CMR COLLEGE OF ENGINEERING & TECHNOLOGY

Kandlakoya(V), Medchal Road, Hyderabad

(Autonomous)

ACADEMIC REGULATIONS FOR
M. TECH. (REGULAR) DEGREE COURSE

(Applicable for the students of M. Tech. course admitted from the
Academic Year 2014-15)

The M. Tech. degree shall be conferred on candidates who are admitted to the program and who fulfill all the requirements for the award of the degree.

1.0 Eligibility for Admissions

Admission to the above program shall be made subject to eligibility, qualification and specialization as prescribed by the State Government 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 pursues a course of study in not less than two and not more than four academic years.

2.2 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.

2.3 The student shall register for all 88 credits and secure all the 88 credits.

2.4 The minimum instruction days in each semester are 90.

2.5 The medium of instruction and examination shall be English.

3.0 A. Courses of Study

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

1. Bio-Technology
2. Embedded Systems
3. Power Electronics
4. Structural Engineering
5. Computer Science & Engineering
6. Machine Design

and any other course as approved by the College/ University/AICTE from time to time.

B. Departments offering M.Tech. programmes with specializations mentioned below:

Sl. No.	Department	M.Tech Course
1	Bio-Technology	Bio-Technology
2	ECE	Embedded Systems
3	EEE	Power Electronics
4	Civil	Structural Engineering
5	CSE	Computer Science & Engineering
6	Mechanical	Machine Design

4.0 Minimum Instructional Days and Attendance

The programs are offered on a unit basis with each subject being considered a unit.

4.1 The minimum instruction period for each semester shall be 90 clear instruction days.

4.2. A student shall be eligible to write semester end examinations if he acquires a minimum of 75% of attendance **in each of all the subjects**.

4.3. Condonation of shortage of attendance in aggregate up to 10%

(65% and above and below 75%) in each semester shall be granted by the Institute Academic Committee.

4.4 Shortage of attendance below 65% in aggregate shall not be condoned.

4.5 Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of subjects of the corresponding semester and their registration shall stand cancelled.

4.6. A fee as prescribed by the Institute Academic Committee shall be payable towards condonation of shortage of attendance.

4.7. A candidate shall put in a minimum required attendance, in at least 50% of the 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, as per the course structure.

4.8. A student will be promoted to the next semester if he satisfies the attendance requirement of the present semester including the days of attendance in sports, games, NCC and NSS activities subject to a maximum of 15 instructional days in a semester. Prior permission of the Head of the Department in writing shall be obtained by the students to avail the attendance from above mentioned activities.

5. 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.

For the theory subjects 60 marks shall be awarded based on the performance in the End Semester Examination and 40 marks shall be awarded based on the Internal Evaluation. For internal evaluation there

shall be two internal examinations conducted-one in the middle of the semester and the other immediately after the completion of instruction. Each internal examination shall be conducted for a total duration of 120 minutes. The final marks secured by each candidate in the internal evaluation is arrived at by giving a weightage of 70% to the best secured internal examination and 30% weightage to the least secured internal examination. A student who is absent for any internal examination for any reason what so ever shall be deemed to have secured 'zero' marks in the test/ examination and no make-up test/ examination shall be conducted.

5.1 Question paper pattern for evaluation

Internal Examination

Part A (20 Marks)

4 questions of 5 marks each (All questions are compulsory).

Part B (20 Marks)

4 questions to be answered out of 6 questions, each question carries 5 marks.

External Examination

Part A (20 Marks)

5 questions (1 question from each unit) of 4 marks each (Compulsory questions)

Part B (40 Marks)

5 questions (1 question from each unit with internal choice) each question carries 8 marks.

5.2 For practical subjects, 60 marks shall be awarded based on the performance in the End Semester Examinations. 40 marks shall be awarded in internal evaluation out of which 20 marks shall be for day to day evaluation and 20 marks shall be for internal examination.

5.3 There shall be seminar presentation during I semester as well as II

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 Academic Committee consisting 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% of marks to be declared successful.

5.4 There shall be a Comprehensive Viva-Voce in III Semester. The Comprehensive Viva-Voce will be conducted by a Committee consisting of Head of the Department and two Senior Faculty members of the Department and an external examiner. The external examiner shall be appointed by the Controller of Examinations in consultation with the HOD. The Comprehensive Viva-Voce is intended to assess the students' understanding of various subjects he has studied during the M. Tech. course of study. The Comprehensive Viva-Voce is evaluated for 100 marks by the Committee. There are no internal marks for the Comprehensive Viva-Voce. A candidate has to secure a minimum of 50% of marks to be declared successful.

5.5 A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% marks in the End semester 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 5.5) he has to reappear for the End semester 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 so has failed in the end examination. In such a case, the candidate must re-register for the subject(s) and secure the required minimum attendance. The candidate's attendance in the re-registered subject(s) shall be calculated separately to decide upon his eligibility for writing the end examination in those subject(s). In

the event of the student taking another chance, his internal marks and end examination marks obtained in the previous attempt stand cancelled.

5.7 In case the candidate secures less than the required attendance in any subject, he shall not be permitted to write the End Examination in that subject. He shall re-register the subject when next offered.

5.8 Laboratory examination for M. Tech. courses for 60 marks must be conducted with two Examiners, one of them being the Laboratory Class Teacher and the second examiner shall be appointed by the Controller of Examinations in consultation with the HOD.

6.0 Evaluation of Project / Dissertation Work:

The work on the project shall be initiated in the beginning of the III semester and the duration of the project is for two semesters. A Project Review Committee (PRC) shall be constituted comprising of Head of the Department and three other senior faculty members concerned with the M.Tech programme. The student can initiate the Project work only after obtaining the approval of PRC. This process is to be completed within four weeks of commencement of III semester.

6.1. The candidate shall be required to submit thesis or dissertation after taking up a topic approved by the Project Review Committee.

6.2 Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the previous semesters and after obtaining the approval of the Institute Academic Committee.

6.3 After satisfying 6.2, a candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work to the PRC for its approval.

6.4 If the candidate wishes to change his supervisor or topic of the project he can do so with approval of PRC. However, the PRC shall examine whether the change of topic/supervisor leads to a major change of his initial plans of project proposal. If so his date of

registration for the project work starts from the date of change of supervisor or topic as the case may be.

6.7   Project work and Dissertation:

A candidate is permitted to submit project dissertation only after successful completion of all subjects (theory and practical), seminars, comprehensive viva-voce, and after the 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 Head of the Department and shall make an oral presentation before the PRC. Along with the draft thesis the candidate shall submit draft copy of a paper in standard format fit for publication in Journal / Conference, based on the project thesis, to the Head of the Department with due recommendation of the supervisor.

6.7.1   Four copies of the Project Dissertation certified by the Supervisor and Head of the Department shall be submitted to the College.

6.7.2   The dissertation shall be adjudicated by one examiner selected by the College. In case the thesis is found to be acceptable; viva-voce will be arranged. For this, Head of Department shall submit a panel of 3 examiners, who are eminent in that field, with the help of the PRC. The Controller of Examinations of the college in consultation with the College Academic Committee shall nominate the examiner.

6.7.3   If the report of the examiner is not favourable, the candidate shall revise and resubmit the dissertation, in the time frame as prescribed by PRC. If the report of the examiner is unfavourable again, the thesis shall be summarily rejected. The candidate can re-register only once for conduct of project and evaluation of dissertation, and will go through the entire process as mentioned above. The total duration for the M.Tech program is limited to four years.

6.7.4   If the report of the examiner is favourable, viva-voce examination shall be conducted by a Board consisting of the Head of the Department, Supervisor and the Examiner who

adjudicated the Dissertation. The Board shall jointly report the student's performance in the project work as –

    (a) Excellent, or
    (b) Good, or
    (c) Satisfactory, or
    (d) Unsatisfactory,

as the case may be. In case, the student fails in the viva-voce examination, or gets the Unsatisfactory grade, he can re-appear only once for the viva-voce examination, as per the recommendations of the Board. If he fails at the second viva-voce examination, the candidate can re-register only once for conduct of project and evaluation of Dissertation, and will go through the entire process as mentioned above. The total duration for the M.Tech program is limited to four years.

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 he shall be placed in one of the following four classes:

Class Awarded	% of marks to be secured
First Class with Distinction	70% and above
First Class	Below 70% but not less than 60%
Second Class	Below 60% but not less than 50%

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

8. Withholding of Results

If the student has not paid the dues, if any, to the institution or if any case of indiscipline is pending against him, the result of the student will be withheld and he will not be allowed into the next semester. His degree will be withheld in such cases.

9. **Transitory Regulations**

    9.1 Discontinued, detained or failed candidates are eligible for admission to two earlier or equivalent subjects at a time as and when offered.

    9.2 The candidate who fails in any subject will be given two chances to pass the same subject; otherwise, he has to identify an equivalent subject as per the academic regulations.

10. **General**

    10.1. Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

    10.2. The academic regulation should be read as a whole for the purpose of any interpretation.

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

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

MALPRACTICES RULES
DISCIPLINARY ACTION FOR
IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/ Improper conduct	Punishment
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 he 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, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall 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 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 to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled.
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 seat. The

		performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals 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 end semester 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.
4.	Smuggles 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 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 end semester Examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive	Cancellation of the

	language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks	performance in that subject
6.	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 college or organizes a walk out or instigates others **to** examination hallwalk out, or threatens the officer-in-charge or any person on duty in or outside the examination hall of any injury**,** to his person or to any of his 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 his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	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 candidate(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 are also debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	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 Semester end 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.	If the student belongs to the college, expulsion from the examination hall and all other subjects hall and all other subjects that 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. 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 other 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.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the College Academic Committee for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

Punishments to the candidates as per the above guidelines.

Malpractice identified at Spot center during valuation

The following procedure is to be followed in case of malpractice cases detected during valuation, scrutiny etc. at spot center.

1) Malpractice is detected at the spot valuation. The case is to be referred to the malpractice committee. Malpractice committee will meet and discuss/question the candidate and based on the evidences, the committee will recommend suitable action on the candidate.

2) A notice is to be served to the candidate(s) involved through the Principal to his address and to the candidate(s) permanent address regarding the malpractice and seek explanations.

3) The involvement of staff who are in charge of conducting examinations, invigilators valuing examination papers and preparing / keeping records of documents relating to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examinations shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.

4) Based on the explanation and recommendation of the committee,

action may be initiated.

5) **Malpractice committee:**

i.	Controller of Examinations	Chairman
ii.	Assistant controller of Evaluation	Member
iii.	Chief Examiner of the subject/ subject expert	Member
iv.	Concerned Head of the Department	Member
v.	Concerned Invigilator	Member

COURSE STRUCTURE AND SYLLABUS
M.Tech (POWER ELECTRONICS)

I Semester

Code	Group	Subject	L	P	C
B1301		Machine Modeling and Analysis	3	0	3
B1302		Power Electronic Converters-I	3	0	3
B1303		Modern Control Theory	3	0	3
B1304		Power Electronic Control of DC Drives	3	0	3
B1305	**Elective –I**	HVDC Transmission			
B1635		Operations Research			
B1225		Embedded Systems	3	0	3
B1226	**Elective –II**	Microcontrollers and Applications			
B1306		Programmable Logic Controllers and their Applications			
B1307		Special Machines	3	0	3
B1308		Power Converters Lab	0	3	2
B1309		Seminar	0	0	2
		Total Credits			**22**

II Semester

Code	Group	Subject	L	P	C
B1310		Power Electronic Converters-II	3	0	3
B1311		Power Electronic Control of AC Drives	3	0	3
B1312		Flexible AC Transmission Systems (FACTS)	3	0	3
B1531		Neural Networks and Fuzzy Systems	3	0	3
B1313	**Elective -III**	Digital Control Systems			
B1314		Power Quality	3	0	3
B1227		Advanced Digital Signal Processing			
B1315	**Elective -IV**	Dynamics of Electrical Machines			
B1316		Reliability Engineering	3	0	3
B1317		Renewable Energy Systems			
B1318	Lab	Electrical Systems Simulation Lab	0	3	2
B1319		Seminar	0	0	2
		Total Credits			**22**

III Semester

Code	Subject	L	P	C
B1320	Comprehensive Viva-Voce	0	0	2
B1321	Project Seminar	0	3	2
B1322	Project Work (Continued to next Semester)	0	0	18
	Total Credits			**22**

IV Semester

Code	Subject	L	P	C
B1322	Project Work and Seminar (Continued from previous Semester)	0	0	22
	Total Credits			**22**

M.TECH(POWER ELECTRONICS)
DETAILED SYLLABUS

(B1301) MACHINE MODELLING AND ANALYSIS

L P C
3 0 3

M. Tech(EEE) – I Semester

UNIT-I:
Basic Two-pole DC machine - primitive 2-axis machine – Voltage and Current relationship – Torque equation.

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 D.C. Compound motor in state variable form – Transfer function of the motor - Numerical Problems

UNIT-III:
Liner transformation – Phase transformation (a, b, c to α, β, o) – Active transformation
(α .β, o to d, q).
Circuit model of a 3 phase Induction motor – Linear transformation - Phase Transformation – Transformation to a Reference frame – Two axis models for induction motor.

UNIT-IV:
Voltage and current Equations in stator reference frame – equation in Rotor reference frame – equations in a synchronously rotating frame – Torque equation - Equations I state – space form.

UNIT-V:
Circuits model of a 3ph Synchronous motor – Two axis representation of Syn. Motor. Voltage and current Equations in state – space variable form – Torque equation.

TEXT BOOKS:
1. Thyristor control of Electric Drives - Vedam Subranmanyam.
2. Analysis of electric machinery and Drives systems - Paul C. Krause, Oleg wasynezuk, Scott D. Sudhoff.

(B1302) POWER ELECTRONIC CONVERTERS-I

L P C
3   0 3

M. Tech(EEE) – I Semester

UNIT-I: MODERN POWER SEMICONDUCTOR DEVICES

Modern power semiconductor devices – MOS turn Off Thyristor (MTO) – Emitter Turn off Thyristor (ETO) – Intergrated Gate-Commutated thyristor (IGCTs) – MOS-controlled thyristors (MCTs) – Static Induction circuit – comparison of their features.

UNIT-II: 1&3-THREE-PHASE AC VOLTAGE CONTROLLERS & CYCLO-CONVERTERS **Single phase AC voltage controllers**: with Resistive, Resistive –inductive and Resistive – inductive-induced EMF loads – AC voltage controllers with PWM Control – Effects of source and load inductances – Synchronous tap changers – Applications – numerical problems.

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.

UNIT-III: **Single phase to single phase cyclo-converters** – analysis of midpoint and bridge Configurations – Three phase to three phase cyclo-converters – analysis of Midpoint and bridge configurations – Limitations – Advantages – Applications – numerical problems.

UNIT-IV: SINGLE-PHASE & THREE-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 – Half controlled 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 phase converters – applications – Numerical problems.

UNIT-V: D.C. TO D.C. CONVERTERS

Choppers: 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 – Multi-output boost converters – 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.
3. Power Electronics Devices, Circuits and Industrial applications, V. R. Moorthi, Oxford University Press

REFERENCE BOOKS:
1. Power Electronics, Dr. P. S. Bimbhra, Khanna Pubishers.
2. Elements of Power Electronics, Philip T. Krein, Oxford University Press.
3. Power Electronics, M. S. Jamil Asghar, PHI Private Limited.
4. Principles of Power Electronics John G. Kassakian, Martin F. Schlect, Geroge C. Verghese, Pearson Education.

(B1303) MODERN CONTROL THEORY

L P C
3 0 3

M. Tech(EEE) – I Semester

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 Solutions to Continuous-Time State Equations – Solutions of Linear Time Invariant Continuous-Time State Equations – State transition matrix and its properties. 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-III: NON LINEAR SYSTEMS

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

UNIT-IV: 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 Lyapunov second method – Generation of Lyapunov functions – Variable gradient method – Krasooviski's method. State feedback controller design through Pole Assignment – State observers: Full order and Reduced order.

UNIT-V: OPTIMAL CONTROL

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

TEXT BOOKS:
1. Modern Control System Theory by M.Gopal – New Age International -1984
2. Modern Control Engineering by Ogata.K – Prentice Hall - 1997

REFERENCE BOOKS:
1. Optimal control by Kircks

(B1304) POWER ELECTRONIC CONTROL OF DC DRIVE
L P C
3 0 3

M. Tech(EEE) – I Semester

UNIT–I: SINGLE-PHASE CONTROLLED RECTIFIERS FED DC MOTOR

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.

UNIT–II: THREE-PHASE CONTROLLED RECTIFIERS FED DCMOTOR

Three-phase semi converter and Three phase full converter for continuous and discontinuous modes of operations – power and power factor - Addition of Free wheeling diode – Three phase double converter.
Three phase controlled bridge rectifier with passive load impedance, resistive load and ideal supply – Highly inductive load and ideal supply for load side and supply side quantities, shunt capacitor compensation, three phase controlled bridge rectifier inverter.

UNIT–III: PHASE, CURRENT & SPEED CONTROLLED DC DRIVE

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 controllers - Current and speed feedback – Design of controllers – Current and speed controllers – Motor equations – filter in the sped feed back 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: 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, Hulley, Liang – II Edition Cambridge University Press.
2. Electronic motor drives modeling Analysis and control – R. Krishnan – I Edition Prentice Hall India.
3. Power Electronics circuits, Devices and Applications – MH Rashid – PHI – 1 Edition 1995.
4. Fundamentals of Electric Drives – GK Dubey Narosa Publishers 1995
5. Power Semiconductor drives – SB Dewan and A Straughen - 1975.

(B1305) HVDC TRANSMISSION
(Elective-I)

L P C
3 0 3

M. Tech(EEE) – I Semester
UNIT-I: INTRODUCTION

General consideration, 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. Harmonics in HVDC Systems, Harmonic elimination, AC and DC filters.

UNIT-III: 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.Interaction between HV AC and DC systems – Voltage interaction Harmonic instability problems and DC power modulation.

UNIT-IV: MTDC SYSTEMS & OVER VOLTAGES

Series parallel and series parallel systems their operation and control.
Over voltages due to disturbances on DC side, over voltages due to DC and AC side line faults.

UNIT-V: CONVERTER FAULTS & PROTECTION

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

REFERENCE BOOKS:

1. E.W. Kimbark: Direct current Transmission, Wiely Inter Science

– New York.

2. J. Arillaga HVDC Transmission Peter Peregrinus ltd. London UK 1983
3. KR Padiyar : High Voltage Direct current Transmission Wiely Esatern Ltd New Delhi – 1992.
4. E. Uhlman : Power Transmission by Direct Current , Springer Verlag, Berlin Helberg. 1985.

(B1635) OPERATIONS RESEARCH
(Elective – I)

L P C
3 0 3

M. Tech(EEE) – I Semester

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 jobs 2 machines sequencing - n jobs 3 machines sequencing – Job-shop sequencing – 2 jobs m machines sequencing – Graphical methods.

UNIT-III:

Game Theory - Introduction - Terminology – Saddle point games - with out Saddle point games - 2 2 games, analytical method - 2 n and m 2 games – graphical method – dominance principle. Dynamic programming – Bellman's principle of optimality – short route – capital investment – inventory allocation.

UNIT-IV:

Non linear optimization – Single variable optimization problem – Unimodal function - Elimination methods – Fibinocci & Golden reaction methods - Interpolation methods - Quadratic & cubic interpotation method. Multi variable optimization problem – Direct research methods – Univariant 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.C.Joshi & K.M. More Ugalya, Narosa Publications
2. Optimization : Theory & Practice – Beweridze, Mc Graw Hill
3. Simulation Modelling & Analysis – Law & Kelton –TMH
4. Optimization Concepts and Applications in Engineering- A.D. Belegundu , J.R. Chandrupata, Pearson Education, Asia

(B1225) EMBEDDED SYSTEMS
(Elective-I)

L P C
3 0 3

M. Tech(EEE) – I Semester

UNIT- I: OVERVIEW OF EMBEDDED SYSTEM

Embedded System, types of Embedded System, Requirements of Embedded System, and 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 & 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.

UNIT-V: HARDWARE AND SOFTWARE CO-DESIGN

Embedded system design and co design issues in software development, design cycle in development phase for Embedded 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, TMH 2003.
2. Programming for Embedded System: DreamTech Software Team- John Wiley -2002

(B1226) MICROCONTROLLERS AND APPLICATIONS
(Elective-II)

L P C
3   0 3

M. Tech(EEE) – I Semester

UNIT-I: OVERVIEW OF ARCHITECTURE & MICROCONTROLLER RESOURCES

Architecture of a microcontroller – Microcontroller resources – Resources in advanced and next generation microcontrollers – 8051 microcontroller – Internal and External memories – Counters and Timers – Synchronous serial-cum asynchronous serial communication - Interrupts.

UNIT-II: 8051- MICROCONTROLLERS INSTRUCTION SET

Basic assembly language programming – Data transfer instructions – Data and Bit-manipulation instructions – Arithmetic instructions – Instructions for Logical operations on the test among the Registers, Internal RAM, and SFRs – Program flow control instructions – Interrupt control flow.

UNIT-III: REAL TIME CONTROLINTERRUPTS

Interrupt handling structure of an MCU – Interrupt Latency and Interrupt deadline
– Multiple sources of the interrupts – Non-maskable interrupt sources – Enabling or disabling of the sources – Polling to determine the interrupt source and assignment of the priorities among them – Interrupt structure in Intel 8051.
TIMERS: Programmable Timers in the MCU's – Free running counter and real time control – Interrupt interval and density constraints.

UNIT-IV: SYSTEMS DESIGN
DIGITAL AND ANALOG INTERFACING METHODS:

Switch, Keypad and Keyboard interfacings – LED and Array of LEDs – Keyboard-cum-Display controller (8279) – Alphanumeric Devices – Display Systems and its interfaces – Printer interfaces – Programmable instruments interface using IEEE 488 Bus – Interfacing with the Flash Memory – Interfaces – Interfacing to High Power Devices – Analog input interfacing – Analog output interfacing – Optical motor shaft encoders –

Industrial control – Industrial process control system – Prototype MCU based Measuring instruments – Robotics and Embedded control – Digital Signal Processing and digital filters.

UNIT-V: REAL TIME OPERATING SYSTEM FOR MICROCONTROLLERS:

Real Time operating system – RTOS of Keil (RTX51) – Use of RTOS in Design – Software development tools for Microcontrollers.

16-BIT MICROCONTROLLERS: Hardware – Memory map in Intel 80196 family MCU system – IO ports – Programmable Timers and High-speed outputs and input captures – Interrupts – instructions.

ARM 32 Bit MCUs: Introduction to 16/32 Bit processors – ARM architecture and organization – ARM / Thumb programming model – ARM / Thumb instruction set –Development-tools.

TEXT BOOKS:

1. Raj Kamal," Microcontrollers Architecture, Programming, Interfacing and System Design"– Pearson Education, 2005.
2. Mazidi and Mazidi, "The 8051 Microcontroller and Embedded Systems" – PHI, 2000.

REFERENCE BOOKS:

1. A.V. Deshmuk, "Microcontrollers (Theory & Applications)" – WTMH, 2005.
2. John B. Peatman, "Design with PIC Microcontrollers" – Pearson Education, 2005.

(B1306) PROGRAMMABLE LOGIC CONTROLLERS AND THEIR APPLICATIONS (Elective–II)

L P C
3 0 3

M. Tech(EEE) – I Semester

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 Pattern and changing a bit shift register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

UNIT-V:

Analog PLC operation: Analog modules and systems Analog signal processing multi bit data processing , analog output application examples, PID principles position indicator with PID control, PID modules, PID tuning, PID functions

REFERENCE BOOKS:

1. Programmable Logic Controllers – Principle and Applications by John W Webb and Ronald A Reiss Fifth edition, PHI
2. Programmable Logic Controllers – Programming Method and Applications by JR Hackworth and F.D Hackworth – Jr- Pearson, 2004.

(B1307)SPECIAL MACHINES
(Elective–II)

L P C
3 0 3

M. Tech(EEE) – I Semester

UNIT-I: SPECIAL TYPES OF D.C MACHINES-I
Series booster-Shunt booster-Non-reversible boost-Reversible booster
SPECIAL TYPES OF DC MACHINES –II: Armature excited machines—Rosenberg generator-The Amplidyne and metadyne— Rototrol and Regulex-third brush generator-three-wire generator-dynamometer.

UNIT–II: STEPPER MOTORS
Introduction-synchronous inductor (or hybrid stepper motor), Hybrid stepping motor, construction, principles of operation, energization with two phase at a time- essential conditions for the satisfactory operation of a 2-phase hybrid step motor - very slow - speed synchronous motor for servo control-different configurations for switching the phase windings-control circuits for stepping motors-an open-loop controller for a 2-phase stepping motor.

UNIT-III: VARIABLE RELUCTANCE STEPPING MOTORS
 Variable reluctance (VR) Stepping motors, single-stack VR step motors, Multiple stack VR motors-Open-loop control of 3-phase VR step motor-closed-Loop control of step motor, discriminator (or rotor position sensor) translator, major loop-characteristics of step motor in open-loop drive – comparison between open-loop position control with step motor and a position control servo using a conventional (dc or ac) servo motor-Suitability and areas of application of stepping motors-5- phase hybrid stepping motor - single phase - stepping motor, the construction, operating principle torque developed in the motor.
SWITCHED RELUCTANCE MOTOR: Introduction – improvements in the design of conventional reluctance motors- Some distinctive differences between SR and conventional reluctance motors-principle of operation of SRM- Some design aspects of stator and rotor pole arcs, design of stator and rotor and pole arcs in SR motor-determination of $L(\theta)$-θ profile - power converter for SR motor-A numerical example –Rotor sensing mechanism and logic control, drive and power circuits, position sensing of rotor with Hall problems-derivation of torque expression, general linear

case.

UNIT–IV: PERMANENT MAGNET MATERIALS AND MOTORS

Introduction, Hysteresis loops and recoil line- stator frames (pole and yoke **-** part) of conventional PM dc Motors, Equivalent circuit of a PM- Development of Electronically commutated dc motor from conventional dc motor.

BRUSHLESS DC MOTOR: Types of construction – principle of operation of BLDM- sensing and switching logic scheme, sensing logic controller, lockout pulses –drive and power circuits, Base drive circuits, power converter circuit-Theoretical analysis and performance prediction, modeling and magnet circuit d-q analysis of BLDM -transient analysis formulation in terms of flux linkages as state variables-Approximate solution for current and torque under steady state –Theory of BLDM as variable speed synchronous motor (assuming sinusoidal flux distribution)- Methods or reducing Torque Pulsations, 180 degrees pole arc and 120 degree current sheet.

UNIT-V: LINEAR INDUCTION MOTOR

Development of a double sided LIM from rotary type IM- A schematic of LIM drive for electric traction development of one sided LIM with back iron-field analysis of a DSLIM fundamental assumptions.

TEXT BOOKS:

1. K.Venkataratnam, "Special electrical machines" - University press.
2. R.K. Rajput ,"Electrical machines"-5th edition.
3. V.V. Athani," Stepper motor : Fundamentals , Applications and Design"- New age International pub.

(B1308) POWER CONVERTERS LAB

L P C
0 3 2

M. Tech(EEE) – I Semester

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 1Hp 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. Cyclo-converter 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.

(B1310) POWER ELECTRONIC CONVERTERS-II

L P C
3 0 3

M. Tech (EEE)– II Semester

UNIT-I: PWM INVERTERS (SINGLE-PHASE & THREE-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 modulations – Advantage – application – numerical problems.

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 DC link inverter – buck and boost inverter – inverter circuit design – advantage applications – numerical problems.

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 capacitors multilevel inverter – principle of operation – main features. Cascaded multilevel inverter – principle of operation – main features – Multilevel inverter applications – reactive power compensation – back to back intertie system – adjustable drives – Switching device currents – de 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. 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.

(B1311) POWER ELECTRONIC CONTROL OF AC DRIVES

L P C
3 0 3

M. Tech (EEE)– II Semester

UNIT-I: INTRODUCTION

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

UNIT-II: STATOR SIDE CONTROL OF INDUCTION DRIVES

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: ROTOR SIDE CONTROL OF INDUCTION DRIVES

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 methods of vector control – Indirect methods 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: VARIABLE RELUCTANCE MOTOR DRIVE

Variable Reluctance motor drive – Torque production in the variable reluctance motor Drive characteristics and control principles – Current control variable reluctance motor service drive.

BRUSHLESS DC MOTOR DRIVES: Three phase full wave Brushless dc motor – Sinusoidal type of Brushless dc motor- current controlled Brushless dc motor Servo drive.

REFERENCES BOOKS:

1. Electric Motor Drives Pearson Modeling, Analysis and control – R. Krishnan – Publications – 1st edition – 2002.
2. Modern Power Electronics and AC Drives B K Bose – Pearson Publications 1st edition
3. Power Electronics and Control of AC Motors – MD Murthy and FG Turn Bull pergman Press (For Chapters II, III, V) 1st edition
4. Power Electronics and AC Drives – BK Bose – Prentice Hall Eagle wood diffs New Jersey (for chapters I, II, IV) - 1st edition
5. Power Electronic circuits Deices and Applications – M H Rashid – PHI – 1995.
6. Fundamentals of Electrical Drives – G. K. Dubey – Narora publications – 1995 (for chapter II)
7. Power Electronics and Variable frequency drives – BK Bose – IEEE Press – Standard publications - 1st edition – 2002.
8. Power Electronics and Motor Drives Advances and Trends, Bimal Bose, Elesevier.

(B1312) FLEXIBLE AC TRANSMISSION SYSTEMS (FACTS)

L P C
3 0 3

M. Tech (EEE)– II Semester

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

Single phase three phase full wave bridge converters transformer connections for 12 pulse 24 and 48 pulse operation. Three level voltage source converter, pulse width modulation converter, basic concept of current source Converters, and comparison of current source converters with voltage source converters.

UNIT-III: 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-IV: 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-V: STATIC SERIES COMPENSATORS

Concept of series capacitive compensation, improvement of transient stability, power oscillation damping, and functional requirements of GTO thyristor controlled series capacitor (GSC), thyristor switched series

capacitor (TSSC), and thyristor controlled series capacitor (TCSC) Control schemes for GSC TSSC and TCSC.

TEXT BOOKS

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

(B1531) NEURAL NETWORK AND FUZZY SYSTEMS

L P C
3 0 3

M. Tech (EEE)– I I Semester

UNIT-I:

Biological neuron Vs artificial neuron, structure and activation functions – Neural network architectures –learning methods, stability and convergence .Single layer networks –Mcculloh–pitts neuron model, Perceptron training and algorithm, delta learning, widrow-Hoff learning rules, limitations, adaline and modification.

UNIT-II:

Multilayer networks, architectures and modeling, BP algorithm, radial basis functions. Unsupervised learning-Winner all learning, out star learning, Counter propagation networks, self organizing networks-Kohonen.

UNIT-III:

Grossberg, Hamming NET, MAXNET, Hopfiled networks, recurrent and associative memory, BAM and ART architectures Fuzzy sets and systems – geometry of fuzzy sets – theorems – fuzzy and neural function estimators – FAM system architectures – Uncertainty and estimation – Types of uncertainty.

UNIT-IV:

Measures of Fuzziness – Classical measures of uncertainty – measures of Dissonance – confession specificity – knowledge base defuzzifictuon.

UNIT-V:

Application to load forecasting, load flow, fault detection-unit commitments, LF control – economic dispatch, Neuro-Fuzzy controllers.

TEXTBOOKS
1. Artificial neural networks – B.Yegna Narayana –phi -1st edition 1999.
2. Neural networks – Simon Haykin – prentice hall international inc.1999.

REFERENCE BOOKS
1. Neural networks and fuzzy system – Bart Kosko – 2nd edition, 2001.
2. Neural network fundamentals with graphs, algorithms & applications – N.K.Bose and Liang –McGraw hill, 1996.
3. Fuzzy logic with fuzzy applications – T.J.Rosee-Mcgraw hill 1997.

(B1313) DIGITAL CONTROL SYSTEMS
(Elective-III)

L P C
3 0 3

M. Tech (EEE)– I I Semester

UNIT – I: INTRODUCTION

Block Diagram of typical control system- advantages of sampling in control systems – examples of discrete data and digital systems – data conversion and quantization – sample and hold devices – D/A and A/D conversion – sampling theorem – reconstruction of sampled signals –ZOH.
Z-transform: Definition and evaluation of Z-transforms – mapping between s-plane and z-plane – inverse z-plane transform – theorems of the Z-transforms –limitations of z-transforms –pulse transfer function –pulse transfer function of ZOH –relation between $G(s)$ and $G(z)$ – signal flow graph method applied to digital systems.

UNIT- II: STATE SPACE ANALYSIS

State space modeling of digital systems with sample and hold – state transition equation of digital time in variant systems – solution of time in variant discrete state equations by the Z-Transformation – transfer function from the state model – Eigen values – Eigen vector and diagonalisation of the A-matrix – Jordan canonical form. Computation of state transition matrix-Transformation to phase to variable canonical form-The state diagram – decomposition of digital system – Response of sample data system between sampling instants using state approach.
Stability: Definition of stability – stability tests – The second method of Liapunov.

UNIT- III: TIME DOMAIN ANALYSIS

Comparison of time response of continuous data and digital control systems-correlation between time response and root locus j the s-plane and z-plane – effect of pole-zero configuration in the z-plane upon the maximum overshoot and peak time of transient response – Root loci for digital control systems – steady state error analysis of digital control

systems – Nyquits plot – Bode plot-G.M and P.M.

UNIT- IV: DESIGN

The digital control design with digital controller with bilinear transformation – Digital PID controller-Design with deadbeat response-Pole placement through state feedback-Design of full order state observer-Discrete Euler Lagrance Equation – Discrete maximum principle.

UNIT-V: DIGITAL STATE OBSERVER

Design of - Full order and reduced order observers. Design by max.principle: Discrete Euler language equation-discrete maximum principle.

TEXT BOOKS

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

REFERENCE BOOKS

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

(B1314) POWER QUALITY
(Elective – III)

L P C
3 0 3

M. Tech (EEE)– I I Semester

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, overview of power quality phenomenon, Remedies to improve power quality, power quality monitoring.

UNIT-II: LONG & SHORT INTERRUPTIONS

Interruptions – Definition – Difference between failures, 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, comparison of observations and reliability evaluation.
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: 1 & 3-PHASE VOLTAGE SAG CHARACTERIZATION

Voltage sag – definition, causes of voltage sag, voltage sag magnitude, and monitoring, theoretical calculation of voltage sag magnitude, voltage sag calculation in non-radial systems, meshed systems, and voltage sag duration.
Three phase faults, phase angle jumps, magnitude and phase angle jumps for three phase unbalanced sags, load influence on voltage sags.

UNIT-IV: POWER QUALITY CONSIDERATIONS IN INDUSTRIAL POWER SYSTEMS

Voltage sag – equipment behavior of Power electronic 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 INTERRUPTIONS & 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. System equipment interface – voltage source converter, series voltage controller, shunt controller, combined shunt and series controller.

Power Quality and EMC Standards:
Introduction to standardization, IEC Electromagnetic compatibility standards, European voltage characteristics standards, PQ surveys.

REFERENCE BOOK:
1. "Understanding Power Quality Problems" by Math H J Bollen. IEEE Press.

(B1227) ADVANCED DIGITAL SIGNAL PROCESSING
(Elective–III)

L P C
3 0 3

M. Tech (EEE)– II Semester

UNIT–I: DIGITAL FILTER STRUCTURES

Block diagram representation – Equivalent Structures – FIR and IIR digital filter Structures AII pass Filters-tunable IIR 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 high-pass – Band-pass, and Band stop- IIR digital filters – Spectral transformations of IIR filters – 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-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 scaling – signal – to- noise in Low –order IIR filters- Low –Sensitivity Digital filter – Reduction of Product round-off errors feedback – Limit cycles in IIR digital filter – Round – off errors in FFT 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- Non-parametric methods for power spectrum estimation – Walsh methods – Blackman 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 – PHI 1996 1ST Edition 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 Processing –Lourens R Rebinarand Bernold.
6. Digital Filter Analysis and Design Auntoniam – TMH.

(B1315) DYNAMICS OF ELECTRICAL MACHINES
(Elective-IV)

L P C
3 0 3

M. Tech (EEE)– I I Semester

UNIT-I: BASIC MACHINE THEORY

Electromechanical Analogy – Magnetic Saturation – Rotating field theory – Operation of Inductor motor – equivalent circuit – Steady state equations of DC machines – operations of synchronous motor – Power angle characteristics

UNIT-II: ELECTRODYNAMICAL EQUATION & 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 DC MACHINES

Separately excited d. c. generations – stead state analysis – transient analysis – Separately excited d. c. motors – stead 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 dynamic 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. Bimbhra P.S. "Generalized Theory of Electrical Machines " Khanna Publishers 2002.

(B1316) RELIABILITY ENGINEERING

L P C
3 0 3

M. Tech (EEE)– I I Semester

UNIT – I: BASICS OF PROBABILITY THEORY & DISTRIBUTION
Basic probability theory – rules for combining probabilities of events – Bernoulli's trials – probabilities density and distribution functions – binomial distribution – expected value and standard deviation of binomial distribution.

UNIT – II: NETWORK MODELLING AND RELIABILITY ANALYSIS
Analysis of Series, Parallel, Series-Parallel networks – complex networks – decomposition method.

UNIT – III: RELIABILITY FUNCTIONS

Reliability functions f(t), F(t),R(t),h(t) and their relationships – exponential distribution – Expected value and standard deviation of exponential distribution – Bath tub curve – reliability analysis of series parallel networks using exponential distribution – reliability measures MTTF, MTTR, MTBF.

UNIT – IV: MARKOV MODELLING Markov chains – concept of stochastic transitional probability Matrix, Evaluation of limiting state Probabilities. – Markov processes one component repairable system – time dependent probability evaluation using Laplace transform approach – evaluation of limiting state probabilities using STPM – two component repairable models.

UNIT – V: FREQUENCY & DURATION TECHNIQUES Frequency and duration concept – Evaluation of frequency of encountering state, mean cycle time, for one , two component repairable models – evaluation

of cumulative probability and cumulative frequency of encountering of merged states.

TEXT BOOKS
1. Reliability Evaluation of Engg. System – R. Billinton, R.N.Allan, Plenum Press, New York, reprinted in India by B.S.Publications, 2007.
2. Reliability Evaluation of Power systems – R. Billinton, R.N.Allan, Pitman Advance Publishing Program, New York reprinted in India by B.S.Publications, 2007.

(B1317) RENEWABLE ENERGY SYSTEMS
(Elective – IV)

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M. Tech (EEE)– I I Semester

UNIT-I:

Photo voltaic 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, applications of super conducting materials in electrical equipment systems.

UNIT-II:

Principles of MHD power generation, ideal MHD generator performance, practical MHD generator, MHD technology.
Wind Energy conversion: Power from wind, properties of air and wind, types of wind Turbines, operating characteristics.

UNIT-III:

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. Types of ocean thermal energy conversion systems Application of OTEC systems examples,

UNIT-IV:

Miscellaneous energy conversion systems: coal gasification and liquefaction, biomass conversion, geothermal energy, thermo electric energy conversion, principles of EMF generation, description of fuel cells, Co-generation and energy storage, combined cycle co-generation, energy storage.
Global energy position and environmental effects: energy units, global energy position.

UNIT-V:

Types of fuel cells, H_2-O_2 Fuel cells, Application of fuel cells – Batteries, Description of batteries, Battery application for large power. Environmental effects of energy conversion systems, pollution from coal

and preventive measures steam stations and pollution, pollution free energy systems.

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

(B1318) ELECTRICAL SYSTEMS SIMULATION LAB

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M. Tech (EEE)– II Semester

1. Write program and simulate dynamical system of following models:
    a. I/O Model
    b. State variable model
    c. 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 model to state variable model and vice versa.
5. Obtain model matrix of a given system, obtain it's diagonalize form if exists or obtain Jordon Canonical form of system.
6. Write a program and implement linear quadratic regulator
7. Design 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 Simulink 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 RL and E loads.
16. PSPICE Simulation of Three phase full converter using RL and E loads.
17. PSPICE Simulation of Single phase AC Voltage controller using RL load.
18. PSPICE Simulation of Three phase inverter with PWM controller.
19. PSPICE Simulation of resonant pulse commutation circuit.
20. PSPICE Simulation of impulse commutation circuit.