ACADEMIC REGULATIONS

COURSE STRUCTURE AND SYLLABI

FOR

M.TECH.
POWER ELECTRIONICS AND DRIVES
(ELECTRICAL AND ELECTRONICS ENGINEERING)
2012-2013

COLLEGE OF ENGINEERING

GAYATRI VIDYA PARISHAD COLLEGE OF ENGINEERING
(AUTONOMOUS)
ACCREDITED BY **NAAC** WITH **A** GRADE WITH A **CGPA** OF **3.47/4.00**
AFFILIATED TO JNTU KAKINADA
MADHURAWADA, VISAKHAPATNAM 530048

Vision

To evolve into and sustain as a Centre of Excellence in Technological Education and Research with a holistic approach.

Mission

To produce high quality engineering graduates with the requisite theoretical and practical knowledge and social awareness to be able to contribute effectively to the progress of the society through their chosen field of endeavor.

To undertake Research & Development, and extension activities in the fields of Science and Engineering in areas of relevance for immediate application as well as for strengthening or establishing fundamental knowledge.

F O R E W O R D

It is three years since the G.V.P College of Engineering has become Autonomous with the appreciation and support of erstwhile JNTU and the fast growing new JNTU-K. The college is progressing well with its programmes and procedures drawing more and more accolades from its sister autonomous colleges and higher authorities. The student community, also could adjust well to the new system without any acrimony.

The College is enriched with the experience of running the Post-graduate programmes under Autonomous stream. It is a moment of pride and achievement that the first Autonomous batch of M.Tech in some branches left the college to the satisfaction of all concerned including firms visited the campus for placements.

Another larger than canvas picture is foreseen for the programmes wherein the college is getting the funds through TEQIP – II for up-scaling the PG education and research under sub- component 1.2. In this connection two new PG Programmes have been introduced in Mechanical, Electrical Engineering.

New set of Boards of Studies, Academic council and Governing Body has further strengthened our hands by endorsing the practices and suggested recommendations.
The encouragement given by the affiliating JNTU-K has left no task insurmountable.

Principal

MEMBERS ON THE BOARD OF STUDIES IN ELECTRICAL & ELECTRONICS ENGINEERING

- Head of the Department.

- Prof. C. Radhakrishna, Director, Global Energy Consulting Engineers Pvt. Ltd., Secunderabad.
- Dr. K. Shanti Swarup, Department of Electrical Engineering, IIT Madras.
- Dr. Ch. Saibabu, Professor in Electrical Engg. and Director (Admns), JNTU-K, Kakinada.
- Dr. M. Sydulu, Professor of EEE, NIT, Warangal.
- Dr. K.A. Gopala Rao, Professor of Electrical Engg. AU College of Engg., Visakhapatnam.
- Dr. N.K. Kishore, Professor of Electrical Engg., IIT Kharagpur.
- Sri M.V.R. Krishna Rao, AGM (ETL), Visakhapatnam Steel Plant.
- Sri T. Srinivas Kishore, Assistant Professor, GMRIT, Rajam.

All faculty of the department.

ACADEMIC REGULATIONS

(Effective for the students admitted into
first year from the academic year 2012-2013)

The M.Tech. Degree of JNTU-KAKINADA shall be recommended to be conferred on candidates who are admitted to the program and fulfill all the requirements for the award of the Degree.

1.0 ELGIBILITY FOR ADMISSION:

Admission to the above program shall be made subject to the eligibility, qualifications and specialization as per the guidelines prescribed by the APSCHE and AICTE from time to time.

2.0 AWARD OF M.TECH. DEGREE:

a. A student shall be declared eligible for the award of the M.Tech. degree, if he pursues a course of study and completes it successfully for not less than two academic years and not more than four academic years.
b. A student, who fails to fulfill all the academic requirements for the award of the Degree within four academic years from the year of his admission, shall forfeit his seat in M.Tech. Course.
c. The duration of each semester will normally be 20 weeks with 5 days a week. A working day shall have 7 periods each of 50minutes.

3.0 COURSES OF STUDY:

M.TECH. COURSES	INTAKE
Chemical Engineering	18
Computer Science and Engineering	18
CAD/CAM	18
Infrastructural Engineering and Management	18
Structural Engineering	18
Power System Control and Automation	18
Embedded Systems & VLSI Design	18
Communications & Signal Processing	18
Software Engineering	18
Power Electronics Drives	18
Computer Aided Analysis And Design (CAAD)	18

4.0 ATTENDANCE:

The attendance shall be considered subject wise.

a. A candidate shall be deemed to have eligibility to write end semester examinations in a subject if he has put in at least 75% of attendance in that subject.

b. Shortage of attendance up to 10% in any subject (i.e. 65% and above and below 75%) may be condoned by a Committee on genuine and valid reasons on representation by the candidate with supporting evidence.

c. Shortage of attendance below 65% shall in no case be condoned.

d. A student who gets less than 65% attendance in a maximum of two subjects in any semester shall not be permitted to takethe end- semester examination in which he/she falls short His/her registration for those subjects will be treated as cancelled. The student should re-register and repeat those subjects as and when offered next.

e. If a student gets less than 65% attendance in more than two

subjects in any semester he/she shall be detained and has to repeat the entire semester.

f. A stipulated fee shall be payable towards condonation of shortage of attendance.

5.0 EVALUATION:

The Performance of the candidate in each semester shall be evaluated subject-wise, with 100 marks for each theory subject and 100 marks for each practical, on the basis of Internal Evaluation and End Semester Examination.

a. A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the End Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

b. For the theory subjects 60 marks shall be awarded based on the performance in the End Semester Examination, 40 marks shall be awarded based on the Internal Evaluation. One part of the internal evaluation shall be made based on the average of the marks secured in the two Mid–Term Examinations of 30 each conducted one in the middle of the Semester and the other immediately after the completion of instruction. Each mid-term examination shall be conducted for a duration of 120 minutes with 4 questions without any choice. The remaining 10 marks are awarded through an average of continuous evaluation of assignments / seminars / any other method, as notified by the teacher at the beginning of the semester.

c. For Practical subjects, 50 marks shall be awarded based on the performance in the End Semester Examinations, 50 marks shall be awarded based on the day-to-day performance as Internal marks**.** A candidate has to secure a minimum of 50% in the external examination and has to secure a minimum of

50% on the aggregate to be declared successful.

d. There shall be a seminar presentation during III semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the Department in a report form and shall make an oral presentation before the Departmental Committee. The Departmental Committee consists of the Head of the Department, supervisor and two other senior faculty members of the department. For Seminar there will be only internal evaluation of 50 marks. A candidate has to secure a minimum of 50% to be declared successful.

e. For Seminar in I, II Semesters in case of the course structure of having 5 Theory + 2 Labs. + 1 Seminar, a student has to deliver a seminar talk in each of the subjects in that semester which shall be evaluated for 10 marks each and average marks allotted shall be considered. A letter grade from A to C corresponding to the marks allotted may be awarded for the two credits so as to keep the existing structure and evaluation undisturbed.

A – Excellent	(average marks > 8
B – Good	(6< average marks <8)
C – Satisfactory	(5< average marks <6)

If a satisfactory grade is not secured, one has to repeat in the following semester.

f. In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.0 a, c) he has to reappear for the End Examination in that subject.

A candidate shall be given one chance to re-register for each subject provided the internal marks secured by a candidate are

less than 50% and he has failed in the subject(s). In such a case the candidate must re-register for the subject (s) and secure required minimum attendance. Attendance in the re-registered subject (s) has to be calculated separately to become eligible to write the end- examination in the re-registered subject(s). In the event of re-registration, the internal marks and end examination marks obtained in the previous attempt are nullified.

g. In case the candidates secure less than the required attendance in any subject(s), he shall not be permitted to appear for the End Examination in that subject(s). He shall re-register for the subject(s) when next offered.
h. Laboratory examination for M.Tech subjects must be conducted with two Examiners, one of them being Laboratory Class Teacher and second examiner shall be other than Laboratory Teacher.

6.0 EVALUATION OF PROJECT / DISSERTATION WORK:

Every candidate shall be required to submit the thesis or dissertation after taking up a topic approved by the Departmental Research Committee (DRC).

a. A Departmental Research Committee (DRC) shall be constituted with the Head of the Department as the chairman and two senior faculty as members to oversee the proceedings of the project work from allotment to submission.
b. A Central Research Committee (CRC) shall be constituted with a Senior Professor as chair person, Heads of all the Departments which are offering the M.Tech. programmes and two other senior faculty members.
c. Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance

d. requirement of all the subjects (theory and practical subjects.)
e. After satisfying 6.0 c, a candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work to the DRC for its approval. Only after obtaining the approval of DRC the student can initiate the Project work
f. If a candidate wishes to change his supervisor or topic of the project he can do so with approval of DRC. However, the Departmental Project Review Committee shall examine whether the change of topic/supervisor leads to a major change in his initial plans of project proposal. If so, his date of registration for the Project work shall start from the date of change of Supervisor or topic as the case may be whichever is earlier.
g. A candidate shall submit and present the status report in two stages at least with a gap of 3 months between them after satisfying 6.0 d.
h. The work on the project shall be initiated in the beginning of the second year and the duration of the project is for two semesters. A candidate shall be permitted to submit his dissertation only after successful completion of all theory and practical subject with the approval of CRC but not earlier than 40 weeks from the date of registration of the project work. For the approval by CRC the candidate shall submit the draft copy of the thesis to the Principal through the concerned Head of the Department and shall make an oral presentation before the CRC.
i. Three copies of the dissertation certified by the supervisor shall be submitted to the College after approval by the CRC.
j. The dissertation shall be adjudicated by one examiner selected by the Principal. For this HOD shall submit in consultation with the supervisor a panel of 5 examiners, who

k. are experienced in that field.

l. If the report of the examiner is not favorable, the candidate shall revise and resubmit the dissertation, in a time frame as prescribed by the CRC. If the report of the examiner is unfavorable again, the dissertation shall be summarily rejected then the candidate shall change the topic of the Project and option shall be given to change the supervisor also.

m. If the report of the examiner is favorable, viva-voce examination shall be conducted by a board consisting of the supervisor, Head of the Department and the examiner who adjudicated the dissertation. The Board shall jointly report candidate's work as:

A. Excellent
B. Good
C. Satisfactory

7.0 AWARD OF DEGREE AND CLASS :

A candidate shall be eligible for the respective degree if he satisfies the minimum academic requirements in every subject and secures satisfactory or higher grade report on his dissertation and viva-voce.

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M.Tech. Degree he shall be placed in one of the following three classes.

% of Marks secured	Class Awarded
70% and above	First Class with Distinction
60% and above but less than 70%	First Class
50% and above but less than 60%	Second Class

The marks in internal evaluation and end examination shall be shown separately in the marks memorandum.

The grade of the dissertation shall also be mentioned in the marks memorandum.

8.0 WITHHOLDING OF RESULTS:

If the candidate has not paid any dues to the college or if any case of indiscipline is pending against him, the result of the candidate will be withheld and he will not be allowed into the next higher semester. The recommendation for the issue of the degree shall be liable to be withheld in such cases.

9.0 TRANSITORY REGULATIONS:

A candidate who has discontinued or has been detained for want of attendance or who has failed after having studied the subject is eligible for admission to the same or equivalent subject(s) as and when subject(s) is/are offered, subject to 6.0 e and 2.0

10.0 GENERAL

1. The academic regulations should be read as a whole for purpose of any interpretation.

2. In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman Academic Council is final

3. The College may change or amend the academic regulations and syllabus at any time and the changes amendments made shall be applicable to all the students with effect from the date notified by the College.

4. Wherever the word he, him or his occur, it will also include she, hers.

COURSE STRUCTURE

I SEMESTER

COURSE CODE	Theory / Lab	L	P	C
12EE2201	Analysis of Power Electronic Converters-1	4	-	4
12EE2202	Solid State Control of DC Drives	4	-	4
12EE2203	Embedded Systems	4	-	4
12EE2204	Digital Control Systems	4	-	4
12EE2205	Optimization Techniques	4	-	4
	Elective - I	4	-	4
12EE2206	Advanced Digital Signal Processing			
12EE2207	High Voltage DC Transmission			
12EE2208	Modern Control Theory			
12EE2209	Power Electronics and Drives Laboratory-I	-	3	2
	Total	**24**	**3**	**26**

II SEMESTER

COURSE CODE	Theory / Lab	L	P	C
12EE2210	Analysis of Power Electronic Converters-II	4	-	4
12EE2211	Solid State Control of AC Drives	4	-	4
12EE2212	Analysis of Special Machines	4	-	4
12EE2213	Dynamics of Electrical Machines	4	-	4
12EE2214	Power Quality	4	-	4
	Elective - II	4	-	4
12EE2215	Flexible AC Transmission Systems (FACTS)			
12EE2216	Neural and Fuzzy Systems			
12EE2217	Design and Simulation of Power Electronics Circuit			
12EE2218	Power Electronics and Drives Laboratory-II	-	3	2
	Total	**24**	**3**	**26**

III SEMESTER

COURSE CODE	THEORY/LAB	L	P	C
Commencement of Project Work				
12EE22SM	SEMINAR	-	-	2

IV SEMESTER

COURSE CODE	THEORY/LAB	L	P	C
12EE22PW	PROJECT WORK/DISSERTATION/ THESIS EXCELLENT/GOOD/SATISFACTORY/ NON-SATISFACTORY	-	-	56

ANALYSIS OF POWER ELECTRONIC CONVERTERS-I

Course Code: 12EE2201 **L P C**
4 0 4

UNIT-I: POWER SEMICONDUCTOR DEVICES

Power Diodes, Power BJTs, Power MOSFETs, Thyristors, Gate Turn Off Thyristors, IGBTs, MOS-Controlled Thyristors, Comparison of Controllable Switches,Drive and Snubber Circuits, Justification for Using Idealized Device Characteristics

UNIT-II: CONTROLLED RECTIFIERS

Introduction, Principle of phase controlled converter operation, single phase full converters, single phase dual converters, Three phase half wave converters, three phase full converters, Three phase dual converters, Power factor improvements, Single phase semiconverters, Three phase semiconverters.

UNIT-III: AC VOLTAGE CONTROLLERS AND CYCLOCONVERTERS

Introduction, Principle of ON-OFF Control,, Single phase bidirectional controllers with resistive loads, Single phase controllers with inductive loads, Three Phase full wave controllers, Single phase transformer connection changers, Single phase cycloconverters,Three phase cycloconverters.

UNIT-IV: DC-DC SWITCH MODE CONVERTERS -I

Introduction, Control of dc-dc converters, Step down (Buck) converter-continuous conduction mode-boundary between continuous and discontinuous conduction-discontinuous conduction mode. Step up (Boost) converter- continuous conduction mode-boundary between continuous and discontinuous conduction-discontinuous conduction mode.

UNIT-V: DC-DC SWITCH MODE CONVERTERS-II

Buck-Boost converter- continuous conduction mode-boundary between continuous and discontinuous conduction-discontinuous conduction mode-output voltage ripple. Cuk dc-dc converter.

UNIT –VI: SINGLE PHASE PWM INVERTERS

Introduction, Basic concepts of switch mode inverters, pulse width modulated switching scheme, single phase inverters-half bridge inverters-full bridge inverters-PWM with bipolar voltage switching-PWM with unipolar voltage switching, Push-pull inverters,

UNIT VII: THREE PHASE PWM INVERTERS

Three phase inverters-PWM in three phase voltage source inverters-square wave operation in three phase inverters, Ripple in the Inverter output, effect of blanking time on voltage in PWM inverters

UNIT VIII: MULTI LEVEL INVERTERS

Introduction, Multilevel Concept, Types of Multilevel Inverters-Diode-Clamped Multilevel Inverter, Principle of Operation, Features of Diode-Clamped Inverter, Improved Diode-Clamped Inverter, Feature of Multilevel Converters, Comparisons of Multilevel Converters

TEXT BOOKS:

1. Ned Mohan, Tore M. Undeland and William P. Robbins, "Power Electronics", John Wiley & Sons,2007, 2nd Edition.
2. Md. H. Rashid, "Power Electronics", Pearson Education, Third Edition, 2008
3. Bimal K. Bose, "Modern Power Electronics and AC Drives", Prentice-hall Of India Pvt. Ltd., 2008.

REFERENCE BOOKS:

1. Philip T. Krein, "Elements of Power Electronics", Oxford University Press,1997.
2. L. Umanand, "Power Electronics:Essentials & Applications", Wiley India,2010.
3. Robert Erickson and Dragon Maksivimovic, "Fundamentals of Power Electronics", Springer , 2nd Edition. Publications, 2001.
4. Issa Batarseh,"Power Electronics", John Wiley,2003.

SOLID STATE CONTROL OF DC DRIVES

	L	P	C
Course Code: 12EE2202	**4**	**0**	**4**

Unit-I: ELECTRICAL Drives - An Introduction

Electrical drives, Advantages of electrical drives, parts of electrical drives, choice of electrical drives, status of dc and ac drives.

Unit-II: Dynamics of electrical drives

Fundamental torque equation, speed torque conventions and multiquadrant operation, equivalent values of drive parameters, components of load torques, nature and classifications of load torques, steady state stability

UNIT-III: CONTROLLED RECTIFIER (1-Φ) FED DC DRIVES

Introduction, Fully Controlled Rectifier Drives, Single phase fully controlled rectifier control of DC separately excited motor-Discontinuous current-continuous current, Single phase half controlled rectifier control of DC separately excited motor-Discontinuous current- continuous current.

UNIT-IV: CONTROLLED RECTIFIER (3-Φ) FED DC DRIVES

Three phase semi converter and three phase full converter control of a separately excited DC motor for continuous and discontinuous modes of operation – power and power factor – Addition of Freewheeling diode – Three phase dual converter control of separately excited DC motor.

UNIT-V:CLOSED LOOP CONTROL OF PHASE CONTROLLED DC MOTOR DRIVES

Two-Quadrant three phase converter controlled DC motor drive, Four quadrant DC motor drive, Transfer Functions of the subsystem-DC motor and load-converter-current and speed controllers-current feedback-speed feedback

UNIT-VI: CHOPPER CONTROLLED DC MOTOR DRIVES

Principle of operation of the chopper, Four quadrant chopper circuit, Chopper for inversion, Chopper with other power devices, Model of the chopper, Input to the chopper, Steady state analysis of chopper controlled DC motor drives, Ratings of the devices.

UNIT- VII: CLOSED LOOP CONTROL OF CHOPPER FED DC MOTOR DRIVES

Speed controlled drive system, Current control loop, Pulse width modulated current controller, Hysteresis current controller, modeling of current controller, Design of current controller.

UNIT-VIII: SIMULATION OF DC MOTOR DRIVES

Dynamic simulations of the speed controlled DC motor drives – Speed feedback speed controller – command current generator – current controller.

TEXT BOOKS :

1. G. K. Dubey, "Fundamentals of Electric Drives", Narosa Publications, 1995, 2nd Edition.
2. R. Krishnan, "Electric Motor Drives Modeling, Analysis and Control", Prentice Hall India Publications, 2008.

REFERENCE BOOKS :

1. Shepherd, Hulley, Liang, "Power Electronics and Motor Control", 2nd Edn., Cambridge University Press,2004.
2. M. H. Rashid, "Power Electronic Circuits, Devices and Applications", 3rd edition, PHI Publications, 2008.
3. G. K. Dubey, "Power Semiconductor drives", Prentice Hall India Publications, 1989-01.
4. P. K. Sen, "Electrical drives" , Prentice Hall India Publications, 2002

EMBEDDED SYSTEMS

Course Code: 12EE2203	L	P	C
(Same as Course Code: 10EE2116)	4	0	4

UNIT I: EMBEDDED COMPUTING

Introduction, Complex Systems and Microprocessor, The Embedded System Design Process, Formalisms for System Design, Design Examples.

UNIT II: THE 8051 ARCHITECTURE

Introduction, 8051 Micro controller Hardware, Input/Output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/Output, Interrupts.

UNIT III: BASIC ASSEMBLY LANGUAGE PROGRAMMING CONCEPTS I

The Assembly Language Programming Process, Programming Tools and Techniques, Programming the 8051. Data Transfer and Logical Instructions.

UNIT IV: BASIC ASSEMBLY LANGUAGE PROGRAMMING CONCEPTS II

Arithmetic Operations, Decimal Arithmetic. Jump and Call Instructions, Further Details on Interrupts.

UNIT-V: APPLICATIONS

Interfacing with Keyboards, Displays, D/A and A/D Conversions, Multiple Interrupts, Serial Data Communication.

UNIT VI: INTRODUCTION TO REAL – TIME OPERATING SYSTEMS

Tasks and Task States, Tasks and Data, Semaphores, and Shared

Data; Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment

UNITVII: BASIC DESIGN USING A REAL-TIME OPERATING SYSTEM

Principles, Semaphores and Queues, Hard Real-Time Scheduling Considerations, Saving Memory and Power, An example RTOS like μC-OS (Open Source); Embedded Software Development Tools: Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System; Debugging Techniques: Testing on Host Machine, Using Laboratory Tools, An Example System.

UNIT VIII: INTRODUCTION TO ADVANCED ARCHITECTURES

ARM and SHARC, Processor and memory organization and Instruction level parallelism; Networked embedded systems: Bus protocols, I/C bus and CAN bus; Internet-Enabled Systems, Design Example-Elevator Controller.

TEXT BOOKS:

1. Wayne Wolf, Elseveir, "Computers as Components", Academic press, 2001
2. Kenneth J.Ayala, "The 8051 Microcontroller", Cengage Learning Publisher, 3rd Edition 2004.
3. David E. Simon, "An Embedded Software Primer", Pearson Education, 2004

REFERENCE BOOKS:

1. Jean J. Labrosse, "Embedding System Building Blocks", CMP Publishers, 2000.
2. Raj Kamal, "Embedded Systems: Architecture, Programming And Design", TMH, 2008.

3. Ajay V Deshmukhi, “Micro Controllers”, TMH.
4. Frank Vahid, Tony Givargis, “Embedded System Design: A Unified Hardware/software Introduction”, Wiley India-wse, 2006
5. Raj Kamal, “Microcontrollers: Architecture, Programming, Interfacing and System Design”, Prentice Hall, 2009.

DIGITAL CONTROL SYSTEMS

Course Code: 12EE2204 **L P C**
4 0 4

UNIT – I: SIGNAL CONVERSION AND PROCESSING

Introduction, Digital Signals and coding, Data Conversion and Quantization, Sample and Hold Devices, Sampling Period Considerations, Mathematical Modeling of the Sampling Process, Sampling Theorem, Mathematical Modeling of Sampling by Convolution Integral, Flap-Top Approximation of Finite Pulse width Sampling, Data Reconstruction and Filtering of Sampling Signals, Zero-Order Hold, First Order Hold, Polygonal Hold and Slewer Order Hold.

UNIT-II: Z – TRANSFORMS, TRANSFER FUNCTIONS and BLOCK DIAGRAMS

Introduction, Linear difference equations, pulse response, Z – transforms, Theorems of Z – Transforms, the inverse Z – transforms, Modified Z- Transforms. Introduction, The Pulse Transfer Function and the Z-Transfer Function, Pulse Transfer Function of the Zero-Order Hold and the Relation between G(s) and G(z), Closed loop systems- characteristic Equation, Causality and Physical Realizability, Sampled Signal Flow Graph.

UNIT – III: STATE SPACE ANALYSIS

State Space Representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and it's Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state – space equations.

UNIT – IV: CONTROLLABILITY AND OBSERVABILITY

Concepts of Controllability and Observability, Tests for controllability and Observability. Duality between Controllability and Observability, Controllability and Observability conditions for Pulse Transfer Function.

UNIT – V: STABILITY ANALYSIS

Stability Analysis of closed loop systems in the Z-Plane. Jury stablility test – Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion. Stability analysis using Liapunov theorems.

UNIT – VI: DESIGN OF DISCRETE-DATA CONTROL SYSTEMS

Introduction, Cascade Compensation by Continuous-Data Controllers, Design of Continuous-Data Controllers with Equivalent Digital Controllers, Digital Controllers, Design of Digital Control Systems with Digital Controllers through bilinear transformation.

UNIT – VII: DIGITAL SIMULATION

Introduction, Digital Simulation- Digital Modeling with Sample and Hold Devices, State Variable Formulation, Numerical Integration, Rectangular Integration, Frequency Domain Characteristics- Frequency Warping, Frequency Prewarping.

UNIT – VIII: MICROPROCESSOR AND DSP CONTROL

Introduction, Microprocessor Control of Control Systems, Single-Board Controllers with Custom-Designed Chips, The Galil DMC-105 Board, Digital Signal Processors- The Texas Instruments TMS320 DSP's, Development Systems and Support Tools.

TEXT BOOKS:

1. Kuo, "Digital Control Systems", 2nd Edition, Oxford University Press, 2003.
2. K.Ogata, "Discrete-Time Control systems", 2nd Edition, Pearson Education/PHI, 2002.

REFERENCE BOOKS:

1. M.Gopal, "Digital Control and State Variable Methods by conventional and intelligent control system", third edition, TMH, 2009.

OPTIMIZATION TECHNIQUES

Course Code: 12EE2205 **L P C**
4 0 4

UNIT-I :INTRODUCTION AND CLASSICAL OPTIMIZATION TECHNIQUES

Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.

UNIT – II: CLASSICAL OPTIMIZATION TECHNIQUES

Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints: Solution by method of Lagrange multipliers – multivariable Optimization with inequality constraints : Kuhn – Tucker conditions.

UNIT – III: LINEAR PROGRAMMING

Standard form of a linear programming problem – geometry of linear programming problems – motivation to the simplex method – simplex algorithm.

UNIT – IV: TRANSPORTATION PROBLEM

Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.

UNIT –V: UNCONSTRAINED NONLINEAR PROGRAMMING

One – dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method

UNIT–VI:UNCONSTRAINED OPTIMIZATION TECHNIQUES

Univariate method, Powell's method and steepest descent method.

UNIT – VII: CONSTRAINED NONLINEAR PROGRAMMING

Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods. Introduction to convex Programming Problem.

UNIT – VIII: INTEGER PROGRAMMING

Gomory's cutting plane method, Branch and bound method.

TEXT BOOKS:

1. "Engineering optimization: Theory and practice"-by S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.

REFERENCE BOOKS:

1 " Optimization Methods in Operations Research and systems Analysis" – by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.
2. Operations Research – by Dr. S.D.Sharma.
3. "Operations Research : An Introduction" – by H.A. Taha, PHI Pvt. Ltd., 6th edition
4. Linear Programming – by G. Hadley

ADVANCED DIGITAL SIGNAL PROCESSING
(Elective – I)

Course Code: 12EE2206
(Same as Course Code: 10EE2116)

L	P	C
4	0	4

UNIT-I: IIR DIGITAL FILTER STRUCTURE

Block diagram representation-Equivalent Structures- IIR digital filter Structures All Pass Filters-tunable IIR Digital Filters-IIR tapped cascaded Lattice Structures--Computational complexity of digital filter structures.

UNIT–II : FIR DIGITAL FILTER STRUCTURE

Block diagram representation- Equivalent structure- FIR digital Filter Structures FIR cascaded Lattice Structures – Parallel- Digital Sine-cosine generator-Computational complexity of digital filter structures.

UNIT-III: IIR DIGITAL FILTER DESIGN

Preliminary considerations-Bilinear transformation method of IIR filter design-design of Low pass high pass, Band pass, and Band stop- IIR digital filters-Spectral transformations of IIR filters

UNIT–IV: FIR DIGITAL FILTER DESIGN

FIR filter design-based on Windowed Fourier series- design of FIR digital filters with least –mean- Square-error-constrained Least-square design of FIR digital filters

UNIT-V: DSP ALGORITHM IMPLEMENTATION

Computation of the discrete Fourier transform- Number representation-Arithmetic Operations-handling of overflow-Tunable digital filters-function approximation.

UNIT-VI ANALYSIS OF FINITE WORD LENGTH EFFECTS

The Quantization process and errors- Quantization of fixed -point and

floating –point Numbers-Analysis of coefficient Quantization effects - Analysis of Arithmetic Round-off errors-Dynamic range scaling-signal- to- noise ratio in Low -order IIR filters-Low-Sensitivity Digital filters

UNIT VII : ERRORS ANALYSIS OF DIGITAL FILTERS

Reduction of Product round-off errors using error feedback-Limit cycles in IIR digital filters- Round-off errors in FFT Algorithms.

UNIT VIII: POWER SPECTRUM ESTIMATION

Estimation of spectra from Finite Duration Observations signals – Non-parametric methods for power spectrum Estimation–parametric method for power spectrum Estimation-Estimation of spectral form-Finite duration observation of signals-Non-parametric methods for power spectrum estimation-Walsh methods-Blackman & torchy method.

TEXT BOOKS:

1. Alan V.Oppenheim, Ronald W.Shafer, "Discrete Time Signal Processing", 1st Edn. PHI, 1996.
2. John G.Proakis, " Digital Signal Processing principles, algorithms and Applications", 3rd Edn. PHI, 2002.

REFERENCE BOOKS:

1. Sanjit K. Mitra , "Digital signal processing",2nd Edn, TMH, 1997
2. S.Salivahanan, A.Vallavaraj, C. Gnanapriya , "Digital Signal Processing ", 2nd Edn,TMH, 2001
3. Lourens R. Rebinar&Bernold , "Theory and Applications of Digital Signal Proceesing",2nd Edn,TMH,2001
4. Auntonian ,"Digital Filter Analysis and Design", TMH, 2001.

HIGH VOLTAGE DC TRANSMISSION
(Elective – I)

Course Code: 12EE2207
(Same as Course Code: 10EE2104)

L	P	C
4	0	4

UNIT I: H.V.D.C. TRANSMISSION
General considerations, Power Handling Capabilities of HVDC Lines, Basic Conversion principles, static converter configuration.

UNIT II: STATIC POWER CONVERTERS
3-pulse, 6-pulse and 12-pulse converters, converter station and Terminal equipment, commutation process, Rectifier and inverter operation, equivalent circuit for converter – special features of converter transformers.

UNIT III : HARMONICS IN HVDC SYSTEMS
Harmonics in HVDC Systems, Harmonic elimination, AC and DC filters.

UNIT IV: CONTROL OF HVDC CONVERTERS AND SYSTEMS
Control of HVDC Converters and systems : constant current, constant extinction angle and constant Ignition angle control. Individual phase control and equidistant firing angle control, DC power flow control.

UNIT V : INTERACTION BETWEEN HV AC AND DC SYSTEMS
Voltage interaction, Harmonic instability problems and DC power modulation.

UNIT VI : MTDC SYSTEMS
Multi-terminal DC links and systems; series, parallel and series parallel systems, their operation and control.

UNIT VII : TRANSIENT OVER VOLTAGES IN HVDC SYSTEMS

Over voltages due to disturbances on DC side, over voltages due to DC and AC side line faults

UNIT VIII: CONVERTER FAULTS AND PROTECTION IN HVDC SYSTEMS

Converter faults, over current protection - valve group, and DC line protection. Over voltage protection of converters, surge arresters.

TEXT BOOKS :

1. E.W. Kimbark, " Direct current Transmission", Wiely Inter Science ,NewYork,1971
2. J.Arillaga , " H.V.D.C.Transmission", Peter Peregrinus ltd., London UK 1983.
3. K.R.Padiyar, " High Voltage Direct current Transmission", Wiely Eastern Ltd., New Delhi, 1992.

REFERENCE BOOKS :

1. E.Uhlman, " Power Transmission by Direct Current", Springer Verlag, Berlin Helberg ,1985.

2. S Rao, "EHV-AC & HVDC Transmission Engineering & Practice", Khanna Publishers, Second Edition 1996.

MODERN CONTROL THEORY
(Elective – I)

Course Code: 12EE2208

L	P	C
4	0	4

UNIT –I: MATHEMATICAL PRELIMINARIES

Fields, Vectors and Vector Spaces – Linear combinations and Bases – Linear Transformations and Matrices – Scalar Product and Norms – Eigen values, Eigen Vectors and a Canonical form representation of Linear operators – The concept of state – State Equations for Dynamic systems – Time invariance and Linearity – Nonuniqueness of state model – State diagrams for Continuous – Time state models

UNIT – II: STATE VARIABLE ANALYSIS

Linear Continuous time model for physical systems – Existence and Uniqueness of Solutions to Continuous – Time State Equations – Solutions – Linear Time Invariant Continuous – Time State Equations – State transition matrix and it's properties

UNIT – III: CONTROLLABILITY AND OBSERVABILITY

General concept of Controllability - General concept of Observability Controllability tests for Continuous – Time Invariant systems - Observability tests for Continuous - Time Invariant systems - Controllability and Observability of state model in Jordan Canonical form - Controllability and Observability Canonical forms of State model

UNIT – IV:NON LINEAR SYSTEMS – 1

Introduction – Non Linear Systems – Types of Non – Linearities – Saturation – Dead – Zone – Backlash – Jump Phenomenon etc; - Singular Points – Introduction to Linearization of nonlinear systems, properties of Non Linear Systems – Describing function – describing function analysis of nonlinear systems- Stability analysis of Non – Linear systems through describing functions

UNIT – V:NON LINEAR SYSTEMS – 11

Introduction to phase – plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase – plane analysis of nonlinear control systems.

UNIT – VI:STABILITY ANALYSIS

Stability in the sense of Lyapunov, Lyapunov's stability and Lyapunov's instability theorems – Stability Analysis of the Linear Continuous time invariant systems by Lyapunov second method – Generation of Lyapunov functions – Variable gradient method – Krasooviski's method.

UNIT –VII: STATE FEEDBACK CONTROLLERS AND OBSERVERS

State Feedback Controller design through Pole Assignment – state observers: Full order and Reduced order

UNIT – VIII: OPTIMAL CONTROL

Introduction to optimal control - Formulation of optimal control problems – calculus of variations – fundamental concepts, functionals, variation of functionals – fundamental theorem of theorem of Calculus of variations – boundary conditions – constrained minimization – formulation using Hamiltonian method – Linear Quadratic regulator

TEXT BOOKS:

1. M. Gopal, "Modern Control System Theory", New Age International ,1984.
2. Ogata. K,, "Modern Control Engineering", Prentice Hall, 1997.

REFERENCE BOOKS:

1. Donald K. Kirk, "Optimal Control Theory - An Introduction", Dover Publications, 2004

POWER ELECTRONICS AND DRIVES LABORATORY- I

Course Code: 12EE2209

L	P	C
0	3	2

1. SPICE Simulation of Three phase full converter using RL E Load.
2. SPICE Simulation of three phase AC Voltage controller using RL load.
3. SPICE Simulation of Three phase inverter with Sinusoidal PWM control for R-Load.
4. SPICE Simulation of single phase current source inverter with RL Load.
5. SPICE Simulation of dc-dc converters.
6. SPICE Simulation of a resonant converter.
7. Performance and operation of 3- phase Semi-Converter with R & R-L load
8. Performance and operation of 3- phase Full-Converter with R & R-L load..
9. Performance & Operation of a four quadrant Chopper fed D.C. Drive
10. Performance & Operation of a 3-phase A.C. Voltage controller with motor load.
11 .Single Phase PWM Inverter with R & R-L load

12 . Operation of 3-phase PWM Inverter with R & R-L load.

13 .DC Series motor controller using Jones Chopper.

14. Speed control of 1-Phase Induction Motor using cycloconverter.

ANALYSIS OF POWER ELECTRONIC CONVERTERS-II

Course Code: 12EE2210 **L P C**
4 0 4

UNIT-I: RESONANT CONVERTERS-I

Introduction, Switch mode inductive current switching, zero voltage and zero current switchings, Classification of resonant converters-load resonant converters-resonant switch converters-resonant dc link converters. Basic resonant circuit concepts-series resonant circuits-parallel resonant circuits.

UNIT-II: RESONANT CONVERTERS-II

Load resonant converters-series loaded resonant dc-dc converters-parallel loaded resonant dc-dc converters.

UNIT-III: RESONANT CONVERTERS-III

Resonant switch converters-ZCS resonant switch converters-ZVS resonant converters,Comparison of ZCS and ZVS topology.

UNIT-IV: SWITCHING DC POWER SUPPLIES-I

Introduction, Linear power supplies, overview of switching power supplies, Flyback converters (derived from buck-boost converters), forward converter (derived from step-down converter), push-pull converter (derived from step-down converter).

UNIT-V: SWITCHING DC POWER SUPPLIES-II

Half bridge converter (derived from step down converter),full bridge converter (derived from step down converter), current source dc-dc converters.

UNIT-VI: POWER CONDITIONERS AND UNINTERRUPTIBLE POWER SUPPLIES:

Introduction, Power line disturbances-types of disturbances-sources of disturbances-effect of sensitive equipment, power conditioners, UPSs-

rectifiers-batteries-Inverters-static transfer switch

UNIT-VII: SPACE VECTOR PWM

Principle of PWM, Principle of space vector PWM, converter switching states, linear or under modulation region, over modulation region, implementation steps

UNIT-VIII: OPTIMIZING THE UTILITY INTERFACE WITH POWER ELECTRONIC SYSTEMS

Introduction, generation of current harmonics, current harmonics and power factor, harmonic standards and recommended practices, need for improved utility interface, improved single phase utility interface, improved three phase utility interface, electromagnetic interference.

TEXT BOOKS:

1. Ned Mohan, Tore M. Undelan and William P. Robbins, "Power Electronics", John Wiley & Sons, 2nd Edition 2007.
2. Md. H. Rashid, "Power Electronics", Pearson Education, Third Edition, 2008
3. Bimal K. Bose, "Modern Power Electronics and AC Drives", Prentice-hall Of India Pvt Ltd,2008.

REFERENCE BOOKS:

1. Philip T.Krein, "Elements of Power Electronics", Oxford University Press,1997.
2. L. Umanand, "Power Electronics:Essentials & Applications", Wiley India,2010.
3. Robert Erickson and Dragon Maksivimovic, "Fundamentals of Power Electronics", Springer 2nd Edition Publications, 2001.
4 Issa Batarseh,"Power Electronics", John Wiley,2003.

SOLID STATE CONTROL OF AC DRIVES

Course Code: 12EE2211

L	P	C
4	0	4

UNIT-I: INTRODUCTION

Review of steady-state operation of Induction motor, Equivalent circuit analysis, torque-speed characteristics.

UNIT-II: VOLTAGE SOURCE INVERTER FED INDUCTION MOTOR DRIVES

Scalar control- Voltage fed Inverter control-Open loop volts/Hz control-Speed control with slip regulation-Speed control with torque and Flux control-Current controlled voltage fed Inverter Drive

UNIT -III: CURRENT SOURCE INVERTER FED INDUCTION MOTOR DRIVES

Current-Fed Inverter control-Independent current and frequency control-Speed and flux control in Current-Fed Inverter drive-Volts/Hz control of Current-Fed Inverter drive-Efficiency optimization control by flux program.

UNIT -IV: SLIP POWER RECOVERY SCHEMES

Slip-power recovery Drives-Static Kramer drive-Phasor diagram-Torque expression-Speed control of a Kramer drive-Static scherbius drive-Modes of operation

UNIT -V: VECTOR CONTROL OF INDUCTION MOTOR

Principles of vector control, Direct vector control, derivation of indirect vector control, implementation – block diagram; estimation of flux, flux weakening operation.

UNIT -VI: CONTROL OF SYNCHRONOUS MOTOR DRIVES

Synchronous motor and its characteristics- Control strategies-Constant torque angle control- power factor control, constant flux

control, flux weakening operation, Load commutated inverter fed synchronous motor drive, motoring and regeneration, phasor diagrams.

UNIT-VII: PMSM DRIVES

Characteristics of permanent magnet, synchronous machines with permanent magnet, vector control of PMSM- Motor model and control scheme.

UNIT -VIII: VARIABLE RELUCTANCE MOTOR DRIVE

Variable Reluctance motor drives- Torque production in the variable reluctance motor -Drive characteristics and control principles - Current control variable reluctance motor servo drive

TEXT BOOK:

1. R. Krishnan, "Electric Motor Drives Modeling, Analysis & control", Pearson Education, 2008
2. B. K. Bose, "Modern Power Electronics and AC Drives", Pearson Publications- 2008.

REFERENCE BOOKS:

1. MD Murphy & FG Turn Bull "Power Electronics control of AC Motors" –Pergman Press ,1st Edition,1998.
2. G.K. Dubey "Fundamentals of Electrical Drives", Narosa Publications, 1995.
3. G.K. Dubey, "Power Semiconductor drives", Prentice hall

ANALYSIS OF SPECIAL MACHINES

Course Code: 12EE2212

L	P	C
4	0	4

UNIT I: STEPPER MOTORS

Constructional features, Principle of operation, Modes of excitation torque production in Variable Reluctance (VR) stepping motor

UNIT II: CHARACTERISTICS OF STEPPER MOTORS

Dynamic characteristics, Drive systems and circuit for open loop control, closed loop control of stepping motor.

UNIT III: SWITCHED RELUCTANCE MOTORS

Constructional features, Principle of operation. Torque equation, Characteristics, Control Techniques, Drive Concept.

UNIT IV: PERMANENT MAGNET BRUSHLESS DC MOTORS

Commutation in DC motors, Difference between mechanical and electronic commutators, Hall sensors, Optical sensors, Multiphase Brushless motor, Square wave permanent magnet brushless motor drives, Torque and emf equation, Torque-speed characteristics, Controllers-Microprocessors based controller.

UNIT V: PERMANENT MAGNET SYNCHRONOUS MOTORS

Principle of operation, EMF, power input and torque expressions, Phasor diagram, Power Controllers, Torque speed characteristics, Self control, Vector control, Current control Schemes.

UNIT VI: SERVOMOTORS

Servomotor – Types – Constructional features – Principle of Operation – Characteristics - Control – Microprocessor based applications.

UNIT VII: AC TACHOMETERS

Schematic diagram, Operating principle, numerical problems

UNIT VIII: LINEAR MOTORS

Linear Motors: Linear Induction Motor (LIM) Classification – Construction – Principle of operation – Concept of Current sheet – Goodness factor – DC Linear Motor (DCLM) types – Circuit equation – DCLM control-applications.

TEXT BOOKS:

1. Kenjo, T, "Stepping Motors and their Microprocessor control", Clarendon Press, Oxford, 1989.
2. Kenjo, T and Naganori, S, "Permanent Magnet and brushless DC motors", Clarendon Press, Oxford, 1989.
3. M. Gopal, "Control Systems-Principle and Design", Tata McGraw-Hill Publishing Company Limited,
Second reprint 1999

REFERENCE BOOKS:

1. Miller, T.J.E. "Brushless Permanent Magnet and Reluctance Motor Drives", Clarendon Press, Oxford, 1989.
2. Naser A and Boldea I, "Linear Electric Motors: Theory, Design and Practical Application", Prentice Hall Inc., New Jersey,1987
3. Floyd E Saner, "Servo Motor Applications", Pittman USA, 1993.
4. P. S. Bimbra, "Generalized Theory of Electrical Machines", Khanna publications-5th edition-1995

DYNAMICS OF ELECTRICAL MACHINES

Course Code: 12EE2213

L	P	C
4	0	4

UNIT I: BASIC CONCEPTS OF MODELING

Basic Two-pole Machine representation of Commutator machines, 3-phase synchronous machine with and without damper bars and 3-phase induction machine, Kron's primitive Machine-voltage, current and Torque equations.

UNIT II: DC MACHINE MODELING

Mathematical model of separately excited D.C motor – Steady State analysis-Transient State analysis-Sudden application of Inertia Load-Transfer function of Separately excited D.C Motor- Mathematical model of D.C Series motor, Shunt motor-Linearization Techniques for small perturbations

UNIT III: REFERENCE FRAME THEORY

Real time model of a two phase induction machine- Transformation to obtain constant matrices-three phase to two phase transformation-Power equivalence.

UNIT IV: DYNAMIC MODELING OF THREE PHASE INDUCTION MACHINE

Generalized model in arbitrary reference frame-Electromagnetic torque-Derivation of commonly used Induction machine models-Stator reference frame model-Rotor reference frame model-Synchronously rotating reference frame model-Equations in flux linkages-per unit model-Dynamic Simulation

UNIT V: SMALL SIGNAL MODELING OF THREE PHASE INDUCTION MACHINE

Small signal equations of Induction machine-derivation-DQ flux linkage model derivation-control principle of Induction machine.

UNIT VI: SYMMETRICAL AND UNSYMMETRICAL 2 PHASE INDUCTION MACHINE

Analysis of symmetrical 2 phase induction machine-voltage and torque equations for unsymmetrical 2 phase induction machine-voltage and torque equations in stationary reference frame variables for unsymmetrical 2 phase induction machine-analysis of steady state operation of unsymmetrical 2 phase induction machine- single phase induction motor - Cross field theory of single-phase induction machine.

UNIT VII: MODELING OF SYNCHRONOUS MACHINE

Synchronous machine inductances –voltage equations in the rotor's dq0 reference frame-electromagnetic torque-current in terms of flux linkages-simulation of three phase synchronous machine- modeling of PM Synchronous motor.

UNIT VIII: DYNAMIC ANALYSIS OF SYNCHRONOUS MACHINE

Dynamic performance of synchronous machine, three-phase fault, comparison of actual and approximate transient torque characteristics, Equal area criteria.

TEXT BOOKS :

1. Electric Motor Drives - Modeling, Analysis& control -R.Krishnan-Pearson Publications-1st edition -2002 (For chapter III,IV,V)
2. Analysis of Electrical Machinery and Drive systems – P.C.Krause, Oleg Wasynczuk, Scott D. Sudhoff – Second Edition-IEEE Press (for Chapters VI, VII,VIII)
3. Generalized Theory of Electrical Machines – P.S.Bimbra-Khanna publications-5th edition-1995(For chapter I,II)

REFERENCE BOOKS:

1. Dynamic simulation of Electric machinery using Matlab / Simulink –Chee Mun Ong-Prentice Hall
2. D.P. Sengupta & J.B. Lynn :Electrical Machine Dynamics, The Macmillan Press Ltd.

3. C.V. Jones :The Unified Theory of Electrical Machines Butterworth, London.
4. Woodson & Melcher, Electromechanical Dynamics, John Wiley & Sons
5. P.C. Kraus :Analysis of Electrical Machines,McGraw Hill Book Company
6. I. Boldia & S.A. Nasar :Electrical Machine Dynamics,The Macmillan Press Ltd.

POWER QUALITY

Course Code: 12EE2214
(Same as Course Code: 10EE2217)

L	P	C
4	0	4

UNIT-I: INTRODUCTION

Introduction of the Power Quality (PQ) problem, Definition of PQ, Terminology: used in PQ: under voltage, Sag, over voltages, Swell, Surges, Interruptions, Harmonics, spikes, Voltage fluctuations, Transients, overview of power quality phenomenon.

UNIT-II: POWER QUALITY AND EMC STANDARDS

Purpose of standardization, IEC Electromagnetic compatibility standards, European voltage characteristics standards.

UNIT-III: LONG INTERRUPTIONS

Interruptions – Definition – Difference between failure, outage, Interruptions – causes of Long Interruptions – Origin of Interruptions – Limits for the Interruption frequency – Limits for the interruption duration – costs of Interruption – Overview of Reliability evaluation to power quality.

UNIT-IV: SHORT INTERRUPTIONS

Short interruptions – definition, origin of short interruptions, basic principle, fuse saving, voltage magnitude events due to re-closing, voltage during the interruption, monitoring of short interruptions, difference between medium and low voltage systems. Multiple events, single phase tripping – voltage and current during fault period, voltage and current at post fault period, stochastic prediction of short interruptions.

UNIT-V: VOLTAGE SAGS- CHARACTERIZATION- SINGLE PHASE

Voltage sags – definition, causes of voltage sag, voltage sag

magnitude, monitoring, theoretical calculation of voltage sag magnitude, voltage sag calculation in non-radial systems, meshed systems, and voltage sag duration.

UNIT-VI: VOLTAGE SAGS- CHARACTERIZATION -THREE PHASE

Three phase faults, phase angle jumps, magnitude and phase angle jumps for three phase unbalanced sags, power quality monitoring, load influence on voltage sags.

UNIT-VII: PQ CONSIDERATIONS IN INDUSTRIAL POWER SYSTEMS

Voltage sags – equipment behavior of Power electronic loads, induction motors, synchronous motors, computers and consumer electronics, adjustable speed AC drives and its operation. Mitigation of AC Drives, adjustable speed DC drives and its operation, mitigation methods of DC drives.

UNIT-VIII: MITIGATION OF INTERRUPTIONS AND VOLTAGE SAGS

Overview of mitigation methods – from fault to trip, reducing the number of faults, reducing the fault clearing time, changing the power system, installing mitigation equipment, improving equipment immunity, different events and mitigation methods. The Systems - Equipment interface – voltage source converter, series voltage controller, shunt controller, combined shunt and series controller.

TEXT BOOK:

1. Math H.J. Bollen, “Understanding Power Quality Problems”, IEEE Press, standard publishers distributors.

FLEXIBLE AC TRANSMISSION SYSTEMS
(Elective – II)

Course Code: 12EE2215 **L P C**
(Same as Course Code:10EE2111) **4 0 4**

UNIT-I: FACTS CONCEPTS
Transmission interconnections power flow in an AC system, loading capability limits, Dynamic stability considerations, importance of controllable parameters, basic types of FACTS controllers, benefits from FACTS controllers.

UNIT-II: VOLTAGE SOURCE CONVERTERS - I
Single phase three phase full wave bridge converter transformer connections for 12 pulse 24 and 48 pulse operation.

Unit-III: VOLTAGE SOURCE CONVERTERS - II
Three level voltage source converter, pulse width modulation converter, basic concept of current source Converters, comparison of current source converters with voltage source converters.

UNIT-IV: STATIC SHUNT COMPENSATION - I
Objectives of shunt compensation, midpoint voltage regulation voltage instability prevention, Improvement of transient stability, Power oscillation damping,

UNIT-V: STATIC SHUNT COMPENSATION - II
Methods of controllable VAR generation, variable impedance type static VAR generators switching converter type VAR generators hybrid VAR generators.

UNIT-VI: SVC AND STATCOM
The regulation and slope transfer function and dynamic performance, transient stability enhancement and power oscillation damping operating point control and summary of compensator control.

UNIT-VII: STATIC SERIES COMPENSATORS

Concept of series capacitive compensation, Improvement of transient stability, power oscillation damping, subsynchronous oscillation damping.

UNIT-VIII: VARIABLE IMPEDANCE TYPE SERIES COMPENSATION

Functional requirements of GTO Thyristor controlled series capacitor (GCSC), Thyristor switched series capacitor(TSSC), and thyristor controlled series capacitor(TCSC) control schemes for GCSC TSSC and TCSC.

TEXT BOOK:

1.N.G. Hingorani and L. Gyugui "Understanding FACTS Devices", IEEE Press Publications, 2000.

REFERENCE BOOKS

1. R.Mohan Mathur, Rajiv K Varma, "Thyristor based FACTS Controller for Electrical Power Systems" , IEEE Press
2. X.P.Zhang, C.Rehtanz, B.Pal "Flexible AC Transmission System – Modelling and Control" Springer.

NEURAL & FUZZY SYSTEMS
(Elective – II)

Course Code: 12EE2216 **L P C**
(Same as Course Code:10EE2111) **4 0 4**

UNIT-I: INTRODUCTION TO NEURAL NETWORKS

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

UNIT-II:ESSENTIALS OF ARTIFICIAL NEURAL NETWORKS

Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application

UNIT-III: FEED FORWARD NEURAL NETWORKS

Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

MULTILAYER FEED FORWARD NEURAL NETWORKS

Credit Assignment Problem, Generalized Delta Rule, Derivation of Back propagation (BP) Training, Summary of Back propagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

UNIT IV: ASSOCIATIVE MEMORIES

Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear

Associator, Matrix Memories, Content Addressable Memory), Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network.

UNIT V: SELF ORGANIZING MAPS AND ADAPTIVE RESONANCE THEORY

Introduction, Competitive Learning, Vector Quantization, Self-Organized Learning Networks, Kohonen Networks, Training Algorithms, Linear Vector Quantization, Stability-Plasticity Dilemma, Feed forward competition, Feedback Competition, Instar, Outstar, ART1, ART2, Applications.

UNIT-VI: CLASSICAL & FUZZY SETS

Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

UNIT- VII: FUZZY LOGIC SYSTEM COMPONENTS

Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

UNIT-VIII: APPLICATIONS

NEURAL NETWORK APPLICATIONS: Process identification, Function Approximation, control and Process Monitoring, fault diagnosis and load forecasting.

FUZZY LOGIC APPLICATIONS: Fuzzy logic control and Fuzzy classification.

TEXT BOOKS:

1. Jacek M. Zuarda, “Introduction to Artificial Neural Systems”, Jaico Publishing House, 1997.
2. Timothy.J.Ross,” Fuzzy logic with Engineering Applications”,

International Editions 1997, TMH Publishers,

REFERENCE BOOKS:

1. N. Yadaiah and S. Bapi Raju "Neural and Fuzzy Systems Foundation, Architectures and Applications", Pearson Education.
2. James A Freeman and Davis Skapura, "Neural Networks ", Pearson, 2002.
3. Simon Hykins "Neural Networks", Pearson Education.
4. C. Eliasmith and CH. Anderson, "Neural Engineering", PHI.
5. Bork Kosko "Neural Networks and Fuzzy Logic System" , PHI Publications.
6. Rajasekharan and Rai "Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications" PHI Publication. Ion

DESIGN AND SIMULATION OF POWER ELECTRONIC CIRCUITS
(Elective – II)

Course Code: 12EE2217

L	P	C
4	0	4

UNIT I : INTRODUCTION
Importance of simulation – General purpose circuit analysis – Methods of analysis of power electronic systems – Review of power electronic devices and circuits.

UNIT II : SIMULATION TECHNIQUES-I
Analysis of power electronic systems in a sequential manner – coupled and decoupled systems

UNIT III : SIMULATION TECHNIQUES-II
Various algorithms for computing steady state solution in power electronic systems – Future trends in computer simulation.

UNIT IV : MODELING OF POWER ELCTRONIC DEVICES-I
Introduction – AC sweep and DC sweep analysis – Transients and the time domain analysis – Fourier series and harmonic components

UNIT V : MODELING OF POWER ELCTRONIC DEVICES-II
BJT, FET, MOSFET and its model- Amplifiers and Oscillator – Non-linear devices.

UNIT VI : SIMULATION OF POWER ELECTRONIC CIRCUITS
Introduction – Schematic capture and libraries – Time domain analysis – System level integration and analysis – Monte Carlo analysis – Sensitivity/stress analysis – Fourier analysis.

UNIT VII : CASE STUDY-I

Simulation of Converters, Choppers, Inverters, AC voltage controllers, and Cyclo-converters feeding R, R-L, and R-L-E loads

UNIT VIII : CASE STUDY-II

Computation of performance parameters: harmonics, power factor, angle of overlap.

TEXT BOOK:

1. Rashid, M., "Simulation of Power Electronic Circuits using PSPICE", PHI, 2006.

REFERENCE BOOKS:

1. Rajagopalan, V. "Computer Aided Analysis of Power Electronic systems"- Marcell Dekker Inc., 1987.
2. John Keown "Microsim, Pspice and circuit analysis"-Prentice Hall Inc., 1998.

POWER ELECTRONICS AND DRIVES LABORATORY-II

Course Code: 12EE2218

L	P	C
4	3	2

1. Simulation of Chopper fed DC motor using MATLAB/SIMULINK

2. Development and Simulation of 3-phase PWM Inverter with sinusoidal pulse-width modulation using MATLAB/SIMULINK

3. Characteristics of induction machines under balanced and symmetrical conditions for the following using MATLAB/SIMULINK
   a. dq model in synchronous reference frame
   b. dq model in stator reference frame
   c. dq model in rotor reference frame

4. Simulation of v/f control of an induction motor drive using MATLAB/SIMULINK

5. Simulation of Open-loop v/f control of a synchronous motor drive using MATLAB/SIMULINK

6. Simulation of a GTO based chopper circuit using MATLAB/SIMULINK

7. Operation of a single phase PWM rectifier with R load.

8. Performance & speed control of 3 phase slip ring Induction motor by Static Rotor Resistance controller.

9. Three phase PWM Pulse generation using Micro controller

10. Microprocessor based speed control of three phase Induction Motor

11. Braking Test of three phase induction motor

12 .Speed control of single phase induction motor.

13. Microcontroller based slip ring Induction motor speed Control using static KRAMMER drive.

14. Speed Control of DC Shunt Motor using SCR Dual converter.

15. Closed loop speed Control of PMDC motor using SCR Converter.