ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

FOR

M. Tech. (POWER ELECTRONICS AND ELECTRIC DRIVES)

(with effect from 2011- 12)

G.NARAYANAMMA INSTITUTE OF TECHNOLOGY & SECIENCE

(For Women)

(Autonomous)

Shaikpet, Hyderabad - 500 008 AP.

ACADEMIC REGULATIONS 2011-12 for M.Tech (Regular) Degree Course

(Effective for the Students admitted in to first year from the academic year 2011-2012)

The M.Tech Degree of Jawaharlal Nehru Technological University Hyderabad shall be conferred on candidates who are admitted to the Program and fulfill all the requirements for the award of the Degree.

ELIGIBILITY FOR ADMISSIONS:

Admission to the above subject are as per the eligibility, qualifications and specialization prescribed by the University from time to time.

Admissions shall be made on the basis of merit rank obtained by the eligible candidate at an Entrance test conducted by the University or on the basis of any other order of merit of GATE or AP-PGECET etc.approved by the University in accordance to reservations prescribed by the University from time to time.

2.0 AWARD OF M. Tech. Degree

2.1 A student shall be declared eligible for the award of the M.Tech degree, if he /she pursues a course of study and completes it successfully with in TWO academic years but not more than four academic years from the date of registration.

2.2 Any student, who fails to fulfill all the academic requirements for the award of M.Tech degree within four academic years from the year of her / her admission, shall forfeit her/ her seat in that M.Tech course.

2.3 The minimum instruction for each semester 90 will be instruction days.

3.0 A. COURSE OF STUDY:

The following specializations are offered at present for the M.Tech course of study.

1. Power Electronics and Electric Drives in EEE
2. Computer Science and Engineering in CSE
3. Digital Electronics and Communication Engineering in ECE

   and any other course as approved by the authorities of the University from time to time

3.0 B. Departments offering M.Tech Programmes with specializations mentioned below:

EEE	Power Electronics and Electric Drives
ECE	Digital Electronics and Communication Engineering.
CSE	Computer Science Engineering

4.0 ATTENDANCE:

1. The programs arc offered on a unit basis with each subject being considered as one unit.
2. A candidate shall be deemed to be eligible to write end semester examinations in any subject if he/she has put in at least 75% of attendance in that subject.
3. Shortage of attendance up to 10% in any subject (i.e. 65% and above and below 75%) may be condoned by the College Academic Committee on genuine and valid reasons on representation by the **candidate** with supporting medical certificate from a registered doctor.
4. A candidate shall get minimum required attendance at least in three (3) theory subjects in the present semester to get promoted to the next semester. In order to qualify for the award of the **M.Tech.** Degree, the candidate shall complete all the academic requirements of the subjects, and pass as per the course structure.
5. Shortage of attendance below 65% shall **in no** case **be condoned.**
6. 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 a maximum of 100 marks for theory and 100 marks for practicals, on the basis of Internal Evaluation and End Semester Examination.

5.1 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. The internal evaluation shall be made based on the better of the marks secured in the two Mid Term-Examinations conducted the first mid to be conducted during 7^{th} to 9^{th} week 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 to be answered out of 6 questions.

5.2 For practical subjects, 60 marks shall be awarded based on the performance in the End **Semester**

Examinations, 40 marks shall be awarded based on the day-to-day performance as Internal

Marks.

5.3 There shall be two seminar presentations during I year I semester one seminar and the second seminar in II Semester. For seminar, a student should take guidance under the supervision of a faculty member, to 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 Head of the Department,
supervisor and two other senior faculty members of the department. For each Seminar there will be only
internal evaluation of 50 marks. A candidate has to secure a minimum of 50% to be declared successful.

5.4 There shall be a Comprehensive Viva-Voce in II year I Semester. The Comprehensive Viva-Voce will beconducted by a Committee consisting of Head of the Department and two Senior Faculty members of theDepartment. The Comprehensive Viva-Voce is aimed to assess the students' understanding in varioussubjects he/she studies during the M.Tech course of study. The Comprehensive Viva-Voce is valued for
100 marks by the Committee. There are no internal marks for the Comprehensive viva-Voce

5.5 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.

5.6 In case the candidate does not secure the minimum academic requirement in any subject (as specified in(5.4) she has to reappear for the End Examination in that subject. A candidate shall be given only one chance to re-register for each subject provided the internal marks secured by a candidate are less than 50% and she has failed in the end examination. In such case 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). The attendance of re-registered subject(s) shall be calculated separately to decide her / her the eligibility for writing the end examination in those subject(s)as mentionedat point a.0 attendance . In the event of taking another chance, the internal marks and end examination marks obtained in the previous attempt are nullified.

5.7 In case the candidate secures less than the required attendance in any subject(s), he shall not be permitted to appear for the End Examination in that subject(s). she shall re-register the subject when next offered.

5.8 Laboratory examination for M.Tech courses must be conducted with two Examiners, one of them being Laboratory Class Teacher and second examiner will nominated by the principle/ Director from the from the panel suggested by HOD..

6.0 EVALUATION OF PROTECT / DISSERTATION WORK:

Every candidate shall be required to submit thesis or dissertation after Selecting a topic approved by the Project Review Committee.

6.1 A Project Review Committee (PRC) shall be constituted by the Principal/ Director as chair, is the convener , HOD and other HODS of M./Tech offering two other senior faculty members.

6.2 Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects (theory and practical subjects).

6.3 After satisfying 6.2, a candidate has to submit, in consultation with her project supervisor, the title, objective and plan of action of her project work to the Departmental Committee for its approval. Only after obtaining the approval of Departmental Committee the student can initiate the Project work.

6.4 If a candidate wishes to change her supervisor or topic of the project she can do so with approval of Departmental Committee. However, the Departmental Committee shall examine whether the change of topic/supervisor leads to a major change of her initial

plans of project proposal, If so, her date of registration for the project work start*; from the date of change of Supervisor or topic as the case may be.

6.5 A candidate shall submit status report (in a bound/Spiral form) in two stages at least with a gap of 3 months between them.

6.6 The work of project shall be initiated in the beginning of the second year and the duration of the project is for two semesters. A candidate is permitted to submit Project Thesis only after successful completion of theory and practical course with approval of PRC not earlier than 40 weeks from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of thesis to the Principal/ Director (through Head of the Department) and shall make an oral presentation before the PRC.

6.7 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College / School /Institute.

6.8 The thesis shall be adjudicated by one examiner selected by the Director. For ther, the head of the concerned department shall submit a panel of *5* examiners, who are eminent in that field with the help of the concerned guide.

6.9 If the report of the examiner is not favorable, the candidate shall revise and resubmit the Thesis, in the
time frame as described by PRC. If the report of the examiner is unfavorable again, the thesis shall be
Summarily rejected.

6.10 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 Thesis. The Board shall
jointly report candidates work as:

A. Excellent
B. Good
C. Satisfactory
D. Unsatisfactory

Head of the Department shall coordinate and make arrangements for the conduct of viva-voce examination.

If the report of the viva-voce is unsatisfactory, the candidate will retake the viva-voce examination after three months, If he fails to get a satisfactory report at the second viva-voce examination, he will not be eligible for the award of the degree.

7.0 AWARD OF DEGREE AND CLASS:

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

Class A warded	% of marks *to he* secured
First Class with Distinction	70% and above
First Class	Below 70% but not less than 60%
Second Class	Below 60% but not le.ss than 50%
Pass Class	Below 50% but not less than 40%

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

8.0) WITHHOLDING OF RESULTS:

If the candidate has not paid *any* dues to the college/ University or if any case of in-discipline is pending against her, the result of the candidate will be withheld and he / she will not be allowed into the next higher semester.

The issue of the degree is liable to be withheld in such cases.

9.0) **TRANSITORY REGULATIONS:**

Candidate who have discontinued Or have been detained for want of attendance or who have failed after having undergone the course are eligible-for admission to the same or equivalent subjects as and when subjects are offered, subject to 5.5 and 2.0

10.0 **GENERAL:**

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

10.2 In case of any doubt or ambiguity in the interpretation of the above rules , the

decision of Vice Chancellor is final.

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

10.4 Wherever the word he, him or her occur, it will also include she, her and hers.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper	**Punishment**
	If the candidate:	
1.(a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which she is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used **as** an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination **hall** and cancellation of the performance in **that subject** only of all the candidates involved. In case of an outsider, she will be handed over to the police and a case is registered against her.
2.	Has copied material the examination hail from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hail and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the Directors office.

3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seal. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted (or the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from classwork and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.0	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to	Cancellation of the performance in that subject.

6.0	Refuses to obey the orders of the Chief Superintendent/ Assistant - Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to her person or to any of her relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of her relations, or indulges in any other act of misconduct or mischief	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candideate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/ year. The candidates also arc debarred and forfeit their seals. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.0	Leaves the exam hall taking away answer script or intentionally tears of the script or any pail thereof inside or outside the examination hail.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.

8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and ail other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of thai semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that (semester/year)

11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

COURSE STRUCTURE AND SYALLABUS - 2011-2012

I YEAR – I Semester

Code	Group	Subject	L	P	Credits
		Electrical Machine Modeling & Analysis	3	0	**3**
		Modern Power Electronics	3	0	**3**
		Microprocessors And Microcontrollers	3	0	**3**
		Power Electronic Control of DC Drives	3	0	**3**
	Elective -I	Digital Control Systems Operations Research High Voltage DC Transmission	3	0	**3**
	Elective -II	Neural & Fuzzy Systems Alternate Energy Conversion Systems Modem Control Theory	3	0	**3**
	Lab	Power Converters Lab	0	3	**2**
		Seminar	-	-	**2**
		Total Credits (6 Theory + 1 Lab.)			**22**

I YEAR – II Semester

Code	Group	Subject	L	P	Credits
		Power Electronic control of AC Drives	3	0	3
		Analysis of Power Electronic Converters	3	**0**	3
		Dynamics of Electric machines	3	0	3
		Flexible AC Transmission Systems (FACTS)	3	0	3
	Elective **-III**	Reliability Engineering Power Quality Embedded Systems	3	0	3
	Elective **-IV**	Programmable Logic Controllers and their Applications Advanced Digital Signal Processing Enterprise Resource Planning	3	0	3
	Lab	Electrical Systems Simulation Lab	0	3	2
		Seminar	-	-	2
		Total Credits (6 Theory + 1 Lab.)			**22**

II YEAR – I Semester

Code	Group	Subject	L	P	Credits
		Comprehensive Viva	**-**	**-**	**2**
		Project Seminar	0	**3**	**2**
		Project work	-	**-**	**18**
		Total Credits			**22**

II YEAR – II Semester

Code	Group	Subject	L	P	Credits
		Project work and Seminar	-	**-**	**22**
		Total Credits			**22**

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(FOR WOMEN)

(AUTONOMOUS)

M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

I Semester

ELECTRICAL MACHINE MODELLING AND ANALYSIS

Unit I: Essentials of Rotating electrical machines – Conventions – transformers and speed voltages in armature-Basic Two-pole DC machine - primitive 2-axis machine - Voltage and Current relationship - Torque equation –**Restrictions of generalized theory.**

Unit II: Mathematical model of separately excited DC motor and DC Series motor in state variable form - Transfer function of the motor - Numerical problems.

Mathematical model of D.C. shunt motor and D.C. Compound motor in state variable form - Transfer function of the motor - Numerical Problems.

Unit III: Linear transformation-Phase transformation (a,b,c to a,p,o)-Acti vc transformation(a,p,o to d,q). Circuit model of a 3 pahse Induction motor - Linear transformation - Phase Transformation - Transformation to a Reference frame - Two axis models for Induction motor.

Unit IV: Voltage and current liquation's in stator reference frame - Equation in Rotor reference frame - Equations in a synchronously rotating frame - Torque equation-Equations in state-space form.

Unit V: Circuit model of a 3ph Synchronous motor - Two axis representation of Syn. Motor.

Voltage and current Equations in state - space variable form - Torque equation.

BOOKS:

1. Thyristor control of Electric Drives - Vedam Subramanyam.
2. Analysis of electric machinery and Drive systems - Paul C.Krause , Oleg wasynezuk, Scott D.Sudhoff.
3. Generalized theory of electrical machines – PS.Bimbra

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

I-Semester

MODERN POWER ELECTRONICS

UNIT I: **Modern power semiconductor devices**

Modern power semiconductor devices - MOS turn Off Thyristor (MTO) - Emitter Turn Off Thyristor (ETO)- Integrated Gate-Commutated thyristor (IGCTs) - MOS-controlIed thyristors (MCTs) –Gate turn Off Thyristor(GTOs) -comparison of devices.

UNIT II: Resonant Pulse Inverters

Resonant pulse inverters - series resonant inverters - series resonant inverters with unidirectional switches - series resonant inverters with bidirectional Switches -analysis of half bridge resonant inverter - evaluation of currents and Voltages of a simple resonant inverter - analysis of half bridge and full bridge resonant inverter with bidirectional switches - Frequency response of series resonant inverters - for series loaded inverter- for parallel loaded inverter - For series and parallel loaded inverters - parallel resonant inverters - Voltage control of resonant inverters - class E inverter and Class E rectifier - numerical problems. Resonant converters

Resonant converters - Zero current switching resonant converters - L type ZCS resonant converter - M type ZCS resonant converter - zero voltage Switching resonant converters - comparison between ZCS and ZVS resonant Converters - Two quadrant ZVS resonant converters - resonant de-link Inverters - evaluation of L and C for a zero current switching inverter - Numerical problems.

UNIT III: Multilevel Inverters

Multilevel concept - Classification of multilevel inverters - Diode clamped multilevel inverter - principle of operation - main features - improved diode Clamped inverter - principle of operation - Flying capcitors multilevel inverter-principle of operation - main features.

Multilevel Inverters (continued)

Cascaded multilevel inverter - principle of operation - main features - Multilevel inverter applications – reactive power compensation - back to back intertie system - adjustable drives - Switching device currents - dc link capacitor voltage balancing - features of Multilevel inverters - comparisons of multilevel converters.

UNIT IV: DC Power Supplies

DC power supplies - classification - switched mode dc power supplies - fly back Converter - forward converter - push-pull converter - half bridge converter -Full bridge converter- Resonant dc power supplies – bidirectional power supplies -Applications.

UNIT V: AC Power Supplies

AC power supplies -. classification - switched mode ac power supplies - Resonant AC power supplies - bidirectional ac power supplies - multistage conversions - control circuits - applications. Power **Conditioners and Uninterruptible Power Supplies** Introduction - power line disturbances - power conditioners - uninterruptible Power supplies - applications.

TEXT BOOKS:

1. Power Electronics - Mohammed H. Rashid - Pearson Education - Third Edition
2. Power Electronics - Ned Mohan, Tore M. Undeland and William P. Robbins - John Wiley and Sons - Second Edition.

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

I- **Semester**

MICROPROCESSORS & MICROCONTROLLERS

Unit I: 8086/8088 processors : Introduction to 8086 Microprocessors, Architecture, Addressing modes, instruction set, Register Organization, Assembler directives.

Unit II: Hard ware description: Pin-diagram signal description min & max modes, bus timing, ready & wait states, 8086 based micro computing system.

Special features & Related Programming: Stack structure of 8086, Memory segmentation, Interrupts, and interrupt Programming, Macros.

Unit III: Advanced Microprocessors: Intel 80386 programming model, memory paging, Introduction to 80486, Introduction to Pentium Microprocessors and special Pentium pro features.

Basic peripherals & Their Interfacing:-Memory Interfacing (DRAM) PPI- Modes of operation of 8255. Interfacing to ADC & DAC.

Unit IV:- Special Purpose of Programmable Peripheral Devices and Their interfacing :-Programmable interval timer, 8253 , PIC 8259A,dispIay controller Programmable communication Interface 8251, USART.

Unit V:-Microcontrollers: Introduction to Intel 8 bit &I6 bit Microcontrollers, 8051-Architecture, Memory organization, Addressing Modes and exercises

Hardware description of 8051: Instruction formats, Instruction sets, interrupt Structure & interrupt priorities, Port structures & Operation linear counter Functions. Different Modes of Operation and Programming examples.

TEXT BOOKS :-

1. "The Intel Microprocessors" Architecture Programming &Interfacing by Barry B Brey.
2. Advanceed Microprocessors by kenrith J Ayala , Thomson publishers.
3. Microcontrollers by Kentrith J Ayala, Thomson publishers.

REFERENCE BOOKS:-

1. Microprocessors & Interfacing Programming & Hard ware by DOUGLAS V.Hall
2. Microprocessors & Microcontrollers by Prof. C.R.Sarma

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

I semester

POWER ELECTRONIC CONTROL OF DC DRIVES

UNIT – I Review of conventional DC drives

Different techniques of speed control and methods of braking of series and separately excited DC motors, WardLeonard speed control,Model and transfer function of series and separately excited DC motor

UNIT - II Controlled Bridge Rectifier (l-ϕ) with DC Motor I.oad

Separately excited DC motors with rectified single -phase supply - single-phase semi converter and single phase full converter for continuous and discontinuous modes of operation - power and power factor

Controlled Bridge Rectifier (3 - ϕ) with DC Motor Load

Three phase semi converter and Three phase full converter for continuous and discontinuous modes of operations- power and power factor - Addition of Freewheeling diode - Three phase double converter.

UNIT - III Phase **controlled DC Motor drives.**

Three phase controlled converter, control circuit, control modeling of three phase converter - Steady state analysis of three phase converter control DC motor drive - Two quadrant, Three phase converter controlled DC motor drive - DC motor and load, converter.

Current and speed controlled DC Motor drives.

Current and speed controllers - Current and speed feedback - Design of controllers - Current and speed controllers - Motor equations - filter in the sped feedback loop speed controller - current reference generator- current controller and flow chart for simulation - Harmonics and associated problems - sixth harmonics torque.

UNIT - IV 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 - rating of the devices - Pulsating torque.

Closed **loop operation of 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 - V **Simulation of DC motor drives.**

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

REFERENCE **BOOKS:**

1. Power Electronics and motor control - Shepherd, Ilulley, Liang - II Edition Cambridge Univeristy Press.
2. FJectronic motor drives model ing Analysis and control - R. Krishnan -1 Edition Prentice **Hall India.**
3. Power Electronics circuits, Devices and Applications - **Mil** Rashid - **PHI** - 1 Edition 1995.
4. Fundamentals of Electric Drives - GK Dubey Narosa Publ ishers 1995
5. Power Semiconductor drives - SB Dewan and A Straughen -1975.
6. Subrahmanyam.V, “Electric Drives and Applications” Tata MC Graw Hill Publishing co., LTD., New delhi, 1994

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

I-Semester

Digital Control Systems
(Elective-I)

UNIT-I: Sampling and Reconstruction

Introduction, sample and hold operations, Sampling theorems, Reconstruction of original sampled signal to continuous-time signal.

The Z-Transforms:

Introduction, Linear difference equations, pulse response, Z-transforms, Theorems of Z-transforms, the inverse-Z-transforms, Modified Z-transforms

Z-Plane Analysis of Discrete-Time Control System:

Z-transform method for solving difference equations; Pulse transfer function, block diagram analysis of sampled-data systems, mapping between s-plane and z-plane: Primary strips and Complementary strips.

UNIT-II: 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.

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 – III: Stability Analysis

Stability Analysis of closed loop systems in the Z-plane, Jury stability test-stability analysis by use of the Bilinear Transformation and Routh Stability criterion. Stability analysis using Liapunov theorems. Root Locus Technique for Discrete Systems.

UNIT – IV: Design of Discrete Time Control System by Conventional methods

Design of digital control based on the frequency response method-Bilinear Transformation and Design Procedure in the w-plane, Lead, Lag and Lead-Lag compensators and digital PID controllers. Design digital control through deadbeat response method.

UNIT – V: State Feedback Controllers and Observers

Design of state feedback controller through pole placement-Necessary and sufficient conditions, Ackerman's formula.

State Observers – Full order and Reduced order observers

Linear Quadratic Regulators

Min/Max principle, Linear Quadratic Regulators, Introduction to Kalman filters, state estimation through Kalman filters.

Text Books:

1. Discrete-Time Control Systems – K.Ogata, Person Education / PHI, 2nd Edition
2. Digital Control and State Variable Methods by M. Gopal, TMH

Reference Books:

1. Digital Control Sysetms, Kuo, Oxford University Press, 2nd Edition, 2003
2. Digital Control Engineering, M.Gopal

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

I- Semester

OPERATION RESEARCH

(Elective - I)

Unit I:

Linear Programming Problem: Formulation - Graphical method - Simplex method -Artificial variable techniques - Big-M tune -phase methods- Duality theorem - Dual simplex method - Sensitivity analysis - effect of changes in cost coefficients, Constraint constants, Addition/Deletion of variables & constraints

Unit II:

Transportation problem - formulation - Initial basic feasible solution methods -Northwest, Least cost & Vogels methods, MODI optimization - Unbalanced & degeneracy treatment

Assignment problem- Formulation- Hungarian method - Variants of assignment problems, Sequencing problems - Flow shop sequencing - n jobsx2 machines sequencing - n jobsx3 machines sequencing -Job-shop sequencing - 2 jobsxm machines sequencing - Graphical methods

Unit III:

Game Theory - Introduction - Terminology - Saddle point games - with out Saddle point games - 2x2 games, analytical method - 2xn and mx2 games - graphical method - dominance principle

Dynamic programming -Bellman's principle of optimal ity- short route -capital investment - inventory allocation

Unit IV:

Non linear optimization - Single variable optimization problem - Unimoda! function - Elimination methods - Fibinocci & Golden reaction methods - Interpolation methods - Quadratic & cubic interpolation method. Multi variable optimization problem - Direct research methods - tJnivariant method - Pattern search methods - Powell's , Hook-Jeaves & Rosen-brock's search method.

Unit V:

Geometric programming - Polynomial - Arithmetic - Seametric inequality - Unconstrained G.P - Constraint G.P with type constraint.

Simulation: Definition - Types- steps- Simulation of simple electrical systems -Advantages and Disadvantages

TEXT BOOKS:

1. Optimization theory & Applications -S.S.Rao, New Age Internationals

2. Operations Research - S.D.Sharma, Galgotia publishers
3. Operations Research - Kausur & Kumar, Spinger Publishers

REFERENCE BOOKS:

1. Optimization techniques: Theory & Practice - M.CJoshi & K.M. More Ugalya, Narosa Publications
2. Optimization : Theory & Practice - Beweridze, Me Graw Hill
3. Simulation Modelling & Analysis - Law & Kelton-TMH

Optimization Concepts and Applications in Engineering- A.D. Belegundu , J.R. Chandrupata, Pearson Education, Asia

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G. NARAYANAMMA INSTITUTE OF TECHNOLOGY & SCIENCE

(FOR WOMEN)

(AUTONOMOUS)

M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

I-Semester

HIGH VOLTAGE DC TRANSMISSION SYSTEM

(Elective - I)

UNIT- I :

Lay out scheme and principle of operation for High voltage DC transmission – Types of DC link – monopolar, bipolar and homopolar – parallel operation of DC link with AC network – advantages and disadvantages of HVDC transmission comparison between Constant Current and Constant voltage HVDC systems.

UNIT- II :

Rectifier and inverter operation, Equivalent circuit for Converter. Features of converter transformer.

Analysis of Three pulse, six pulse and Twelve Pulse converters.

Harmonics in HVDC system, Harmonic elimination using AC and DC filters, Cost estimation of filter.

UNIT- III :

Control of HVDC Converters:

Constant current control, Constant extinction angle control, Constant Ignition angle control, Individual phase angle control, Equidistant firing angle control, DC power flow control.

Interaction between HVAC and DC systems :Voltge interaction , Harmonic instability problems.

DC Power modulation:

UNIT-IV :

Converter faults and Protection :

Over voltages due to disturbance on AC and DC side and their protection , Over currents and their protection. Valve group and DC line protection, Surge arresters.

UNIT – V :

Multi-terminal HVDC systems :

Series, Parallel, Series-Parallel systems, their operation and control.

Reference Books :

1. EHVAC and HVDC Transmission by S.Rao.
2. *HVDC Power Transmission System & Technology* - KR. Padiyar. Reprint 2005 New Age International New Delhi.

3. *HVDC Transmission by Kamakshiah 2011 Tata Mcgraw Hill*.
4. *Dicert current Transmission*- E.W. Kimbark, Wiley Inter Science, New York.
5. *HVDC Transmission* – J.Arillaga, Peter Petregrinus Ltd.

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

I- Semester

NEURAL AND FUZZY SYSTEMS

(Elective - II)

Unit - I: Introduction to Neural Networks

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, 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

Feed Forward Neural Networks

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

Unit III: Multilayer Feed forward Neural Networks

Generalized Delta Rule, Derivation of Back-propagation (BP) Training, Summary of Back-Propagation Algorithm, Learning Difficulties and Improvements.

Associative Memories

Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis.

Unit IV: Self-Organizing Maps (SOM)

Introduction, Competitive Learning, Vector Quantization, Self-Organized Learning Networks, Kohonen Networks, Training Algorithms, Linear Vector Quantization, Stability-Plasticity Dilemma, Feed forward & Feedback Competition.

Classical & Fuzzy Sets

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

UNIT V: Fuzzy Logic System Components

Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods. 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. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai - **PHI** Publication.
2. Introduction to Artificial Neural Systems - Jacek M. Zuarda, Jaico Publishing House, 1997.

REFERENCE BOOKS:

1. Neural and Fuzzy Systems: Foundation, Architectures and Applications, - N. Yadaiah and S. Bapi Raju, Pearson Education
2. Neural Networks - James A Freeman and Davis Skapura, Pearson, 2002.
3. Neural Networks - Simon Hykins, Pearson Education
4. Neural Engineering by C.EIiasmith and CH.Anderson, PHI
5. Neural Networks and Fuzzy Logic System by Bork Kosko, PHI Publications.

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

I - Semester

ALTERNATE ENERGY CONVERTION SYSTEMS

(Elective - II)

Unit I:

Introduction: Global energy position ,Energy units, Environmental effects of Coal and Steam stations, preventive measures to reduce pollution from the conventional power generation methods, Examples for pollution free Energy systems.

Photo voltaic (PV) power generation : Spectral distribution of energy in solar radiation, Solar cell configurations, Voltage developed by solar cell, Photo current and Load current. Practical solar cell performance, Commercial photo voltaic systems, Test specifications for PV systems. Advantage of the Tracking system in PV modules, Small grid connected PV systems.

Super conducting materials: Applications of super conducting materials in electrical equipment systems.

Unit II:

MHD technology: Principles of MHD power generation, ideal MHD generator performance, practical MHD generator, Types of MHD generator methods.

Wind Energy conversion: Power from wind, Properties of air and wind, Types of wind Turbines, Operating characteristics, Interconnection to grid.

Unit III:

Tidal Power : Tides and tidal power stations, modes of operation, tidal project examples, turbines and generators for tidal power generation.

Wave energy conversion: properties of waves and power content, vertex motion of Waves, device applications.

Ocean Thermal Energy Conversion(OTEC) : Types of ocean thermal energy conversion systems,Application of OTEC systems examples, Environmental affects of OTEC.

Unit IV:

Miscellaneous energy conversion systems: Coal gasification and liquefaction, Biomass conversion, Its development trends in India, Geothermal energy, Thermo electric energy conversion, Principles of EMF generation. Fuel cell, Working principle of Fuel cell, Types of fuel cells, Application of fuel cells.

Unit V:

Co-generation : Combined cycle co-generation.

Energy storage : Energy storage parameters, Batteries, Lead acid battery, Constructional features- Battery charge-discharge cycles, Operating limits, Maintenance of Lead acid batteries, Sizing of Lead-acid batteries for various applications. Ultra capacitors, Double layers capacitors, High energy Ultra capacitors and their applications.

TEXT BOOKS

1. "Energy conversion systems" by Rakosh das Begamudre, New age international publishers, New Delhi-2000.
2. "Renewable Energy Resources" by John Twidell and Tony Weir, 2nd edition, Fspon & Co
3. Renewable Energy Resources, Basic principles and Applications,G.N. Tiwari and M.K.Ghosal. Narosa Publications.
4. Non-Conventional Energy Resources , G.D.Rai.

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

I- **Semester**

MODERN CONTROL THEORY
(Elective-II)

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-Non-uniqueness of state model-state diagrams for Continuous-Time State models.

UNIT-II: State Variable Analysis

Linear Continuous time models for Physical Systems-Existence and uniqueness of Solution to Continuous-Time State Equations- Solutions of Linear Time Invariant Continuous-Time State Equations-State transition matrix and its properties

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 Models in Jordan Canonical form – Controllability and Observability Canonical forms of State Model.

UNIT – III Stability Analysis

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

State feedback Controllers and Observers

State feedback controller design through pole assignment – State observers: Full order and reduced order

UNIT – IV:

Introduction to Optimal control – Formulation of Optimal Control Problems – Calculus of Variations – Fundamental Concepts, Functionals, Variation of Functionals - Fundamental Theorem of Calculus of Variations – Boundary Conditions – Constrained Minimization – Formulation using Hamiltonian Method – Linear Quadratic Regulator

UNIT – V: Non Linear Systems - I

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 non-linear systems – Stability analysis of Non-Linear Systems through describing functions.

Non Linear Systems II

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

Text Books:

3. Modern Control System Theory by M. Gopla – New Age International-1984
4. Modern Control Engineering – by K.Ogata, Person Education / PHI,1997

Reference Books:

1. Optimal Control by Kircks

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

I- Semester

POWER CONVERTERS LAB

1. Speed Measurement and closed loop control using PMDC motor
2. Thyristorised drive for PMDC Motor with speed measurement and closed loop control.
3. IGBT used single 4 quadrant chopper drive for PMDC motor with speed measurement and closed loop control.
4. Thyristorised drive for 1 Up *DC* motor with closed loop control.
5. 3 Phase input, thyristorised drive, 3 Hp DC motor with closed loop
6. 3 Phase input IGBT, 4 quadrant chopper drive for DC motor with closed loop control equipment.
7. Cycloconverter based AC Induction motor control equipment.
8. Speed control of 3 phase wound rotor Induction motor.
9. Single phase fully controlled converter with inductive load
10. Single phase half wave controlled converter with inductive load.

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

Semester – II

POWER ELECTRONIC CONTROL OF A.C. DRIVES

UNIT I: Introduction to AC **Drives**

Introduction to motor drives - Torque production - Equivalent circuit analysis - Speed-Torque Characteristics with Variable voltage operation. Variable frequency operation, constant v/f operation - Variable stator current operation - Induction motor characteristics in constant torque and field weakening regions

UNIT II: Control of Induction motor drives at Stator side

Scalar control - Voltage fed inverter control - Open loop volts/Hz control - speed control slip regulation - speed control with torque and flux control - current controlled voltage fed inverter drive - 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 III: Control of Induction motor drives at Rotor side

Slip power recovery drives - Static Kramer Drive - Phasor diagram -Torque expression – Speed control of Kramer Drive - Static Scheribus Drive - modes of operation

Vector control of Induction Motor Drives

Principles of Vector control - Vector control methods - Direct method of vector control - Indirect method of vector control -Adaptive control principles- Self tuning regulator-Model referencing control.

UNIT IV: Control of Synchronous motor drives

Synchronous motor and its characteristics - Control strategies - Constant torque angle control - Unity power factor control Constant mutual flux linkage control

Controllers

Flux weakening operation - Maximum speed - Direct flux weakening algorithm - Constant Torque mode controller- Flux Weakening controller-Indirect flux weakening-Maximum permissible torque-speed control scheme - Implementation strategy - Speed controller design.

UNIT V: SWITCHED RELUCTANCE MOTORS

Constructional features- Principle of operation-Torque equation-power electronic converter circuits-characteristics and control-Torque/speed characteristics, current sensing-Rotor position measurement and estimation.

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

PERMANENT MAGNET BRUSHLESS DC MOTORS

Commutation in DC motor-Difference between mechanical and electronic commutators-Hall effect sensors-optical sensors-Multiphase brushless motor-Square wave permanent magnet brushless motor drives-Torque and EMF equation-Torque-speed characteristics-controllers

REFERENCE **BOOKS:**

1. Electric Motor Drives Pearson Modeling, Analysis and Control - R.Krishnan - Publications - 1 st edition-2002
2. Modern Power Electronics and AC Drives - B.K.Bose - Pearson Publications - 1st edition
3. Power Electronic control of AC Motors - MD Murphy and FG Turn Bull Pergman Press(For Chapters II.Ill, V) — 1st edition
4. Power Electronics and AC Drives - B.K.Bose - Prentice Hall, Eagle wood diffs New Jersey(for chapters I, II, IV)- 1st edition
5. Power Electronic circuits, Devices and Applications - M.H.Rashid - PHI - 1995
6. Fundamentals of Electrical Drives - GK.Dubey - Narora publications -1995 (For Chapter II)
7. Power Electronics and Variable frequency drives - B.K.Bose - IEEE Press - Standard publications –lst edition-2002
8. R.Krishnan, “switched reluctance motor drives-Modelling,Analysis and control” Prentice Hall of India Pvt. Ltd., NEW DELHI,2003.
9. Miller T.J.E “Brushless permanent magnet and reluctance motor drives”, Clarendon press,oxford,1989

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

II- Semester

ANALYSIS OF POWER ELECTRONIC CONVERTERS

Unit I **Single Phase AC Voltage Controllers.** Single phase AC voltage controllers with Resistive, Resistive-inductive and Resistive-inductive-induced e.m.f. loads - ac voltage controllers with PWM Control - Effects of source and load inductances - Synchronous tap changers- Applications - numerical problems.

Unit II **Three Phase AC Voltage Controllers.**

Three phase AC voltage controllers -Analysis of controllers with star and delta Connected Resistive, Resistive-inductive loads - Effects of source and load Inductances - applications - numerical problems.

Cyclo-converters.

Single phase to single phase cycloconverters - analysis of midpoint and bridge Configurations - Three phase to three phase cycloconverters - analysis of Midpoint and bridge configurations - Limitations - Advantages Applications - numerical problems.

Unit III **Single Phase Converters.**

Single phase converters - Half controlled and Fully controlled converters - Evaluation of input power factor and harmonic factor - continuous and Discontinuous load current - single phase dual converters - power factor Improvements - Extinction angle control - symmetrical angle control - PWM - single phase sinusoidal PWM - single phase series converters -Applications - Numerical problems. **Three Phase Converters.**

Three phase converters - Half control led and fully controlled converters - Evaluation of input power factor and harmonic factor - continuous and Discontinuous load current - three phase dual converters - power factor Improvements - three phase PWM - twelve pulse converters - applications - Numerical problems.

Unit IV **D.C. to D.C. Converters**

Analysis of step-down and step-up dc to dc converters with resistive and Resistive-inductive loads - Switched mode regulators -Analysis of Buck Regulators - Boost regulators - buck and boost regulators - Cuk regulators - Condition for continuous inductor current and capacitor voltage - comparison Of regulators -**Multiouput** boost converters - advantages - applications - Numerical problems.

Unit V **Pulse Width Modulated Inverters(single phase).**

Principle of operation - performance parameters - single phase bridge inverter- evaluation of output voltage and current with resistive, inductive and Capacitive loads - Voltage control of single phase inverters - single PWM - Multiple PWM- sinusoidal PWM - modified PWM - phase displacement Control -Advanced modulation techniques for improved performance-Trapezoidal, staircase, stepped, harmonic injection and delta modulation

-Advantage - application - numerical problems. **Pulse Width Modulated Inverters(three phase).**

Three phase inverters - analysis of 180 degree condition for output voltage And current with resistive, inductive loads - analysis of 120 degree Conduction - voltage control of three phase inverters - sinusoidal PWM - **Third** Harmonic PWM - 60 degree PWM - space vector modulation - Comparison of PWM techniques - harmonic reductions - Current Source Inverter - variable d.c. link inverter - boost inverter - buck and boost inverter - inverter circuit design - advantages - applications - numerical problems.

TEXT BOOKS:

1. Power Electronics - Mohammed H. Rashid - Pearson Education -Third Edition - First Indian **reprint** 2004.
2. Power Electronics - Ned Mohan, Tore M. Undeland and William P. Robbins -John Wiley and Sons Second Edition.

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

II- **Semester**

DYNAMICS OF ELECTRICAL MACHINES

Unit I: Basic Machine Theory

Hlectromechanical Analogy - Magnetic Saturation - Rotating field theory - Operation of Inductor motor - equivalent circuit - Steady state equations of d.c. machines - operation of synchronous motor- Power angle characteristics.

Unit II: Electrodynamical equations and their solutions

Spring and Plunger system - Rotational motion - mutually coupled coils - Lagrange's equation -Application of Lagrange's equation - solution of Electro dynamical equations.

Unit III: Dynamics of D.C. Machines

Separately excited D.C. generators - stead state analysis - transient analysis -Separately excited d.c. motors - steady state analysis - transient analysis -interconnection of machines - Ward Leonard system of speed control.

Unit IV: Induction Machine Dynamics

Induction machine dynamics during starting and braking - accelerating time - Induction machine dynamics during normal operation - Equation for dynamical response of the Induction motor.

Unit V: Synchronous Machine Dynamics

Electromechanical equation-motor operation-generator operation-small oscillations-general equations for small oscillations-representation of the oscillation equations in state variable form.

REFERENCE BOOKS :

1. Sen Gupta D.P. and J.W. "Electrical Machine Dynamics", Macmillan Press Ltd., 1980
2. BimbhraP.S. "Generalized Theory of Electrical Machines", Khanna Publishers 2002.

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

II- Semester

FLEXIBLE AC. TRANSMISSION SYSTEMS

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: **Static Shunt Compensation:**

Objectives of shunt compensation, mid point voltage regulation voltage instability prevention, improvement of transient stability, Power oscillation damping. Methods of controllable var generation, variable impedance type static var generators switching converter type var generators -hybrid var generators.

Unit III: 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 IV: Static Series Compensators:

concept of series capacitive compensation, improvement of transient stability, power oscillation damping Functional requirements. GTO thyristor controlled series capacitor(GSC),thyristor switched series capacitor(TSSC), and thyristor controlled series capacitor(TCSC) control schemes for GSC ,TSSC and **TCSC.**

Unit V: UPFC

Unified power flow controller-Conventional transmission control capabilities-independent real and reactive power flow control-comparison of the UPFC to series compensators and phase angle regulators

TEXT BOOK :

1. "Understanding **FACTS** Devices" N.G. Hingorani and *L.* Guygi. IEEE Press Publications 2000.

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

II - Semester

RELIABILITY ENGINEERING
(ELECTIVE-III)

UNIT I: Elements of Probability Theory

Probability distributions : Random Variables, density and distribution functions, Mathematical expectation. Binominal distribution, Poisson distribution, normal distribution, exponential distribution, Weibull distribution.

UNIT II :

Definition of Reliability, Significance of the terms appearing in the definition.

Component Reliability, Hazard rate, derivation of the reliability function in terms of the hazard rate. Hazard models.

Failures: Causes of failures, Types of failures (early failures, chance failures and wear-out failures). Modes of failure. Bath tub curve. Effect of preventive maintenance. Measures of reliability: mean time to failure and mean time between failures.

UNIT III :

Reliability of logic diagrams (reliability block diagrams)

Classification of engineering systems: Series, parallel, series-parallel, parallel-series and non-series-parallel configuration. Expressions for the reliability of the basic configurations.

Reliability evaluation of Non-series-parallel configuration: minimal tie-set, minimal cut-set and decomposition methods. Deduction of the minimal cutsets from the minimal pathsets.

UNIT IV :

Discrete Markov Chains: General modelling concepts, stochastic transitional probability matrix, time dependent probability evaluation and limiting state probability evaluation. Absorbing states.

Continuous Markov Processes: Modelling concepts, State space diagrams, Stochastic Transitional Probability Matrix, Evaluating limiting state probabilities.

Reliability evaluation of repairable systems.

UNIT V : Reliability Evaluation of Electrical Power Distribution Systems

Introduction, Evaluation Techniques, Definitions of varies Customer-oriented, load and energy oriented indices, Evaluation of the indices. Applications to Radial Networks, Certain case studies.

TEXT BOOK:

1. "RELIABILITY EVALUATION OF ENGINNERING SYSTEMS", Roy Billinton and Ronald N. Allan, Plenum Press.
2. "RELIABILITY EVALUATION OF POWER SYSTEMS", Roy Billinton and Ronald N. Allan, Plenum Press.

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

II –Semester

POWER QUALITY
(ELECTIVE-III)

UNIT I: Introduction

Introduction of the Power Quality (PQ) problem, Terms used in PQ:Voltage, sag ,Swell, Surges ,Harmonics .over voltages ,spikes ,Voltage fluctuations ,Transients ,Interruption, over view of power quality phenomenon. Remedies to improve power quality, power quality monitoring

UNIT II: Long Interruptions

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

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 III: voltage sag – characterization – Single phase:

Voltage sag – definition, causes of voltage sag, voltage sag magnitude, monitoring, theoretical calculation of voltage sag magnitude, voltage sag calculation in non -radial system, meshed systems, voltage sag duration

Voltage sag-characterization-three phase:

Three phase faults,phase angle jumps ,magnitude and phase angle junps for three phase balanced sags, load influence on voltage sags.

UNIT IV: PQ considerations in Industrial Power systems:

Voltage sag−equipment behavior of Power electronics loads, induction motors, synchronous motors, computers 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 V: Mitigation of Interruption and Voltage Sags:

Overview of mitigation methods –from fault to trip, reducing the number of faults, reducing the number of faults, reducing the fault clearing time changing the power system, installing mitigation equipment, improving equipment immunity, different even and mitigation methods

Wiring and grounding

Reason for grounding, typical wiring and grounding problems, solution of wiring and grounding problems.

Reference Book:

1. " Understanding Power Quality Problems" by *Math H J Bollen, IEEE Press*

2. Electrical power quality –*R C Dugan, M.F,M Granghar, H.W.Beaty-TMH.*

3. *Arindam Ghosh and Gerard Ledwich*,"Power Quality Enhancement using custom power devices ", Kulwer academicpublishers.

4. Power system harmonics –*A.J. Arrillga*

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

II- Semester

EMBEDDED SYSTEMS

(Elective -III)

UNIT- I Overview of Embedded System:

Embedded System, types of Embedded System, Requirements of Embedded System, Issues in Embedded software development, Applications.

UNIT-II: Processor & Memory Organization:

Structural units in a processor. Processor selection, Memory devices. Memory selection, Memory Allocation & Map; Interfacing

UNIT-III: Devices, Device Drivers & Buses for Device Networks:

I/O devices, Timer & Counter devices, Serial Communication, Communication between devices using different buses.

Device drives, Parallel and serial port device drives in a system, interrupt servicing mechanism, context and periods for context switching, Deadline and Interrupt Latency.

UNIT-IV: Programming & Program Modeling Concepts

Program elements, Modeling Processes for Software Analysis, Programming Models, Modeling of Multiprocessor Systems, Software algorithm Concepts, design, implementation, testing, validating, debugging, Management and maintenance, necessicity of RTOS.

U N I T - V Hardware and Software Co-Design

Embedded system design and co design issues in software development, design cycle in development phase for i imbedded System, Use of ICE & Software tools for development of ES, Issues in embedded system design.

REFERENCE BOOKS:

1. Embedded Systems: Architecture, Programming and Design - Rajkamal, TMII2003
2. Programming for Embedded System: DreamTech Software Team-John Wiley -2002

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

II –Semester

PROGRAMMABLE LOGIC CONTROLLERS AND THEIR APPLICATIONS

(Elective - IV)

Unit I:

PLC Basics, PLC system, I/O modules and interfacing CPU processor programming equipment programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

Unit II:

PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation.

Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

Unit III:

PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers PLC Functions Timer functions and industrial applications counters counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

Unit IV:

Data Handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit functions, sequencer functions, Matrix functions.

Analog PLC operation: Analog modules and systems, analog output application examples

Unit V:

PLC Applications: Controlling Of Two Axis Robots, Controlling Of Three Axis Robots, Industrial control, PID principles, Motor controls, AC Motor starter, Fail safe programming, Trouble shooting & Maintenance

REFERENCE BOOKS:

1. Programmable Logic Controllers – Principles and Applications by John W. Webb and Ronald A. Reis, Fifth Edition, PHI
2. Programmable Logic Controllers – Programming Methods and Applications by John R. Hackworth and Fredrick D. Hackworth, Jr. – Pearson, 2004.

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

II- Semester

ADVANCED DIGITAL SIGNAL PROCESSING

(Elective - IV)

UNIT-I: Digital Filter Structure

Block diagram representation-Equivalent Structures-FIR and IIR digital filter Structures All pass Filters-tunable IIR Digital Filters-IIR tapped cascaded Lattice Structures-FIR cascaded Lattice structures-Parallel-Digital Sine-cosine generator- Computational complexity of digital filter structures.

UNIT-II: Digital filter design

Preliminary considerations-Bilinear transformation method of IIR filter design, design of Low pass highpass-Bandpass, and Band stop- IIR digital filters-Spectral transformations of IIR filters- **HIS** 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-III: DSP algorithm implementation

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

UNIT-IV 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 scaiing-signal- to-**noise** ratio in Low -order IIR filters-Low-Sensitivity Digital filters-Reduction of Product round-off errors using error feedback-Limit cycles in IIR digital filters- Round-off errors in FIT Algorithms.

UNIT V: 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-Nonparametric methods for power spectrum estimation-Walsh methods-BIackman and torchy method.

REFERENCE BOOKS:

1. Digital signal processing-sanjit K. Mitra-TMH second edition

2. Discrete Time Signal Processing - Alan V.Oppenheim, Ronald W.Shafer - PIII-1996 1st edition-9th reprint
3. Digital Signal Processing principles, algorithms and Applications - John G.Proakis -PHI -3rd edition-2002.
4. Digital Signal Processing - S.Salivahanan, A. Vallavaraj, C. Gnanapriya **-TMH** - 2nd reprint-2001
5. **Theory and Applications of Digital** Signal Proceesing-LourensR.RcbinarandBernold
6. Digital Filter Analysis and Design-Auntonian-TMII

2011-2012

G. NARAYANAMMA INSTITUTE OF TECHNOLOGY & SCIENCE

(FOR WOMEN)

(AUTONOMOUS)

M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

II- Semester

ENTERPRISE RESOURCE PLANNING

(ELECTIVE-IV)

UNIT I:

General modes for ERP, Integrated management information; Benefits of ERPJJusincss modelling for ERP, Representative lists of various core processes and of entities forming data model.

UNIT II:

Problem statement ; Key issues; Implementation methodology and guidelines. IiRP Domain in power plants: Power plant management, Project management, Operation management, Maintenance Management. Fuel management, Materials management, Human resource management, Finance management, Safety management, and Environment management

UNIT III:

Introduction to IRP and DSM; framework of DSM.

Customer load control; Intemiptible electric service; Various evaluation criteria, Rate design in DSM Objectives, lime - of- use (TOU) rate.

UNIT IV:

Market planning, generic load - shape changes

Evaluating DSM programs, an overview of detailed evaluation approach.

UNIT V:

Cost benefit analysis, consumer perspective, utility perspective. Customer acceptance of DSM programs. Strategic marketing, Marketing implementation strategies.

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REFERENCE BOOKS :

1. Vinod Kumar Garg and N.K. Venkita Krishnan: "Enterprise Resource Planning - Concepts and Practice". Prentice - Hall of India Pvt. Ltd., 1999
2. C.W. Gellings and J.G Chamberlin; "Demand - Side Management: Concepts and Methods", The Fairmont Press, inc, 1993

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M. TECH. (POWER ELECTRONICS AND El ECTRIC DRIVES)

II- Semester

ELECTRICAL SYSTEMS SIMULATION LAB

1. Write program and simulate dynamical system of following models:
   a) I/O Model
   b) State variable model

   Also identify time domain specifications of each.
2. **Obtain** frequency response of a given system by using various methods:
   (a) General method of finding the frequency domain specifications.
   (b) Polar plot
   (c) Bode plot

   Also obtain the Gain margin and Phase margin.
3. Determine stability of a given dynamical system using following methods.
   a) Root locus
   b) Bode plot
   c) Nyquist plot
   d) **Liapunov** stability criteria
4. Transform a given dynamical system from I/O mode! to state variable model and vice versa.
5. Obtain model matrix of a given system, obtain its diagonalize form if exists or obtain Jordon Canonical form of system.
6. Write a program and implement linear quadratic regulator
7. Resign a compensator for a given systems for required specifications.
8. Conduct a power flow study on a given power system.
9. Design a **PID** controller.
10. Conduct a power flow study on a given power system network using Guass-Seidel iterative method.
11. Develop a program to solve Swing Equation.
12. **Develop** a Simutink model for a single area load frequency problem and simulate the same.
13. Develop a Simulink model for a two-area load frequency problem and simulate the same.
14. Design a **PID** controller for two-area power system and simulate the same.
15. **PSPICE** Simulation of Single phase full converter using RLandE loads.
16. **PSPICE** Simulation of Three phase full converter using RLandE loads.
17. **PSPICE** Simulation of Single phase AC Voltage controller using RL load.
18. **PSPICE** Simulation of Three phase inverter with PWM control ler.
19. PSPICE Simulation of resonant pulse commutation circuit.
20. **PSPICE Simulation** of impulse commutation circuit.