance assuming constant load current, Effect of freewheeling diode, Input Line Current Harmonics, Power factor, current distortion and displacement factors- Inverter Mode of Operation.

UNIT-3: Thyristor Commutation and DC-DC converters

Thyristor Commutation, Class A, B, C, D, E commutation technique, Principle of operation, control strategies, step up choppers, step-down chopper, step up-down chopper, types of choppers circuits based on quadrant of operation, Introduction to Switched-Mode Power Supply (SMPS) Circuits.

UNIT-4: Inverter

Commutation, Class A, B, C, D, E commutation technique, Definition, classification of inverters, Single-phase Half and Full bridge Inverter, Series and parallel inverter, Pulse Width Modulated (PWM) technique for voltage control, SPWM Technique 1-phase inverters, Three-phase Voltage Source Bridge type of Inverters (120 and 180 Degree conduction modes), Current Source Inverter.

UNIT-5: AC controllers

Single-phase mid-point and bridge types of step-up and step-down cyclo-converters. Single phase AC Voltage regulators and its basic analysis.
Applications: UPS, SMPS, Induction Heating, Electronic Ballast, AC/DC drives speed control.

Text Books:

1. Power Electronics: M.H. Rashid, PHI.
2. Power Electronics: P.S. Bhimra, Khanna Publishers.
3. Power Electronics: M.D. Singh and K.B. Khanchandani, Tata Mc Graw Hill.
4. Thyristorised Power Controllers: G.K.Dubey, SR.Doradla, A. Joshi and RMK. Sinha Wiley Eastern Ltd. Publisher.

Reference Books:

1. Elements of Power Electronics: Philip T. Krein, Oxford University Press.
2. Power Electronics: Cyril W Lander MGH Publishers.
3. Modern Power Electronics & AC drives: B.K. Bose, Prentice Hall.
4. Power Electronics: Converters Applications and Design, Media Enhance, Ned Mohon, Wiley; Third edition.

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Course Outcomes:

After completion of this course, student will:

1. Gain knowledge on AC-DC, DC-DC, DC-AC converters and their operation under various conduction for RLE loads.
2. Have ability to solve the require mathematics analysis through electrical circuit and its graphical representation.
3. Be able to understand basic operation of electrical drives.
4. Gain knowledge of UPS and SMPS.

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Semester: VI **Branch: Electrical & Electronics Engineering**
Subject: Digital Signal Processing **Code: EEE3223**

Course Description:

This course includes signal analysis, different types of system, transformation of signal like Z transform, DFT, FFT, different types of filter design like Butterworth, Chebyshev, and architecture of DSP processor TMS320C 5416.

Course Objectives:

Students will learn to do the following:

1. Design FIR and IIR filters to meet specific magnitude and phase requirements.
2. Perform Z and inverse Z transforms using the definitions, Tables of Standard Transforms and Properties, and Partial Fraction Expansion.
3. Determine if a DT system is linear, time-invariant, causal, and memory less, and BIBO stability of systems given in frequency domain.
4. Determine Z-transform, ROC analysis, FFT, DTFT for discreet sample.
5. Able to understand architecture of TMS320C 5416/6713 processor.

Syllabus:

UNIT-1: Discrete-time Signals & Systems

Discrete time signals & sequences, linear shift invariant systems, stability, and causality, linear constant coefficient difference equations, Frequency domain representation of discrete time signals and systems. Interconnections of LTI systems with physical interpretations,

UNIT-2: Review of Z transform and its properties.

Discrete Fourier series: Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear convolution of sequences using DFT, Computation of DFT. Relation between Z-transform and DFS Fast Fourier transforms: Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT, and FFT for composite N

UNIT-3: Filter Design

Basic concepts of IIR and FIR filters, difference equations, and design of Butterworth IIR

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analog filter using impulse invariant and bilinear transforms, design of linear phase FIR filters, no. of taps, rectangular, Hamming and Blackman windows.
Realization of Digital Filters: Direct Form-I, Direct Form-II, Cascade Form, Parallel Form, Lattice Ladder Structure.

UNIT-4: Multirate Digital Signal Processing

Decimation, interpolation, sampling rate conversion, Implementation of sampling rate conversion, Estimation techniques.

UNIT-5: Digital Signal Processor

Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor, writing of small programs in Assembly Language.
FPGA: Architecture, different sub-systems, design flow for DSP system design, mapping of DSP algorithms onto FPGA.

Text Books:

1. Digital Signal Processing – Principles, Algorithms and Applications, J.G.Proakis & D.G.Manolakis, Pearson Ed.
2. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co.
3. Digital Signal Processing Signals, Systems and Filters, A. Antoniou, TMH Publishing Co.
4. VLSI Digital Signal Processing Systems Design and Implementation, Wiley International Publication.
5. Digital Signal Processing with Field Programmable Gate Arrays, U.Meyer-Baese, Springer.

Reference Books:

1. Digital Signal Processing: P. Rameshbabu, Scitech Publications (India).
2. Digital Signal Processing: S. Salivahanan, A. Vallabraj & C. Gnanapriya, TMH Publishing Co.
3. Digital Signal Processing-A Hands on Approach: C. Schuler & M. Chugani, TMH Publishing Co.
4. Digital Signal Processing: A. Nagoor Kani, TMH Education.

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5. Digital Signal Processing: S. Poornachandra & B. Sasikala, MH Education.

6. Digital Signal Processing: Spectral Computation and Filter Design Chi-Tsong Chen, Oxford University Press.

7. DSP Processor user manuals and application notes: Texas Instruments.

8. Xilinx FPGA user manuals and application notes.

9. Digital Signal Processing- A Computer based Approach: K. S. Mitra, Berkeley McGraw-Hill, 1998, ISBN 0-941413-35-7

Course Outcomes:

After completion of this course students will have:

1. Acquired knowledge about discrete-time sequences, concept of energy and power, periodicity.
2. Acquired knowledge DFT and FFT.
3. Ability to design linear digital filters both FIR and IIR using different techniques and their associated structures.
4. Ability to understand the concept of linear prediction and estimation.
5. Ability to understand the concept of ROC.
6. Acquired knowledge about time-frequency analysis.

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Semester: VI **Branch: Electrical and Electronics Engineering**
Subject: Electromagnetic Field Theory **Code: EEE3224 (1)**

Course Description:

This course is to acquire the knowledge of Electromagnetic field theory that allows the student to have a solid theoretical foundation to be able in the future to design, emission, propagation and reception of electro- magnetic wave systems

Course Objectives:

1. To impart knowledge on the basics of static electric and magnetic field and the associated laws.
2. To give insight into the propagation of EM waves.
3. To introduce the methods in computational electromagnetic.
4. To evaluate formulae for the electromagnetic fields from very general charge and current distributions.
5. To lay the foundations of electromagnetism and its practice in modern communications.

Syllabus:

UNIT-1: Introduction

Vector Relation in rectangular, cylindrical, spherical and general curvilinear coordinate system, Coulomb's law, Electric field intensity, electric field due to point charge, line charge, continuous volume charge and surface charge

UNIT-2: Static electric field

Electric flux density, Vector differential operator, Gradient, Divergence, Curl, Divergence theorem, Stokes theorem, Point, Line, Surface and Volume charge distributions, , Gauss law and its applications, Gauss divergence theorem, Maxwell's first equation, potential differences for different configurations

UNIT-3: Capacitance & Dielectrics

Capacitor properties and boundary conditions, the method of images, nature of dielectric materials, boundary conditions for perfect dielectric materials, Poisson's and Laplace's equation and their solution, Current and current density, Continuity equation.

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UNIT-4: Static magnetic field

Magnetic field vector: Magnetic field intensity, flux density & magnetization, Bio-Savart's law, Ampere's law, Helmholtz's theorem, Magnetic scalar and vector potential, Stokes theorem, magnetic flux density, , Derivation of Steady magnetic field Laws, boundary conditions, Force on a moving charge, Force on a differential current element, torque on a closed circuit

UNIT-5: EM waves & Time varying fields

Fundamental relations for Electrostatic and Magnetostatic fields, Faraday's law for Electromagnetic Induction, Maxwell's field equations, electromagnetic radiation, Uniform plane wave in free space, standing wave ratio, Poynting Theorem and Poynting vector, skin effect, EM Boundary condition

Text Books:

1. Engineering Electromagnetics: William H.Hayt and Jr. John A. Buck , Tata McGraw-Hill.
2. Electromagnetic Field and Waves: S. Baskaran and K. Malathi, Scitech Pub.
3. Electromagnetics: J. D. Kraus, McGraw Hill, 2007.
4. Field's waves in Electromagnetic systems: Ramo, Whinnery and Duzer, 3rd edition, Wiley, 1994.

Reference Books:

1. Fundamentals of Electromagnetics: Karl E Longman and Sava V Savov, Prentice Hall of India, New Delhi, 2006.
2. Elements of Electromagnetics: Matthew N.O. Sadiku, 4th edition, Oxford University Press, 2006.
3. Electromagnetic Waves and Radiating Systems: E.C. Jordan and K.G. Balmain, Prentice Hall of India 2nd edition.
4. Electromagnetic Field Theory: R. S. Kshetrimayum, Cengage Learning.

Course Outcomes:

Student completing the course will be able to:

1. Analyze field potentials due to static changes and static magnetic fields.

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2. Explain how materials affect electric and magnetic fields.
3. Compute force and torque for various current carrying elements.
4. Compute potential for different charge distributions.
5. Gain knowledge about the application of boundary conditions for fields.

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Semester: VI **Branch: Electrical and Electronics Engineering**
Subject: Wind and Solar Electrical system **Code: EEE3224 (2)**

Course Description:

Subject provides an introduction to energy systems and solar and wind energy resources, with a scientific examination of the energy field and an emphasis on alternate energy sources and their technology and application. The class will explore society's present needs and future energy demands, examine conventional energy sources and systems, including fossil fuels and nuclear energy, and then focus on alternate, renewable energy sources such as solar), wind power. Energy conservation methods will be emphasized.

Course Objectives:

1. The fundamentals of design calculations and analysis of solar and wind systems.
2. The functioning and design of solar thermal cooling systems.
3. The knowledge on solar passive heating and cooling.
4. Connection of solar and wind power plant with grid.

Syllabus:

UNIT-1: Introduction

Overview of World Energy Scenario, Overview of India's Energy Scenario, energy and development linkage, Energy Economics , Net Energy Analysis, Environmental Impacts of energy use , environmental audits, Emission factors and inventories Global Warming, CO_2 Emissions, Impacts, Mitigation Sustainability, Externalities, Future Energy Systems: Wind and Solar Electrical system.

UNIT-2: Constant Speed Wind Power Plants(WPP)

Type-A WPP: Working Principle, topologies, Starting methods, Maintenance,
Type-B WPP: Working Principle, Types, Maintenance

UNIT-3: Variable Speed Wind Power Plants

Type-C WPP: Working principle, Working Principle Back-to-Back control, Maintenance procedure
Type-D Geared WPP: Working Principle , Maintenance procedure; Type-D direct-drive WPP: Working principle, Maintenance procedure

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UNIT-4: Solar Power Plant

Solar Thermal Power Plants: Working of Concentrated Solar Power (CSP) plant, Maintenance procedure of CSP systems, Solar photovoltaic (PV) Power Plants: Working of a typical Solar PV Power plant, Types of Batteries for solar PV system.

UNIT-5: Power Quality and Grid Connection

Local impact of wind power on the grid, System wide impact of wind power on the grid, Power Quality of solar PV systems, Grid interface issues of wind power, Grid operational issues of wind power, Grid connection of CSP plants, Grid connection of solar PV power plants, Wind- solar hybrid systems.

Text Books:

1. Energy and the Challenge of Sustainability, World energy assessment, UNDP New York, 2000.
2. Fowler, J.M., Energy and the environment, 2nd Edn., McGraw Hill, New York, 1984.
3. Wind Power Technology, Earnest , Joshua , PHI Learning, New Delhi, 2014
4. Solar Photovoltaic: Fundamentals, Technologies and Application, Solanki, Chetan Singh, PHI Learning, New Delhi, 2014

Reference Books:

1. Solar Energy: S.P. Sukhatme, J.K.Nayak. Tata McGraw, New Delhi, 2010.
2. Introduction to Photovoltaics : John R. Balfour, Michael,L. Shaw, Sharlave Jarosek Jones & Bartlett,Publishers, Burlington,2011
3. Concentrator Photovoltaic: Luque A. L. and Andreev V.M, Springer, 2007
4. Solar Cells and Their Applications: Partain L.D., Fraas L.M. Wiley, 2nd Ed., New Delhi

Course Outcomes:

Student completing the course will be able to:

1. Maintain constant speed wind power plants.
2. Maintain variable speed wind power plants.

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3. Maintain concentrated solar power (CSP) and solar photovoltaic (PV) wind power plants.

4. Check the grid compatibility of the power from wind and solar power plants.

5. Resolve the grid integration issues of wind and solar power plants.

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Semester: VI **Branch : Electrical & Electronics Engineering**
Subject: Electrical Machines Design **Code:EEE3224(3)**

Course Description:

This course describes the concept and sound knowledge about constructional details and design of various types of electrical machines such as Electrical Motors, Generators and Transformers.

Course Objectives:

1. To study MMF calculation and thermal rating of various types of electrical machines.
2. To design armature and field systems for D.C. machines.
3. To design core, yoke, windings and cooling systems of transformers.
4. To design stator and rotor of induction machines.
5. To design stator and rotor of synchronous machines and study their thermal behavior.

Syllabus:

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, Standard specifications.

UNIT-2: DC Machines

Output Equations, Main Dimensions, Magnetic circuit calculations, Carter's Coefficient, Net length of Iron, Real & Apparent flux densities, Selection of number of poles, Design of Armature, Design of commutator and brushes, performance prediction using design values.

UNIT-3: Transformers

Output Equations, Main Dimensions, KVA output for single and three phase transformers, Window space factor, Overall dimensions, Operating characteristics, Regulation, No load current, Temperature rise in Transformers, Design of Tank, Methods of cooling of Transformers.

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UNIT-4: Induction Motors

Output equation of 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 poly-phase machines, Magnetizing current, Short circuit current, Circle diagram, Operating characteristics.

UNIT-5: Synchronous Machines

Output equations, choice of loadings, Design of salient pole machines, Short circuit ratio, shape of pole face, Armature design, Armature parameters, Estimation of air gap length, Design of rotor, Design of damper winding, Determination of full load field MMF, Design of field winding, Design of turbo alternators, Rotor design.

Text Books:

1. A course in electrical machine design: Sawhney A.K., Dhanpat Rai & Sons, New Delhi.
2. Principles of Electrical Machine Designs with Computer Programmes: S.K. Sen, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Reference Books:

1. Electrical Machine Design Data Book: A. Shanmugasundaram, G. Gangadharan, R. Palani, New Age International Pvt. Ltd.

Course Outcomes:

1. Have knowledge of various parts of an electrical machine.
2. Develop knowledge helpful for PhD.
3. Ability to calculate losses and efficiency of different machines.
4. Ability to conduct experiments on Machines to find the characteristics.
5. Ability to calculate torque and speed of given Machine.

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Semester: VI **Branch: Electrical & Electronics Engineering**
Subject: Signal processing and Communication Engineering
Code: EEE3224 (4)

Course Description:

To provide a thorough understanding of the fundamentals of signals and systems required in the study of signal processing, communication systems.

Course Objectives:

1. To provide a detailed treatment of techniques used for implementation and performance analysis of transceivers for general communication applications.
2. Digital Communication - Explain and apply basic concepts of Digital Communication system.
3. Random Variables - Describe, explain, and analyze the operation of random variable in Digital Communication System.
4. Waveform Sampling - Analyze and design different Digital Modulation technique for Communication Systems in digital applications.

Syllabus

UNIT-1: Communication systems and noise

Introduction to modern communication systems and frequency band allocation, Random process, correlation and power spectrum of random signals, random signals through linear systems, Gaussian random process and white noise; Shot noise and thermal noise; Noise figure and noise temperature of a two-port network, system noise calculations

UNIT-2: Continuous-wave modulation techniques:

Characteristics of AM and FM; Generation and detection techniques for AM-FC, AM-DSB, SSB, NBFM, WBFM and PM; PLL and its applications in carrier acquisition and FM demodulation; Effect of noise on AM and FM systems, evaluation of SNR at detector output

UNIT-3: Introduction to digital communication

Digital communication system model, modulation process, analog vs digital communication; Fundamental limitations of communication systems Concept of probability, random variable and its characterization, probability density functions,

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transformations of random variables, statistical averages.

UNIT-4: Waveform sampling and coding

Sampling theorem for low-pass and band-pass signals, practical difficulties in signal reconstruction; Instantaneous, natural and flat-top sampling; PAM and TDM; Uniform quantization and its noise analysis, non-uniform quantization, A-law, μ-law; PCM, DM and DPCM, performance comparison; Adaptive quantization and prediction, low bit rate coding and compression standards for speech signals; Emerging digital communication techniques including video compression and HDTV.

UNIT-5: Introduction to Information theory

Measure of information, entropy; Channel capacity and Shannon's theorems; Introduction to source coding and channel coding techniques.

Text Books:

1. Haykin, S., "Communication Systems", 4th Ed., John Wiley & Sons.
2. Lathi, B.P., "Modern Digital and Analog Communication Systems", 3rd Ed., Oxford University Press.
3. Proakis, J.G., Salehi, M., "Digital Communications", 5th Ed., McGraw-Hill International.
4. Oppenheim, A.V., Willsky, A.S. and Nawab, S.H., "Signals & Systems", 2nd Ed., Prentice-Hall of India.
5. Haykin, S. and Van Been, B., "Signals and Systems" 2nd Ed., John Wiley & Sons.

Reference Books:

1. Sklar, B., "Digital Communications", 2nd Ed., Pearson.
2. Carlson, A.B., Crilly, P.B. and Rutledge, J.C., "Communication Systems: An Introduction to Signals and Noise in Electrical Communication", 4th Ed., McGraw-Hill.
3. Couch II, L.W., "Digital and Analog Communication Systems", 7th Ed., Pearson.
4. Ziemer, R.E., Tranter, W.H. and Fannin, D.R., "Signals and Systems: Continuous and Discrete", 4th Ed., Pearson Education.
5. Roberts, M.J., "Fundamentals of Signals & Systems", Tata McGraw-Hill.

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Course Outcomes:

A student completing this course will be able to:

1. Understand the basics of Modulation Processes and differentiate between Digital and Analog Modulation processes.
2. Understand the Application of random variable in analog and Digital Communication System.
3. Able to understand uniform and non uniform quantization.
4. Determine step size for calculation of Quantization error.
5. Explain how Analog Signal will be converted to Digital Signal using Sampling Theorem.
6. Explain, compare, and contrast the input and output for different Digital Modulation Scheme, such as PCM, DPCM, DM, and ADM.
7. Use Discrete Fourier Transform and its properties for solving discrete convolution.
8. Determine the Z-Transform and its ROC for stability analysis.
9. Explain the operation and features of Digital Signal Processor.
10. Calculate the transfer characteristics and frequency response of different filters.
11. Understand the limitations of the various Filters Design, identify the appropriate model for a given problem or situation, and justify the selection.

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Semester: VI **Branch : Electrical & Electronics Engineering**
Subject: Computer Organization & Architecture **Code: EEE3224(5)**

Course Description:

This course will introduce students to the fundamental concepts underlying modern computer organization and architecture. Main objective of the course is to familiarize students about hardware design including logic design, basic structure and behavior of the various functional modules of the computer and how they interact to provide the processing needs of the user. It will cover machine level representation of data, instruction sets, computer arithmetic, CPU structure and functions, memory system organization and architecture, system input/output, multiprocessors, and digital logic. The emphasis is on studying and analyzing fundamental issues in architecture design and their impact on performance.

Course Objectives:

1. Discuss the basic concepts and structure of computers.
2. Understand concepts of register transfer logic and arithmetic operations.
3. Explain different types of addressing modes and memory organization.
4. Learn the different types of serial communication techniques.
5. Summarize the Instruction execution stages.

Syllabus:

Unit I:

Basics of Computer, Von Neumann Architecture, Generation of Computer, RISC & CISC, Instruction Execution **Requester transfer and Micro- Operations:** Register transfer language, Inter – Register transfer, Arithmetic, Logic and shift micro operations, Control functions.

UNIT-2:

Computer Organization and Design: Instruction, codes computer instructions, Timing and, control Execution of instructions, Input-Output and interrupts, Design of computer. **Central Processor organization:** Processor bus organization, ALU, Stack Organization, Instruction formats, Addressing modes, Data transfer and manipulation, Program control, Parallel processor.

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UNIT-3:

Microprogram Control Organization: Control memory, Address sequencing, Microprogram example, Microprogram sequencer & Microinstruction formats.

UNIT-4:

Arithmetic Processor Design: Comparison and subtraction, Algorithm for addition, Subtraction, Multiplication, division, Processor Configuration, Design of Control.
Arithmetic algorithms: Arithmetic with signed 2's complement numbers, Multiplication and Division, Floating point arithmetic operations, Decimal Arithmetic Unit and operations

UNIT-5:

I/O Organization: I/O interfaces, asynchronous data transfer, DMA, Priority interrupt, I/O processor, Multiprocessor system organization. **Memory organization:** Various memories – Auxiliary, Associative, Cache, Microcomputer, Virtual ones, and Memory Hierarchy, Memory Management hardware. Computer software: Assembly language, Assembler, program loops, subroutines, system.

Text Books:

1. Computer System Architecture: M. M. Mano, Pearson Edn.
2. Computer Architecture and Organization, J.P. Hayes Int'l student edition, McGraw – Hill.

Reference Books:

1. Structured Computer Organization: A. S. Tannabaum.
2. Computer Organization: V.C.Hamacher et al, McGraw Hill.
3. Introduction of Digital computer Design: V. Rajaraman& T.Radhakrishnman, PHI.

Course Outcomes:

By the end of this course students will:

1. Learn the basic computer architecture and functioning.
2. Learn Data transfer schemes, memory management, Instructions, programs and subroutine execution.

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3. Able to design and troubleshoot the computer systems.

4. Understand the theory and architecture of central processing unit.

5. Analyze some of the design issues in terms of speed, technology, cost, performance.

6. Design a simple CPU with applying the theory concepts.

7. Use appropriate tools to design verify and test the CPU architecture.

8. Learn the concepts of parallel processing, pipelining and interprocessor communication.

9. Understand the architecture and functionality of central processing unit.

10. Exemplify in a better way the I/O and memory organization.

11. Define different number systems, binary addition and subtraction, 2's complement representation and operations with this representation.

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Semester: VI **Branch: Electrical and Electronics Engineering**
Subject: Switchgear and Protection Lab **Code: EEE3225**

Course Description

The purpose of the course is to provide students with an understanding of how to analyze, build, and troubleshoot power system systems circuits. Student should become proficient in using oscilloscopes, signal analyzers, and similar equipment to test digital circuits. Students will become more comfortable with the software like MATLAB. In addition students must learn to write well-organized reports.

Course Objectives:

1. Design and implementation of different protective relays.
2. Impart knowledge of various kinds of switchgears.
3. Impart knowledge of various kinds of protection schemes for electrical power system.
4. Provide knowledge of protection equipment's operation and maintenance.

Syllabus:

1. To study the operation of definite time overcurrent relay.
2. To study Over Current Relay static type & draw characteristics.
3. To study and plot characteristics of Over Voltage relay electromechanical type.
4. To study and plot characteristics of Under Voltage relay electromechanical type.
5. To study and plot characteristics of IDMT over Current relay electromechanical type.
6. To study and plot characteristics of Instantaneous relays.
7. To study and plot characteristics of percentage-biased differential relays.
8. To study and plot characteristics of IDMT earth fault relay electromechanical type.
9. Study of PID controller on second order system.

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10. To study and plot the characteristics of impedance relay.

11. To study the operation of static over voltage relay.

12. To study the construction and operation of Buchholz Relay.

13. To study Static type Negative Sequence relay.

14. To study directional over current relay.

15. To study different types of circuit breakers.

List of Equipments/Machine Required:

Relays, Digital meter, Transformer, Variable voltage source, Over Current and Negative Sequence Relay (static type), Directional Over Current Relay, Over Current and Negative Sequence Relay (static type),IDMT Over Current Relay (Electromechanical type),Over Voltage/Under Voltage/ Instantaneous Relay (Electromechanical type),Buchholz Relay

Course Outcomes:

Students will be able to:

1. Correctly operate standard electronic test equipment such as oscilloscopes, signal analyzers, digital multi-meters, power supplies, and frequency meters and implement various circuits.
2. Students will be able to correctly analyze a circuit and compare its theoretical performance to actual performance.
3. Students will be able to apply troubleshooting techniques to test digital circuits.
4. Students will be able to prepare and present an organized written engineering report on electronic testing of digital circuits.
5. Students will demonstrate proficiency in MATLAB, and different digital circuits' analysis and design methods by designing, implementing, and testing project-based digital and analog circuits.

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Semester: VI **Branch: Electrical and Electronics Engineering**
Subject: Power Electronics Lab. **Code: EEE3226**

Course Description:

To understand the principle of DC-AC conversion and the different topology for three phase to three phase and single phase to single phase DC-AC conversion.

Course Objectives:

1. To understand and develop the firing circuit requirement for different power semiconductor devices such as SCR, MOSFET, IGBT etc used as switches.
2. To understand the concepts of different types of AC-DC, DC-DC, AC-AC & DC-AC controlled converters for Industrial applications.

Syllabus:

List of Experiments: (Minimum 10 Experiments)

1. To study and plot the V-I characteristics of a SCR.
2. To study and plot the drain characteristics of a MOSFET.
3. To study and plot the drain characteristics of an IGBT.
4. To study and plot the V-I characteristics of a TRIAC.
5. To study single-phase half-wave controlled rectifier for R /RL load.
6. To study single-phase full-wave controlled rectifier for R /RL load.
7. To study single-phase Bridge controlled rectifier for R /RL load.
8. To study Single Phase series inverter with R /RL loads.
9. To study Single Phase parallel inverter with R /RL loads.
10. To study of three-phase half-wave/full-wave controlled rectifier for R load.
11. To study step-down chopper circuit.
12. To study step-up chopper circuit.
13. To study step-up down chopper circuit using MATLAB / PSPICE simulation.

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14. To study the three phase VSI for 180/120 mode of conduction using MATLAB / PSPICE simulation.

15. To study Single Phase step down cycloconverter for R and RL loads using MATLAB / PSPICE simulation.

Equipments/Machine/Software required:

1. Power electronics experiments kit boards, MATLAB. PSPICE

Reference Books & Manuals:

1. Power Electronics, P.S. Bhimra, Khanna Publishers.

2. Elements of Power Electronics, Philip T. Krein, Oxford University Press.

Course Outcomes:

At the end of this course the student will be able to:

1. Hands on expertise on various power electronics converter operation understanding.

2. Solve the require mathematics analysis through electrical circuit and its graphical representation.

3. Design the power electronics converters using MATLAB or PSPICE.

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Semester: VI **Branch: Electrical & Electronics Engineering**
Subject: Digital Signal Processing Lab. **Code: EEE3227**

Course Description:

This course includes simulation of signals in different method using MATLAB and verifies it using TMS320C6713 Processor.

Course Objectives:

1. Simulation of different signal generation.
2. Understand the analysis of signal in different transformation techniques.
3. Acquire skills in TMS320C6713 Processor.

Syllabus:

List of software experiments:

1. Study of architecture of DSP chips - TMS 320C6X Instructions.
2. Writing & execution of small programs related to arithmetic operations and convolution using TMS320C6713 Processor.
3. To write a program to generate continuous time signals like unit step, saw-tooth, triangular, sinusoidal, ramp and sinc function and various operations on signals such as addition, multiplication, scaling, shifting and folding, MATLAB program.
4. To write a program to compute autocorrelation and cross correlation between signals.
5. Linear and circular Convolution of two sequences using MATLAB.
6. Z-transform of various sequences – verification of the properties of Z-transform.
7. DFTs / IDFTs using matrix multiplication and also using commands.
8. Implementation of N-point FFT algorithm.
9. Butterworth filter design with different set of parameters.
10. FIR filter design using rectangular, Hamming and Blackman windows.

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11. Frequency responses of anti imaging and anti aliasing filters.

12. Computation of Power Density Spectrum of a Sequence.

Recommended Books or Manuals:

MATLAB: An Introduction with Applications by Amos Gilat: John Wiley & Sons.

Course Outcomes:

Student completing the course will be able to:

1. Get the basic knowledge about the generation of different kind of signals.
2. Able to understand the basic knowledge of signal transformation technique.
3. Access and evaluate different types of Filter design.
4. Get the knowledge about TMS320C6713 Processor.

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