IPS Academy

INSTITUTE OF ENGINEERING & SCIENCE

(A UGC Autonomous Institute affiliated to RGPV)

Electrical and Electronics Engineering Department

Scheme & Syllabus of I Year (M.Tech.)

Curriculum of PG (Sp. in Power Electronics) in Electrical and Electronics Engineering Department

1st Year 1st Semester

S. No.	Course Code	Course Title	Hrs./ week L	T	P	Credits
1	**PSMC – EEE 101**	Advance Mathematics	3	0	0	3
2	**PSCC – EEE 102**	Power electronics Devices & Phase Control Circuits	3	1	0	4
3	**PSCC – EEE 103**	Advance Control System	3	1	0	4
4	**PSEC – EEE 101**	Elective I	3	0	0	3
5	**LC – EEE 101**	Software Simulation Lab.	0	0	4	2
6	**LC – EEE 102**	Advance Power Electronics Lab.	0	0	4	2
7	**MLC-EEE 101**	Bridge course in Power Electronics Engineering	2	0	0	2
8	**Aud. I**	Stress Management	2	0	0	0
Total credits						**20**

Professional Elective (PSEC-EEE101)
(A) Power Quality & Conditioning
(B) Power Electronic Inverter &Chopper Circuit
(C) D S P & its Application

1st Year 2nd Semester

S. No.	Course Code	Course Title	Hrs./ Week L	T	P	Credits
1	**PSCC – EEE 201**	Advanced Microprocessor, Microcontroller & Applications	3	1	0	4
2	**PSCC – EEE 202**	Advance Electric Drives	3	1	0	4
3	**PSEC – EEE201**	Elective II	3	0	0	3
4	**OEC – EEE 201**	Open Elective I	3	0	0	3
5	**LC – EEE201**	Electrical Drives Lab.	0	0	4	2
6	**LC – EEE 202**	Microprocessor and Microcontroller Lab.	0	0	4	2
7	**MLC – EEE 201**	Research Methodology and IPR	2	0	0	2
8	**Aud. II**	Disaster Management	2	0	0	0
Total credits						**20**

Professional Elective (PSEC-EEE201)	Open Electives (OEC-EEE601)
(A) Computer Aided Power Electronics Analysis & Design	(A) Voice and Data Network
(B) EHVAC & DC Transmission	(B) Waste to Energy
(C) Power electronics Applications in Power System	(C) Industrial safety

PSMC-EEE101	Advance Mathematics	3L: 0T: 0P (3 hrs.)	3credits

Course Objectives: This course introduces the applications of Advance Mathematics in the Electrical & Electronics Engineering. It covers the concepts of solution of partial differential equations, Integral transforms, concepts of probability, stochastic process, queuing theory, fuzzy sets, fuzzy logic, MATLAB, reliability and decision theory which are used in solving problems related with Electrical and Electronics Engineering.

Module-1: Partial Differential Equations and Transform Calculus (8 Hours)
Solution of Partial Differential Equation (PDE) by separation of variable method, Numerical solution of PDE (Laplace, Poisson's, Parabola) using finite difference methods, Elementary properties of Fourier transform and Wavelet transform, DFT, WFT, Wavelet transform.

Module-2: Concepts of Probability (8 Hours)
Probability, Compound probability and discrete random variable. Binomial, Normal and Poisson's distributions, Sampling distribution, Elementary concept of estimation and Theory of hypothesis, Recurred relations.

Module-3: Stochastic Process and Queuing theory (8 Hours)
Stochastic process, Markov process, Transition probability, Transition probability matrix, First and higher order Markov process, Markov chain. Queuing system, Transient and Steady state, Traffic intensity, Distribution queuing system, Concepts of queuing models (M/M/1: Infinity/ Infinity/ FCFS), (M/M/1: N/ Infinity/ FCFS), (M/M/S: Infinity/ Infinity/ FCFS).

Module-4: Fuzzy Sets, Fuzzy Logic and MATLAB (8 Hours)
Operations of fuzzy sets, Fuzzy arithmetic & relations, Fuzzy relation equations, Fuzzy logics. MATLAB introduction, Programming in MATLAB scripts, Functions and Their application.

Module-5: Reliability & Decision Theory (8 Hours)
Introduction and Definition of reliability, Derivation of reliability functions, Failure rate, Hazard rate, Mean time to failure & Their relations, Concepts of fault tolerant analysis, Elementary idea about Decision theory and Goal programming.

Course Outcomes:
CO 1. To understand and use the concepts of solution of partial differential equations and transform calculus in practical problems appear in Electrical and Electronics Engineering.

CO 2. To identify and solve problems regarding probability and hypothesis.

CO 3. To explain and apply the concept of stochastic process and queuing theory in engineering problems.

CO 4. To understand and apply the concept of fuzzy sets and fuzzy logic in different problems of Electrical & Electronics engineering.

CO 5. To identify and solve problems using the concepts of reliability and decision theory.

Textbooks/References:

1. M. K. Jain, Numerical solution of differential equations, John Wiley & Sons, 2010.
2. R. N.Bracewell, Fourier Transform & It's Applications, Tata McGraw Hill, 2014.
3. S. C. Chapra, Applied Numerical Methods with MATLAB, Tata McGraw Hill, 2007.
4. T. J. Ross, Fuzzy Logic with Engineering Application, Wiley publisher, 2016.
5. S. Ross, A First Course in Probability, Pearson education India, 6th edition, 2018.
6. Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2015.
7. R. J. Beerwends, Fourier and Laplace transform, Cambridge university press, 2003.
8. P. G. Hoel, S. C. Port, C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003.
9. Alberto Leon-Garcia, Probability and Random Processes for Electrical Engineering, Pearson, 2008. 10. N.W. McLachlan, Laplace Transforms and Their Applications to Differential Equations, Dover Publications, 2014.
10. Douglas C. Montgomery, Applied Statistics and Probability for Engineers, 5th Edition, Wiley India, 2012.

PSCC-EEE102	**Power Electronics Devices and Phase Controlled Circuit**	**3L: 1T: 0P (4 hrs.)**	**4 credits**

Course Objective
Students will be able to comprehend the concepts of converters and also relate to the applications of phase controlled rectifiers. They will able to describe the importance of AC voltage controllers and cyclo converters for various industrial applications.

Pre Requisite: The students should know about the power working of electronic devices and their applications.

Module 1 (8 Hrs.)
Power Semiconductor requirements, Structures, Static and dynamic characteristics of power semiconductor devices, Series and parallel operation of devices, Device drivers, Cooling of power devices, Device ratings, Protection against dv/dt and di/dt, Device data sheets, interpretations.

Module 2 (6 Hrs.)
Different single-phase and three phase line commutated converter configurations, performance analysis with different loads, Effect of source inductance, commutation and overlap, Inverter mode of operation, Gate circuit schemes for phase control.

Module 3 (8 Hrs.)
Dual phase controlled converter circuit (single and three-phase), principle of operation, practical converters, operation in circulating and non-circulating mode, Comparison, firing schemes.

Module 4 (8 Hrs.)
Cyclo-converters, principle of operation, Three-phase dual converter as a cyclo-converter, Cyclo-converter circuits, circulating and non-circulating current mode, load and line harmonics, load commutated cycle-converters, Control schemes.

Module 5 (8 Hrs.)
AC voltage controllers, types and principle of operation, on-off control and phase angle control, performance analysis with different loads, their applications for power supplies (solid state tap changing regulator) and AC motor control.

Course Outcomes: Students will be able to

CO1. Acquire knowledge about fundamental concepts of power semiconductor devices used in power electronics

CO2. Analyze various single phase and three phase line commuted converter circuits and understand their applications.

CO3. Understand the working dual phase controlled convert circuit.

CO4. Understand the working cyclo converter and dual phase controlled convert cyclo converter circuit.

CO5. Understand the working and application of AC voltage controller as a A C motor control circuit.

Text/ Reference books

1. N. Mohan, T.M. Undeland and W.P Robbins, "Power Electronics Converters, Applications and Design", third edition, John Wiley & Sons Inc, 2003.
2. M. H. Rashid, "Power Electronics Circuits, Devices and Application", third edition Pearson education 2009.
3. Joseph Vithayathil, "Power Electronics Principles and Applications", Tata McGraw Hill edition 2010.
4. B.W. Williams, "Power Electronics, Devices Drivers and Application" Wiley New York 1987.
5. B. R. Pelley, "Thyristor Phase controlled converters and cyclo-converters", wiley Inter science 1971.

PSCC-EEE103	**Advanced Control System**	**3L: 1T: 0P (4 hrs.)**	**4 Credits**

Course Objective:-
This subject deals with state space, describing function, phase plane and stability analysis including controllability and observability. It also deals with modern control and optimal control systems, Nonlinear control, Variable Structure Control

Pre Requisite: - Should have knowledge of mathematics, differential equations and difference equation, Laplace transform, matrices and vectors

Module 1 (11 hrs.):**STATE SPACE ANALYSIS**
Review of Linear Control System, introduction to modern control system , State space method of description, State Space Representation using Phase Variable and Canonical Variables, , Solution of State Equation, State Transition Matrix and its Properties, Eigen Values, Eigen Vectors, Canonical Forms –Controllable Canonical Form, Observable Canonical Form, Jordan Canonical Form., Diagonalization, Concepts of Controllability Observability & Stability, Discretization of continuous-time State space model

Module 2 (08 hrs.)Pole Placement Design and State Observers:
Introduction, Stability Improvements by State Feedback, Necessary and Sufficient Conditions for Arbitrary Pole Placement,. State Regulator Problem and State Regulator Design, Evaluation of State Feedback Gain Matrix K, Selection of Location of Desired Closed Loop Poles, State Observer Design, Full Order/Reduced Order Observer Design, Observer Based State Feedback Control.

Module 3 (07 hrs)Non-linear systems Analysis:
Introduction, Common Nonlinear System Behaviors, Common Nonlinearities in Control Systems, Fundamentals, Describing Functions of Common Nonlinearities, Stability Analysis by Describing Function Method, Concept of Phase Plane Analysis, , Singular points, Stability of Nonlinear System, Construction of Phase Trajectories, Lyapunov Stability Definitions, Lyapunov Stability Theorems, Lyapunov Functions for Nonlinear Systems.

Module 4 (07 hrs.)Optimal Control:
Introduction to Optimal Control, Parameter Optimization Calculus of variation, Euler-Lagrange equations, Boundary conditions, Transversality condition, Bolza problem, Pontryagin's maximum principle.

Module 5 (07 hrs.). Variable Structure Control
Variable Structure Control and its applications. Examples on variable structure control

Course Outcomes: Students will be able to

CO1: Analyze   control system by classical control method and advanced control method.

CO2: Analyze Pole placement problem.

CO3: Analyze non-linear control systems by different methods.

CO4:.Analyze optimum control by different methods in terms of performance indices.

CO5. Analyze to Variable Structure Control

Text Books/ Reference Books

1. B. C. Kuo, “Automatic Control Systems”, eight edition, Wiley India 2009.
2. K. Ogata, “Modern Control Engineering”, fifth edition, Prentice-Hall 2010.
3. B. C. Kuo, “Digital Control Systems”, Oxford University Press 1992.
4. K. Ogata, “Discrete-Time Control Systems”, second edition, Pearson Education 2005.
5. 5 Andrew P. Sage, “Optimum System Control”, Pearson Education Canada, 1977.
6. 6 M. GopalModern Control System Theory New Age International, 1993 –

PSEC-EEE101(A)	Power Quality and Conditioning	L :3 T :1 (hrs.)	Credits 4

Course Objective: To understand the aspects of power quality in distribution system and various indices to estimate the power quality.
Pre Requisite: Power System, Power Electronics

Module 1(8 hrs.)
Understanding Power quality, types of power quality disturbances, power quality indices, Causes and effects of power quality disturbances.
Module 2 (9 hrs.)
Loads that causes power quality problems, State of art on Passive shunt and series compensation, Classification and working of passive shunt and series compensation, Classification, Principle and control of active shunt compensator: DSTATCOM, Active series compensators, working and its control.
Module 3 (7 hrs.)
Causes and effects of harmonics, converter configuration and their contribution to supply harmonics, other sources of harmonics.
Module 4 (9 hrs.)
Radio interference, supply standards, elimination/suppression of harmonics, classical solutions & their drawbacks, passive input filters, design of harmonic filters, Improved power quality converter topologies,(single and three phase), transformer connections, Elimination/suppression of harmonics using active power filters – topologies, and their control methods, PWM converter as a voltage source active filter, current source active filter.
Module 5 (8 hrs.)
Active wave shaping of input line current, constant frequency control, constant tolerance band control, variable tolerance band control, discontinuous current control, Electromagnetic interference(EMI), EMI generation ,EMI standards and elimination.

Course Outcomes: Students will be able to

CO1 Reliably identify the sources of various power quality problems.

CO2 Discuss various compensation techniques and various power quality compensating devices.

CO3 Educate the harmful effects of poor power quality and harmonics.

CO4 Decide the compensators and filters to keep the power quality indices within the standards.

CO5 Discuss harmonic distortion and various harmonic controlling Techniques.

Text/ Reference books

1. Power Quality- by R.C. Duggan

2. Power System harmonics –by A.J. Arrillga

3. Power electronic converter harmonics –by Derek A. Paice

4. Power quality problems and mitigation techniques: Bhim singh, Amrish Chandra, Kamal Al- Haddad.

PSEC-EEE101(B)	**Power Electronics Inverter and Chopper Circuit**	**3L : 0T : 0P (3 hrs.)**	**3 credits**

Course Objective
Students will be able to comprehend the concepts of DC / AC and DC/DC converters and also relate to the applications of phase controlled Circuits.

Pre Requisite: The students should aware about the fundamentals of Converters.

Module 1 (9 Hrs.)
Inverter principles, Inverter topologies for single phase and three phase inverters, Push pull, half bridge and full bridge single-phase inverters, Quasi square wave inverters, Three-phase six step and current controlled inverters, current source single & Three-phase inverters.

Module 2 (7 Hrs.)
Voltage and frequency control techniques for inverters. 120o and 180o mode of operation of three-phase inverters, basic concepts of switch mode inverter, PWM with bipolar and unipolar switching. Push Pull inverters, switch utilization, Effect of blanking time, space vector modulation, phase sequence control, selective harmonics elimination techniques.

Module 3 (6 Hrs.)
Multi-level inverters, concept, advantages of multilevel inverters, types and principle of operation, Diode clamped multilevel inverter and cascaded multilevel inverters.

Module 4 (8 Hrs.)
Principles and classification of chopper circuits, Analysis of practical choppers for single, two and four quadrant operation, Device selection, duty cycle range of practical choppers, Design consideration for RL and RLE loads, Multiphase Choppers, thyristor choppers, Switching control circuits for chopper converters.

Module 5 (9 Hrs.)
Switch mode power supplies, buck. Boost and buck-boost converters, Control of DCDC converters, Continuous and discontinuous conduction mode, Effect of patristic elements, Converter comparison.

Course Outcomes: Students will be able to

CO1. Acquire knowledge about fundamental concepts of single phase and three phase inverters.

CO2. Understand the voltage and frequency control techniques for inverters.

CO3. Analyze various multilevel inverters and their applications.

CO4. Analyze the working application and design of chopper circuits.

CO5. Understand the working and application Switch mode power supplies.

Text Books/ Reference Books:

1. N. Mohan, T. M. Undeland and W.P Robins, "Power Electronics Converters, Application and Design", third edition, John Wiley India 2003.
2. M. H. Rashid, "Power Electronics Circuits, Devices and Applications", third edition Prentice-Hall 2004.
3. L. Umanand, "Power Electronics Essentials and Applications", Wiley India 2009.
4. Joseph Vithayathil, "Power Electronics principle and Applications", Tata McGraw Hill 2010.
5. D.W. Hart, "Power Electronics", Tata McGraw Hill edition 2011.
6. K. Thorborg, "Power electronics", Prentice Hall, UK 1988.
7. E. R. Hnatek, "Design of Solid-State Power Supplies", Van Nostrand Reinhold New York 1989.
8. T. Kenjo, "Power Electronics for the Microprocessor Age", Oxford University Press New York 1990.
9. R. Bausiere, F. Labrique and G. Seguier, "Power Electronics Converters: DC- DC Conversion", Springer-Verlag, 1993.

PCEC – EEE101(C)	DSP & its Application	3L: 0T: 0P (3 hrs.)	3 credits

Course Objective: The objective of this course is to familiarize the students with the most important methods in DSP, including digital filter design, transform-domain processing and importance of Signal Processors.

Pre Requisite: Electric Circuit Theory and Mathematics

Module 1 (8 hrs.)

Introduction to DSP - Classification of signals, Multichannel and multi dimensional continuous v/s discrete time signals, continuous v/s discrete valued signals, continuous time sinusoidal signal, discrete time sinusoidal signals, sampling of analog signal, sampling theorem, quantification and coding of D/A conversion.

Module 2 (6 hrs.)

Discrete Time Signal and Systems - Discrete time signal, systems, Z-transform & Inverse Z-transform, analysis of discrete time, linear time invariant systems, co-relation of discrete time systems.

Module 3 (6 hrs.)

Frequency Analysis Of Signals - Frequency analysis of analog signals, frequency analysis of discrete time signals. Properties of Fourier Transform, Frequency Domain Characteristics, Time Frequency Dualities, Sampling of signals in time and frequency domain, DFT & FFT.

Module 4 (8 hrs.)

Design Of Digital Filter - Design of linear phase FIR filter using window & frequency sampling method. Design of equi-ripple linear phase filters. Comparison of design methods for linear phase FIR filters. Design of IIR filters from analog filters. Direct Design Technique for digital IIR filters.

Module 5 (6 hrs.)

DSP Application - Introduction to digital signal processors chips, case study of different DSP applications. Application of filters to analog & digital signal processor, FET spectrum analyzer.

Course Outcomes: Students will be able to

CO1. Realize the abstraction of signals and systems, from the point of view of analysis and characterization.

CO2. Able to calculate Z-transforms for discrete time signals and system functions

CO3. To study about discrete time systems and to learn about DFT and FFT algorithms.

CO4. Design and realization of FIR and IIR filters.

CO5. Explain about application of DSP.

Text/ Reference books

1. "Digital Signal Processing: Principles, Algorithm & Application", 4th edition, Proakis, Manolakis, Pearson
2. "Discrete Time Signal Processing":Oppeheim, Schafer, Buck Pearson education publication, 2nd Edition, 2003.
3. Digital Signal Processing fundamentals and Applications,Li Tan , Jean Jiang, Academic Press,2nd edition,2013
4. Digital Signal Processing – A computer based Approach, S.K.Mitra, Tata McGraw Hill,3rd edition,2006
5. Digital Signal processing-A Practical Approach,second edition, Emmanuel I. feacher, and BarrieW..Jervis, Pearson Education
6. Digital Signal Processing, S.Salivahanan, A.Vallavaraj, C.Gnapriya TMH
7. Digital Signal processing-A Practical Approach,second edition, Emmanuel I. feacher, and BarrieW..Jervis, Pearson Education
8. Digital Signal Processing, S.Salivahanan, A.Vallavaraj, C.Gnapriya TMH
9. Digital Signal Processors, Architecture, programming and applications by B. Venkatramani, M Bhaskar, Mc-Graw Hill.

LC – EEE 101	Simulation Lab (PG)	0:0:4	2

Course Objective: To teach students simulation processor of different power electronics converter.

Pre Requisite: Power Electronics, Basic MATLAB, PSIM.

List of Experiments

Experiments can cover any of the above topics, following is a suggestive list:

1. Review of Simulation Software – MATLAB & PSIM
2. Simulation & Analysis of Buck Converter
3. Simulation & Analysis of Boost Converter
4. Simulation of 3 phase rectifier circuit
5. Simulation of 3 phase inverter circuit
6. Simulation of Chopper Circuit
7. Simulation of FACTs Device
8. Simulation of PV module
9. Simulation of Three phase permanent magnet synchronous motor drive
10. Simulation of Chopper fed DC Drive

Course Outcomes: Students will be able to

CO 1 :Analyzing operation of different power electronic converters.

CO2 :Analyzing waveforms exhibited at the input and output ports of the converters.

CO3 **:**Measurement of input and outputs of converters

Text/ Reference books

1. Dr. Shailendra Jain, "Modeling and Simulation using MATLAB - Simulink", 2nd Edition, John wiley & sons.

LC–EEE 102	**Advance Power Electronics Lab.**	**0L: 0T: 4P (4 hrs.)**	**2 Credits**

Course Objective
Students will be able to comprehend the concepts of converters and also relate to the applications of phase controlled rectifiers. They will able to describe the importance of AC voltage controllers and cyclo converters for various industrial applications.

Pre Requisite: The students should know about the power working of electronic devices and their applications.

List of Experiments.

1. Understanding the Operation of three phase Half Controlled Rectifier.
2. Understanding the Operation of three phase Full Wave, Fully Controlled Bridge type Controlled Rectifier.
3. Study of Lienear relation between control voltage and SCR converter output DC voltage – using cosine firing scheme.-
4. Analyses of SCR based Parallel Inverter.
5. Analyses of SCR based series Inverter.
6. Analyses of SCR based Bridge Inverter.
7. Analyses of SCR based Mc murry Bedford Inverter.
8. Understanding the Operation of SCR based cycloconverter using R Load.
9. Understanding the Operation of SCR based cycloconverter using RL Load.
10. Understanding the Operation of SCR based Buck Boost Chopper.
11. Understanding the Operation of SCR based Morgans Chopper

MLC-EEE101	Bridge course on Power Electronics	2L : 0T : 0P (hrs.)	2 Credits

Course Objective: To review the concept of power electronics and find out the applications in recent trends.

Pre Requisite: Knowledge of Basic Electrical, Fundamental of Power Electronics, Network Analysis.

Module1: **(7 Hrs)**
Review of power Electronics: Concept of power electronics, application of power electronics, advantages and disadvantages of power electronics converters, power electronics systems, power semiconductor devices and recent trends in power semiconductor devices.
Over view on PNPN devices: Thyristors, brief description of members of Thyristor family with symbol, V-I characteristics and applications, SCR turn on methods, ratings, Heating, mounting & SCR protection, series and parallel operation, different commutation techniques of SCR.
Recent trends in power semiconductor devices. (GaN/SiC devices)

Module 2: (7 Hrs)
Phase controlled converters: Principle of operation of single phase and three phase half wave, half controlled, full controlled converters with R-L and RLE loads, effects of freewheeling diodes and source inductance on the performance of converters.
AC-DC PWM rectifiers Power quality issues, flyback converter based power factor correction circuits (PFC) Models, applications in front end of motor drives

Module 3: (8 Hrs)
DC-DC converters: Principle of operation, control strategies, step up choppers, types of choppers circuits based on quadrant of operation.
Analysis of buck, boost, buck-boost, Cuk converters, Analysis of isolated dc-dc converters including forward, flyback, push-pull, full bridge and dual active bridge topologies.

Module 4: (6 Hrs)
DC-AC Converters: Definition, classification of inverters based on nature of input source, wave shape of output voltage, method of commutation & connections, methods of harmonic reduction of inverters, Resonant Pulse inverters.
DC-AC PWM inverters Voltage source inverters - topology and PWM techniques, Models of single phase and three phase inverters and control methods, Applications in low frequency AC synthesis, Three-phase PWM techniques

Module 5: (7 Hrs)
Practical issues in power electronic converters Selection criteria for diodes, MOSFETs and IGBTs; gate drive circuits, Thermal management EMI and layout issues.
Recent trends in power electronics - Electric Vehicles**,** Renewable and Energy Storage Application of Power Electronics

Course Outcomes: Students will be able to

CO 1 Acquire knowledge about fundamental concepts and switches used in power electronics

CO 2 Analyze AC-DC converter (Rectifier) circuits

CO 3 Illustrate working principles of DC-DC converter (Inverters) circuits

CO 4 Illustrate working principles of DC-AC converter (Choppers) circuits

CO 5 Acquire knowledge about recent trends in power electronics & applications.

Text/ Reference books

1. Joseph Vithayathil, "Power Electronics, Principles and Applications", McGraw Hill Series, 6th Reprint, 2013.
2. M D. Singh, K B. Khanchandani, "Power Electronics", Tata McGraw Hill Publishing company limited, 2nd Edition, 2006.
3. M H Rashid, "Handbook of Power Electronics", Pearson Education India, 2008.
4. C. M. Pauddar, "Semiconductor Power Electronics (Devices and Circuits)", 1st Edition, Jain Brothers New Delhi, 1999.
5. L. Umanand, "Power Electronics Essentials and Applications", Wiley, 2010.
6. Ned Mohan Tore. M. Undel and, William. P. Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, 3rd edition, 2003.
7. Sen, P.C., "Power Electronics", Tata McGraw Hill Publishing Company limited, 1nd Edition, 2001.

PSCC – EEE201	**Advanced Microprocessor and Microcontroller & its Application**	**3L: 0T: 1P (4 hrs.)**	**4 credits**

Course Objective: The objective of this course is to familiarize the students with the architecture of and the instruction set of an Intel microprocessor and microcontroller, design of various types of digital and analog interfaces. The course also provides hands on experience on assembly language programming.

Pre Requisite: Digital Electronics Circuits.

Module 1 (8 hrs.)

ADVANCED PROCESSORS

Introduction to 16-bit and 32-bit microprocessors – 80x86 family. Assembly language programming for 8086/8088. Register details, operation-addressing modes & instruction set of a typical 16-bit microprocessor

Module 2 (10hrs.)

PROGRAMMIABLE SUPPORT CHIPS

Programmable parallel interface chip (e.g.8255) functional schematic. Pin function operating mode interface with microprocessor chip programming serial communication interface chip (e.g. 8251) functional schematic pin function. Operating mode interface with processor mode and command words for the chip programmable interrupt controller (8259) functional schematic pin function single and cascaded operation interface with microprocessor and I/O devices programmable interval timer (8253) functional schematic pin functions. Modes of operations.

Module 3 (6 hrs.)

32-BIT INTEL MICROPROCESSORS

The Intel 80286, 80386, 80486, Pentium and RISC based Intel MMX architecture. Real mode of 80386, protected mode of 80386, Virtual 8086 mode.

Module 4 (6hrs.)

MICROCONTROLLER

Hardware and software integration in microprocessor control system. An overviewof 8-bit microcontroller architecture and instruction set.

CASE STUDY

Example of microprocessor application: Data acquisition system open loop closeloop controller

Module 5 (6hrs.)

ARM FAMILY OF PROCESSORS

Overview of ARM architecture, Android-ARM hardware- software interface.

Course Outcomes: Students will be able to

CO1. Discuss various advanced microprocessor and their application.

CO2. Discuss and interface with various controllers.

CO3. Explain about 32-Bit Intel Microprocessors.

CO4. Understand basic concept microcontroller.

CO5. Discuss about basic of ARM architecture

Text/ Reference books

1. Advanced Microprocessor A.K. Ray, K.M. Bhurchandi, TMH.
2. Microprocessor Hardware & Programming Douglas V Hall.
3. ARM System Developer's Guide: Designing and Optimizing System Software Morgan Kauffman Publisher.
4. IBM PC Assembly Language & Programming, Peter Abel, PHI.
5. Microprocessor & Interfacing – Dauglas Hall, THM .
6. Ramesh S Gaonkar, Microprocessor architecture, Programming and applications with 8085, 5/E Prentice Hall, 2002.
7. Advanced 80386 Programming Techniques: James Turley.
8. Advance Microprocessor - Deniel Tabak.
9. The Intel Microprocessors (Eight Editions): Barry B. Brey.
10. The 8086 Microprocessor, Kenneth Ayala, Cengage Learning.
11. The 8088 and 8086 Microprocessors, Triebel & Singh, Pearson Education.

ARM System-on-Chip Architecture (2nd Edition): Steve Furber

PSCC-EE202	Advance Electrical Drives	L3 : T1 : P0 (4 hrs.)	4 Credits

Course Objective:advance electrical drives course are give unified treatment of complete electrical drive systems, electrical machines, power converters and control system.

Module 1(10hrs.)

DC Drives: Rectifier fed DC drive,Phase controlled converter fed DC drives, steady state analysis of three phase converter controlled DC motor Drive, principle of DC motor speed control, Chopper Control DC drives,steady state analysis of chopper controlled DC Drives, Dual-converter control of DC drive, DC motor Drive with field weakening, four quadrant DC motor drives; Close loop control of DC drive, dynamics of D.C. motor drives and analysis of steady state and dynamic operation.

Module 2 (8hrs.)

AC Drives: Closed loop control schemes, dynamic and regenerative braking, Torque slip characteristics, speed control through slip, rotor resistance control, and chopper controlled resistance; Review of dq0 model of 3-Ph IM, Principle of vector control of IM, Direct vector control, Indirect vector control with feedback, Indirect vector control with feed-forward, Indirect vector control in various frames of reference, Decoupling of vector control with feed forward compensation , Direct Torque Control of IM.

Module 3 (8hrs.)

Vector and Sensor Vector Control of Induction Motor: Introduction of vector control, direct vector control, derivation of indirect vector control, implementation-block diagram, estimation of flux, flux weakening operation; Slip and speed estimation at low performance, rotor angle and flux linkage estimation at high performance, rotor speed estimation scheme estimators using rotor slot harmonics, model reference adaptive systems, extended Kalamn filter, injection of auxiliary signal on salient rotor.

Module 4(10hrs.)

Synchronous Motor Drives: Introduction of three phase synchronous machine, analysis of steady state operation and dynamic operation, voltage and torque equations in machine variables and rotor reference frame variables (Park's equations), analysis of dynamic performance for load torque variations; Types of PM Synchronous motors, Torque developed by PMSM, Model of PMSM, Implementation of vector control for PMSM.

Module 5 (10hrs.)

Control of Switched Reluctance Motor Drives: Introduction of Switched Reduction Motor Drives, SRM Structure, Stator Excitation, techniques of sensor less operation, convertor topologies, SRM drive design factors, Torque controlled SRM, instantaneous Torque control using current controllers and flux controllers.

Control of BLDC Motor Drives: Principle of operation of BLDC Machine, Sensing and logic switching scheme, methods of reducing Torque pulsations, Three-phase full wave Brushless dc motor, Sinusoidal type of Brushless dc motor, current controlled Brushless dc motor.

Course Outcomes: Students will be able to

CO1: To understand the basic concepts and closed loop control methods for DC Drives.

CO2: To explain closed loop control methods for AC Drives.

CO3: To explain Vector and Sensor Vector Control of Induction Motor drives.

CO4: To understand the basic concepts and modeling of Synchronous motor drives.

CO5: To explain control methods for special motor drives

Text/ Reference books

1. Mohan N., Underland T.M. and Robbins W.P., "Power Electronics –Converters, Applications and Design", 3rd Ed., Wiley India. 2008
2. Bose B.K., "Power Electronics and Variable Frequency Drives –Technology and Applications", IEEE Press, Standard Publisher Distributors. 2001
3. B.K.Bose, Power Electronics & A.C. Drives, Prentice Hall, 1986
4. Rashid M., "Power Electronics- Circuits, Devices and Applications", 3rd Ed., Pearson Education.
5. Dubey G. K., "Power Semiconductor Controlled Drives", Prentice Hall International Edition. 1989
6. Murphy J. M. D. and Turnbull F. G., "Power Electronics Control of AC Motors", Peragmon Press.
7. G. K. Dubey : Fundamentals of Electrical Drives, 2nd Edition, Alpha Science International, 2001.
8. S. B. Dewan, Gordon R. Slemon and A. Straughen: Power Semiconductor Drives, John Wiley Pub.1996.
9. R. Krishnan: Electric Motor drives - Modelling, Analysis and Control, PHI India Ltd., 2002.
10. W. Shepherd, D. T. W. Liang and L.N. Hulley: Power Electronics and Motor Control, 2nd Edition, Cambridge Univ. Press, 1995.

PSEC-EEE201 (A)	Computer Aided Power Electronics Analysis & Design	3L :1T : 0P (hrs.)	Credits 4

Course Objective: Educate students with the modeling and simulations of various power electronic devices and converters using simulation softwares like SPICE and MATLAB simulink.

Pre Requisite: Power Electronics, Power System

Module 1(8 hrs.)

Introduction to power electronics simulation, methods of analysis and formulation of system equations.

Module 2 (9 hrs.)

Modeling of power electronics system elements, computer formulation of power electronics system equations, review of graph theory.

Module 3 (7 hrs.)

Introduction to Spice, Auto sec, Simulink for power electronics converter analysis. Introduction to digital optimization, Sequential methods of simulation.

Module 4 (9 hrs.)

Advance techniques for efficient computation. Creation of data files for power semiconductors, magnetic and capacitors.

Module 5 (8 hrs.)

Modeling of stray inductance, Capacitances and connections, Thermal Modeling and heat flow design. Analysis under abnormal fault conditions and design of protection circuits.

Course Outcomes: Students will be able to

CO1 Discuss the Power Electronics simulation and formulation of System equation.

CO2 Abilityto simulate power electronic converters and analyze their performance.

CO3 Understandmodeling and simulations of various power electronic devices and converters using SPICE and MATLAB simulink..

CO4 DiscussAdvance techniques for efficient computation.

CO5 Educate different fault conditions and design of protection circuits.

Text/ Reference books

1. Computer Aided Power Electronics Analysis and design Venkatachari Rajgopal

2. Power Electronics and AC Drives B. K. Bose

3. Power Electronics Control Turnbull JMD Murphy & FG

4. Design of Inductors & Transformers Col. Mc

5. Manufacturers Catalogue on Rectifiers GE,

6. West.code/International/ Ferraz/Prague/Siemens etc.

PSEC-EEE201 (B)]	**HVDC Engineering**	**L3: T0 : P0 (3 hrs.)**	**3 Credits**

Course Objective: This subject deals with the importance of HVDC transmission, analysis of HVDC converters, faults and protections, harmonic

Prerequisites: Power System-I, II , Power Electronics

Module:1(8 Hours)
Comparison of AC/DC transmission. Application of DC transmission. Examples of HVDC lines. Analysis of HVDC converter, Pulse No. Six and twelve pulse converter analysis. Relation for current and voltage.

Module:2 (8 Hours)
HVDC system control, Principles of DC link control, converter control characteristics. Firing angle control, System control hierarchy. Harmonics and filters, Generation of harmonics and elimination

Module:3 (8 Hours)
AC/DC system load flow, system modeling, PU system unified and sequential methods of solution, reactive power requirement at converter bus.

Module:4 (8 Hours)
AC-DC system interactions, voltage interaction, dynamic voltage regulation, voltage instability, dynamic stability and power modulation. Harmonic, instability, torsional interactions with HVDC system.

Module:5 (8 Hours)
Fault modelling and analysis, over current characteristics of DC line, faults, detection of DC line faults, fault characteristics protection of DC line grounding. Main design aspects of HVDC transmission system. General requirements series/parallel arrangements of converters. Converter design. Converter transformer design aspects

Course Outcomes: Students will be able to

CO 1To understand the concept of HVDC transmission and HVDC converters and the applicability and advantage of HVDC transmission over conventional AC transmission.

CO 2: Understand HVDC system control strategies.

CO 3: Students can understand AC- DC load flow, and reactive power requirement at converter bus.

CO 4: Understand the AC DC interaction and the concept of voltage instability, dynamic stability and power modulation

CO 5: Study and understand the nature of faults happening on both the AC and DC sides of the converters and formulate protection schemes for the same.

Text Books:

1. J.Arrillage, “High Voltage Direct Current Transmission”, IET edition 1998.

2. J. Arrillaga and N. R. Watson “Computer Modeling of Electrical Power System” John Wiley edition 2001.

Reference Books:

1. K. R. Padiyar, “HVDC power transmission systems”, New Age International edition1990.

2. E.W. Kimbark, “Direct Current Transmission”, Wiley Inter science edition 1971.

PSEC-EEE201(C)	**Power electronics Applications to Power System(Elective)**	**L3: T0: P0 (3 hrs.)**	**3 Credits**

Course Objective: The objective of this course is to make students familiar with power system component models, sensitivity analysis proximity indicators and FACTs devices.

Prerequisites: Power Electronics Power system I, II

Module – I (10 Hours)

Power System components models formation of bus admittance matrix, algorithm for formation of bus impedance matrix. Reactive power capability of an alternator, transmission line model & amp; loadability, Reactive power transmission & amp; associated difficulties, Regulated shunt compensation, Models of OLTC & Phase shifting transformer, load flow study.

Module-II(8 Hours)

Sensitivity analysis: Generation shift distribution factors, line outage distribution factors, Compensated shift factors. Power systems security levels, contingency selection & evaluation, security constrained economic dispatch. Pre-contingency corrective rescheduling.

Module - III(8 Hours)

Voltage stability: Proximity indicators e.g. slope of PV curve, Minimum Eigen value of reduced load flow Jacobian participation factors based on modal analysis and application.

Module - IV(8 Hours)

Flexible ac transmission system, reactive power control, brief description and definition of FACT's controllers, shunt compensators, configuration and operating characteristics of TCR, FC-TCR, TSC, STATCOM Comparisons of SVCs and STATCOM.

Module -V(8 Hours)

Thyristers controlled series capacitor (TCSC) Advantages of the TCSC, Basic principle and different mode of operation, analysis variable reactance model and transient stability model of TCSC. Introduction, operating principle of UPFC and IPFC

Course Outcomes: Students will be able to

CO 1: Students can understand formation of bus admittance matrix, Regulated shunt compensation, modeling of OLTC

CO 2: Students can understand sensitivity analysis, power systems security levels, contingency selection

CO 3: Students are familiar with voltage stability, proximity indicators.

CO 4 Students can understand the FACTs controller and shunt compensation devices.

CO 5:Students can understand FACTs controller for series compensation.

Text Books:

1. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", Tata McGraw Hill 2011.
2. A. J. Wood and B. F. Wollenberg, "Power generation, operation and control", second edition John Wiley and Sons 1996.
3. N. G. Hingorani and L. Gyugyi, "Understanding facts: Concepts and Technology of flexible AC transmission systems", Wiley Press 2000.

Reference Books:

1. P. Kundur, "Power System Stability and control", McGraw-Hill edition 2008.
2. R. M. Mathur and R. K. Varma, "Thyristor Based FACTS Controllers for electrical Transmission systems", John Wiley and sons 2002.

LC-EEE201	Electrical Drive Lab	0L : 0T : 4P (hrs.)	Credits 2

Course Objective: Student will understand different practical application of Electrical Drive in Industry.
Pre Requisite: Power Electronics, Control System

Followed by:

1. Modeling of separately excited DC Motor (system identification / parametric measurement).
2. Armature control of S.E.DC Motor - Constant Torque, Constant HP.
3. Four quadrant DC Drive - Motoring and Braking
4. T-N characteristics using voltage control
5. T-N characteristics using V/F control
6. T-N characteristics of different loads
7. Simulation of closed loop DC drive
8. Simulation of closed loop V/F drive
9. Study of commercial AC and DC drives.

Course Outcomes: Students will be able to

CO1 Describe the structure of Electric Drive systems and their role in various applications.
CO2 Discuss the operation of dc motor drives to satisfy four-quadrant operation.
CO3 Explain industrial aspects of induction motor drives in an energy efficient manner using power electronics.
CO4 Describe speed control of Induction motor drive using rotor resistance control & slip power recovery methods.
CO5 Define industrial application & control of Synchronous Motors by Separate &Self-control.

LC-EEE202	MPMC Lab	0L : 0T : 4P (hrs.)	Credits 2

Course Objective: The objective of this course is to become familiar with the architecture and the instruction set of an Intel microprocessor. Assembly language programming will be studied as well as the design of various types of digital and analog interfaces.

Pre Requisite: Basics of Microprocessor, Digital Electronics

Followed by:

1. Addition of two binary number of 8 byte length.
2. To find the maximum no. in a given string (16 bytes long) and store it in location 0310.
3. To sort a string of a no. of bytes in descending order.
4. To multiply an ASCII string of eight numbers by a single ASCII digit. The result is a string of unpacked BCD digits.
5. To study architecture and pin out diagram of 8086.
6. To study architecture and pin out diagram of 8051.
7. Write an 8051 C program to ON/OFF the Buzzer.
8. Write an 8051 C program LEDs blinking.
9. Write a LCD program for character move.
10. Write a C program to read the keypad and display the result on the LCD.
11. Write a program on Stepper Motor's Movement in Forward and Reverse Directions.
12. To study the architecture of SOC Broadcom-2835 application board of Raspberry Pi.
13. To demonstrate the basic linux commands on Raspberry pi.
14. To create a database & Store the value in Raspberry Pi.

Course Outcomes: Students will be able to

CO1. Explain about 8086 microprocessorand its assembly languageprogramming.

CO2. Explain about 8051 microcontroller and its assembly language programming..

CO3. Discuss about interfacing with various controllers like ADC & DAC with 8051 microcontroller.

CO4. Understand the basic concept of Raspberry Pi.

CO5. Demonstrate the basic concept of linux.

IPS Academy

INSTITUTE OF ENGINEERING & SCIENCE

(A UGC Autonomous Institute affiliated to RGPV)

Electrical and Electronics Engineering Department

MLC-EEE201	**Research Methodology & IPR**	**2L:0T:0P (2 hrs.)**	**2 Credits**

Course Objective: To understand the research problem and knownabout the literature studies, plagiarism and ethics.

Module 1(10hrs.)
Foundations of Research: Meaning of research problem, Motivation, Sources and Objectives of research problem; Criteria Characteristics of a good research problem, Errors in selecting a research problem, Concept of theory, empiricism, deductive and inductive theory; Understanding the language of research – Concept, Construct, Definition, Variable; Research Process; Problem Identification & Formulation, Hypothesis Testing – Logic & Importance.

Module 2(10hrs.)
Research Design: Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations, Exploratory Research Design – concept, types and uses; Descriptive Research Designs – concept, types and uses; Experimental Design: Concept of Independent & Dependent variables; Qualitative and Quantitative Research – Concept of measurement, causality, generalization, replication; Merging the two approaches.

Module 3 (8hrs.)
Measurement: Concept of measurement, Problems in measurement in research – Validity and Reliability; Levels of measurement – Nominal, Ordinal, Interval, Ratio; Sampling-Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, and Sample Size; Characteristics of a good sample; Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling.

Module 4 (8hrs.)
Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association; Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline.

Module 5 (8hrs.)
Use of tools / techniques for Research: Reference Management Software like Mendeley, Software for paper formatting like LaTeX/MS Office, Effective literature studies approaches, analysis, Plagiarism, Research ethics; Interpretation of Data and Paper Writing – Layout of a Research Paper, Ethical issues related to publishing, Plagiarism and Self-Plagiarism, Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of

Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports and Oral Presentation.

Course Outcomes: Students will be able to

CO1: To understand the foundation of research.

CO2: To impart the knowledge the formulation research problems.

CO3: To understand the measurement procedures.

CO4: To understand data analysis methods.

CO5: To impart the knowledge of use of tools / techniques for research.

Text/ Reference books

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'.
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction".
3. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
4. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
5. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
6. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
7. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
8. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
9. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.

Aud II	Disaster management	2L: 0T: 0P (02 hrs.)	Credits: 00

COURSE OBJECTIVE:
To. understand the fundamentals approaches of disaster risk reduction & relationship between vulnerability, disaster, disaster prevention and risk reduction

COURSE CONTENT:
Types and consequence of major accident hazards, Role of management, Local authorities and public, Disaster Management rehabilitation Cycle - Prevention, Mitigation, Preparedness, Disaster impact, Response, Restoration, Reconstruction, Onsite & offsite emergency planning; Emergency preparedness, rehearsal & exercises.

Role of Insurance in Disaster Management, Role of International co-operation (i.e. NGO & UN Agencies), Effect on environment due to disaster. Need for National Capacity Building and Disaster Knowledge Network.

The Disaster Management Act:: Need for technological input in disaster mitigation, community based disaster preparedness program; Preparation of Disaster Management; Plan Early Warning System; Role of Information " Technology (IT)

Natural Disaster like Earthquake, Mine fire, flood etc, Dangerous properties of some highly hazardous chemicals, Industrial Disaster due to toxic gas release, Fire or Explosion, Case - Studies.

Accident related Disasters (Forest fires, Air, road, & Rail Accidents, Rural & Urban Fires, Oil Spills, Major building collapse etc, Case Studies.

COURSE OUTCOME:

CO1. Student will able to evaluate the principles and practices of disaster risk reduction and management.

CO2. Student will able to know the basic role of public, national/international organizations m disaster management.

CO3. Student will able to prevention, mitigation preparedness, response and recovery process in disaster management.

CO4. Students will able to understand distinguish between the different approaches needed to manage pre-during and post disaster periods.

CO5. Student will able to apply the knowledge in conducting independent DM study including data search and analysis from disaster case study.

EVALUATION:

Evaluation will be continuous an integral part of the class as well through external assessment.

REFERENCES:

Disaster Management Act 2005
Industrial Security Management S.C. Dey
Dangerous Properties of Industrial Material 0 Irvin Sex.
Encyclopedia of occupational Health & Safety (OSHA) IV edition.
Safe Handling of Hazardous Chemicals by Rohatgi.
Industrial Fire Hazards H(lnd Book (NFPA)
Major Hazard ControllL. 0. Geneva.
What went wrong- Trevor Kletz.
Chemical process safety Ll Daniel. A. Crawl, Joseph F Louver.
Madhya Pradesh Control of Industrial Major Accident Hazards rules 1999

OEC-EEE201(A)	Voice & Data Network	3L: 0T: 0P (03 hrs.)	Credits: 03

Course Objective: The purpose of this subject is to cover the basics of telephone networks and switching structures and basic concept of OSI and TCP/IP model and networking. In this subject we discuss switching structures, various protocols, standards.

Prerequisite: Data Communication

Module I (8 hrs.)
Introduction: Principle of cross-bar switching, Electronic switching, Space division switching, Time division switching – digital: space and time and combination, Two, Three and N stage networks, Traffic engineering – Network traffic load and parameters, grade of service and blocking probability, modeling switching systems, Incoming traffic and service time characterization, blocking models and loss estimates, delay systems.

Module II (8 hrs.)
Telephone Networks: Subscribe loop systems, switching Hierarchy and Routing, Transmission plan, Transmissions systems, Numbering plan, Charging plan, Signaling techniques, In channel signaling, common signaling. Internet Telephony and voice over IP (VoIP) - RTP and RTCP.

Module III (8 hrs.)
Data Networks: Types of data networks, topologies, centralized and distributed networks, LAN, WAN, MAN, overview of wireless networks, Overview of network models: ISO-OSI and TCP/IP, Physical Layer, Transmission media-guided and unguided, Circuit Switching and Packet Switching, Statistical Multiplexing.

Module IV(8 hrs.)
Data link layer: LLC and MAC sub layer, Error control, Flow control, Sliding Window Protocols, Static and Dynamic Channel Allocation in LAN, CSMA/CD Protocols, Collision free protocols, IEEE 802 standards for Ethernet, High speed LANs.

Module V (8 hrs.)
Network Layer and Transport Layer: Routers and Routing Protocols, IP protocol and addressing, Congestion Control and Algorithm, Transport layer services and principles, Connectionless v/s connection oriented services, UDP and TCP, Application Layer, Domain Name System, Electronic mail, World Wide Web, Security issues for Intranet and Internet, Quality of Service issues.

Assessment: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

Course Outcomes:

Students earning credits will develop ability to:

CO1. Understand the multi stage switching structures involving time and space switching stages and telecommunication traffic models.

CO2. Understand about basics of telephone signals and signaling techniques.

CO3. Understand the concepts of OSI, TCP/IP Models, circuit and packet switching.

CO4. Understand about the data link layer and IEEE standards for Ethernet.

CO5. Understand about routing protocol, congestion control and transport layer protocols.

Text/ Reference Books:

1. Thiagrajan Vishwanathan, “Telecommunication Switching Systems and Networks”, PHI. 1998.
2. William Stallings, “Data and computer communications”, Prentice Hall, 10th edition, 2017.
3. B. A. Forouzan, “Data Communications and Networking”, Tata McGraw Hill, 4th Edition, 2007
4. Tenenbaum, “Computer Networks”, 5th Edition, PHI, 2011.
5. L. Peterson and B. S. Davie, “Computer Networks: A Systems Approach”, 5th Edition, Morgan Kaufman, 2011.

OEC-EEE201(C)	Industrial safety	3L: 0T: 0P (03 hrs.)	Credits: 03

Course Objective:

To impart of knowledge on safety concept, legislation, performance and training in an organization for accident prevention purpose.

Module 1 (06 Hrs)

LEGISLATION: Objective, Definition, Application & provisions related to safety fire prevention and fire protection in Factories Act 1948, M.P. Factories rules 1962 ,Indian Explosive Act 1884, Gas Cylinder Rules 2004, Petroleum Act 1934 with Rules 2002. Overview of OHSAS 18001.

Module 2 (08 Hrs)

CONCEPTS & TECHNIQUES: Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety, incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit.

Module 3 (08 Hrs)

ACCIDENT INVESTIGATION AND REPORTING: Concept of an accident, reportable and non reportable accidents, unsafe act and condition –principles of accident prevention, Supervisory role- Role of safety committee – Accident causation models - Cost of accident. Overall accident investigation process - Response to accidents, India reporting requirement, Planning document, Planning matrix, Investigators Kit, functions of investigator, four types of evidences, Records of accidents, accident reports-Class exercise with case study.

Module 4 (08 Hrs)

SAFETY PERFORMANCE MONITORING: Permanent total disabilities, permanent partial disabilities, temporary total disabilities - Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety "t" score, safety activity rate – problems.

Module 5 (08 Hrs)

SAFETY EDUCATION AND TRAINING: Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation –communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

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

CO1. Know definition, application & provisions related to safety & fire prevention.
CO2. Apply the knowledge of safety concept and techniques in conducting plant inspections.
CO3. Evaluate accident indices used in safety performance monitoring.
CO4. Contribute in documentation process of accident investigation..
CO5. Understand the different approaches needed to impart safety education and training.

List of Text/Reference Books:

1. Accident Prevention Manual for Industrial Operations", N.S.C.Chicago, 1982
2. Heinrich H.W. "Industrial Accident Prevention" McGraw-Hill Company, New York, 1980.
3. Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay, 1997.
4. John Ridley, "Safety at Work", Butterworth & Co., London, 1983.
5. Blake R.B., "Industrial Safety" Prentice Hall, Inc., New Jersey, 1973
6. All Relevant Acts & Rules.
7. Fire Services Acts & rules of different states.

Curriculum of PG (Sp. in Power Electronics) in Electrical and Electronics Engineering Department

2nd Year 3rd Semester

S.No.	Course Code	Course Title	Hrs./ week			Credits
			L	T	P	
1	PSEC-EEE301	Elective III	3	0	0	3
2	LLC- EEE 301	Business communication	1	0	0	1
3	SBC- EEE301	Dissertation Phase- I	0	0	20	10
					Total credits	14

Professional Elective (PSEC-EEE301)
(A) Grid Interface of Energy Sources / Microcontrollers and Control
(B) Power Electronics Supply System & Design
(C) Non-Conventional Energy Sources and Energy Conservation

2nd Year 4th Semester

S.No.	Course Code	Course Title	Hrs./ week			Credits
			L	T	P	
1	SBC- EEE 401	Dissertation Phase- II	0	0	32	16
Total credits						16

PSEC-EEE301 (B)	**Power Electronics Supply System & Design**	**L3: T0 : P0 (3 hrs.)**	**3 Credits**

Course Objective: The objective of this course is to make students familiar with analysis and design of different converter, soft switching of converter and ups

Prerequisites: Power Electronics

Module:1(8 Hours)

Review of basic power electronics principles, Introduction to various power electronics supplies. Performance parameters for power electronics supplies and their measurement.

Module:2(10 Hours)

DC to DC converters: Analysis and design of cuk converters, two quadrant and full bridge non- isolated converters, Isolated converters, i.e., flyback, forward, push-pull, half- bridge, full bridge Zeta, and SEPIC topology, block diagram of converter control, modeling such as averaged model, linearized and state space model Design of DC inductor, Concept of integrated magnetic

Module: 3(8 Hours)

Soft switching DC to DC converters, zero current switching topologies, zero voltage switching topologies, generalized switch cell, ZCT and ZVT DC converters, design and simulation

Module :4(8 Hours)

Pulse width modulation rectifiers, properties of ideal rectifiers, Realization of near deal rectifiers, CCM boost converter, DCM flyback converters, control of current waveforms, AC Choppers: Modeling and analysis of AC choppers, harmonics control using symmetrical and asymmetrical waveform pattern, design and simulation.

Module:5(8 Hours)

Static un-interruptible power supply, on-line, off-line and line interactive UPS, modes of operation, batteries and converters selection and design for UPS, performance evaluation of UPS, power factor correction techniques, control of UPS.

Course Outcomes: Students will be able to

CO 1: Students can understand various types of power electronics devices and their performance.

CO 2: Students are able to analyze and design of different converter

CO 3: Students are familiar with different switching technique topologies.

CO 4 Students can understand the modeling and analysis of AC choppers and PWM technology.

CO 5: Students can understand the different types of UPS operation and performance evaluation.

Text Books:

1. Issa Batarseh, "Power Electronics Circuits", John Wiley & Sons Inc 2004.
2. Ned Mohan, "Power Electronics: Converters, Applications, and Design", John Wiley & Sons Inc 2003.
3. M. H. Rashid, "Power Electronics Circuits, Devices and Applications", third edition Pearson Education India, 2009.
4. L. Umanand, "Power Electronics Essential and Applications", Wiley India 2009.

Reference Books:

1. R. W. erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2013.
2. Y.S Lee, "Computer Aided Analysis and Design of Switch Mode Power Supplies", Marcel Dekker, New York 1993.
3. D. C. Griffith, "Uninterruptible Power Supplies", Marcel Dekker Inc, New York 1993. 4. K. Billing, "Switch Mode Power Supply Handbook", third edition McGraw Hill, Boston 2010.
4. "Switching Power Supply Design", A I Pressman, McGraw Hill Publication, 1991"Handbook of Power Electronics", M H Rashid

SBC – EEE 401	**Dissertation Phase – II**	**0L: 0T : 32P (hrs.)**	**16 Credits**