ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

M.TECH
POWER SYSTEMS WITH EMPHASIS ON H.V. ENGINEERING / HIGH VOLTAGE ENGINEERING

(Applicable for the batches admitted from 2013-14)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
KUKATPALLY, HYDERABAD – 500 085.

ACADEMIC REGULATIONS R13 FOR M. TECH. (REGULAR) DEGREE COURSE

Applicable for the students of M. Tech. (Regular) Course from the Academic Year 2013-14 and onwards

The M. Tech. Degree of Jawaharlal Nehru Technological University Hyderabad shall be conferred on candidates who are admitted to the program and who fulfil 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 University from time to time.

Admissions shall be made on the basis of merit/rank obtained by the candidates at the qualifying Entrance Test conducted by the University or on the basis of any other order of merit as approved by the University, subject to reservations as laid down by the Govt. 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. However, he is permitted to write the examinations for two more years after four academic years of course work.

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.

3.0 A. COURSES OF STUDY

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

1. Advanced Manufacturing Systems
2. Aerospace Engineering/ Aeronautical Engineering
3. Automation
4. Biomedical Signal Processing and Instrumentation
5. Bio-Technology
6. CAD/CAM
7. Chemical Engineering
8. Communication Systems
9. Computer Networks
10. Computer Networks and Information Security
11. Computer Science
12. Computer Science and Engineering
13. Computers and Communication Engineering.
14. Construction Management
15. Control Engineering
16. Control Systems
17. Cyber Forensic / Cyber Security & Information Technology
18. Design for Manufacturing/ Design and Manufacturing
19. Digital Electronics and Communication Engineering.
20. Digital Electronics and Communication Systems
21. Digital Systems and Computer Electronics
22. Electrical Power Engineering
23. Electrical Power Systems
24. Electronics & Instrumentation

25. Electronics and Communication Engineering
26. Embedded Systems
27. Embedded Systems and VLSI Design
28. Energy Systems
29. Engineering Design
30. Environmental Engineering
31. Geoinformatics and Surveying Technology
32. Geotechnical Engineering.
33. Heating Ventilation & Air Conditioning.
34. Highway Engineering
35. Image Processing
36. Industrial Engineering and Management
37. Information Technology
38. Infrastructure Engineering
39. Machine Design
40. Mechatronics.
41. Microwave & Radar Engineering
42. Nano Technology
43. Neural Networks
44. Parallel Computing
45. Power and Industrial Drives
46. Power Electronics
47. Power Electronics and Electrical Drives
48. Power Engineering and Energy Systems
49. Power Plant Engineering & Energy Management
50. Power System Control and Automation
51. Power System with Emphasis H.V. Engineering / H.V. Engineering
52. Production Engineering.
53. Real Time Systems
54. Software Engineering
55. Structural Engineering
56. Systems & Signal Processing
57. Thermal Engineering.
58. Transportation Engineering
59. VLSI
60. VLSI and Embedded System/ Electronics Design Technology
61. VLSI Design
62. VLSI System Design
63. Web Technologies
64. Wireless and Mobile Communication

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

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

Civil Engg.	Construction Management Environmental Engineering Geoinformatics and Surveying Technology Geotechnical Engineering Highway Engineering Infrastructure Engineering Structural Engineering Transportation Engineering
EEE	Control Engineering Control Systems Electrical Power Engineering Electrical Power Systems Power and Industrial Drives Power Electronics Power Electronics and Electrical Drives Power Engineering and Energy Systems Power Plant Engineering & Energy Management Power System Control and Automation Power System with Emphasis H.V. Engineering / H.V. Engineering
ME	Advanced Manufacturing Systems Automation CAD/CAM Design for Manufacturing/ Design and Manufacturing Energy Systems Engineering Design Heating Ventilation & Air Conditioning Industrial Engineering and Management Machine Design Mechatronics. Power Plant Engineering & Energy Management Production Engineering Thermal Engineering.
ECE	Biomedical Signal Processing and Instrumentation Communication Systems Computers and Communication Engineering. Digital Electronics and Communication Engineering. Digital Electronics and Communication Systems Digital Systems and Computer Electronics Electronics & Instrumentation Electronics and Communication Engineering Embedded Systems Embedded Systems and VLSI Design

	Microwave & Radar Engineering Systems & Signal Processing VLSI VLSI and Embedded System/ Electronics Design Technology VLSI Design VLSI System Design Wireless and Mobile Communication
CSE	Computer Networks Computer Networks and Information Security Computer Science Computer Science and Engineering Cyber Forensic / Cyber Security & Information Technology Image Processing Information Technology Neural Networks Parallel Computing Real Time Systems Software Engineering Web Technologies
Aeronautical Engg.	Aerospace Engineering / Aeronautical Engineering
Bio-technology	Bio-Technology
Chemical Engg.	Chemical Engineering
Nano Technology	Nano Technology

4.0 ATTENDANCE

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

4.1 A student shall be eligible to write University examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects.

4.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester shall be granted by the College Academic Committee.

4.3 Shortage of Attendance below 65% in aggregate shall not be condoned.

4.4 Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class and their registration shall stand cancelled.

4.5 A prescribed fee shall be payable towards condonation of shortage of attendance.

4.6 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

4.7 A candidate shall put in a 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, as per the course structure.

4.8 A student shall not be promoted to the next semester unless he satisfies the attendance requirements of the previous semester including the days of attendance in sports, games, NCC and NSS activities.

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 and 40 marks shall be awarded based on the Internal Evaluation. The internal evaluation shall be made based on the average of the marks secured in the two Mid Term-Examinations conducted-one in the middle of the Semester and the other immediately after the completion of instruction. Each mid term examination shall be conducted for a total duration of 120 minutes with Part A as compulsory question (16 marks) which consists of four sub-questions and carries 4 marks each and Part B with 3 questions to be answered out of 5 questions each question for 8 marks. If any candidate is absent from any subject of a mid-term examination, an on-line test will be conducted for him by the University. The details of the Question Paper pattern for End Examination (Theory) is given below:

- The End semesters Examination will be conducted for 60 marks which consists of two parts viz. i).Part-A for 20 marks, ii). Part –B for 40 marks.
- Part-A is compulsory question where it consists of five questions one from each unit and carries four marks each. This will be treated as Question 1.
- Part-B consists of five Questions (numbered from 2 to 6) carries 8 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" "or" choice (that means there will be two questions from each unit and the student should answer only one question)

5.2 For practical subjects, 60 marks shall be awarded based on the performance in the End Semester Examinations and 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 and 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 II year I 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. 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.

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 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 must be conducted with two Examiners, one of them being the Laboratory Class Teacher and the second examiner shall be another Laboratory Teacher.

6.0 EVALUATION OF PROJECT/DISSERTATION WORK

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

6.1 A Project Review Committee (PRC) shall be constituted with Principal as Chairperson, Heads of all the Departments offering the M. Tech. programs and 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, both theory and practical.

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 Departmental Academic Committee for approval. Only after obtaining the approval of the Departmental Academic Committee can the student initiate the Project work.

6.4 If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the Departmental Academic Committee. However, the Departmental Academic Committee shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

6.5 A candidate shall submit his status report in a bound-form in two stages at least with a gap of 3 months between them.

6.6 The work on the project shall be initiated at the beginning of the II year and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of theory and practical course with 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 Principal through Head of the Department and 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 University. For this, the Principal of the College shall submit a panel of 5 examiners, eminent in that field, with the help of the guide concerned and head of the department.

6.9 If the report of the examiner is not favourable, the candidate shall revise and resubmit the Thesis, in the time frame as decided by the PRC. If the report of the examiner is unfavourable again, the thesis shall be summarily rejected.

6.10 If the report of the examiner is favourable, 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 the candidate's work as one of the following:

A. Excellent

B. Good

C. Satisfactory

D. Unsatisfactory

The 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 shall retake the Viva-Voce examination only 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 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%
Pass Class	Below 50% but not less than 40%

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

8.0 WITHHOLDING OF RESULTS

If the student has not paid the dues, if any, to the university 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.

9.0 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 R13 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 the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

10.4 The University 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 University.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	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 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 and sent to the University.
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 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.

4.	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 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.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the 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 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 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 also are 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 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 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. 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.	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)
   - (i) A show cause notice shall be issued to the college.
   - (ii) Impose a suitable fine on the college.
   - (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

***

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.TECH - POWER SYSTEMS WITH EMPHASIS ON H.V. ENGINEERING / HIGH VOLTAGE ENGINEERING

COURSE STRUCTURE AND SYLLABUS

I Year I Semester

Code	Group	Subject	L	P	Credits
		Generation and Measurement of High Voltages	3	-	3
		Dielectric and Insulation Engineering	3	-	3
		HVDC Transmission	3	-	3
		Flexibility AC Transmission Systems (FACTS)	3	-	3
	Elective –I	Gas Insulated Systems (GIS) AI Techniques Voltage Stability	3	-	3
	Elective –II	Microcontrollers and Applications Reactive Power Compensation and Management Breakdown Phenomenon in Insulation	3	-	3
	Lab	High Voltage Laboratory	-	3	2
		Seminar	-	-	2
		Total Credits	18	3	22

I Year II Semester

Code	Group	Subject	L	P	Credits
		High Voltage Testing Technology	3	-	3
		EHV AC Transmission	3	-	3
		Surge Phenomena and Insulation Coordination	3	-	3
		Advanced Power System Protection	3	-	3
	Elective –III	Partial Discharge in High Voltage Equipment Programmable Logic Controllers and their Applications Power System Transients	3	-	3
	Elective -IV	HV Transformers Pulse Power Engineering Advanced EM Fields	3	-	3
		Seminar	-	-	2
		Total Credits	18	3	22

II Year - I Semester

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

II Year - II Semester

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PS H.V. Engg. / H.V. Engg.)

GENERATION AND MEASUREMENT OF HIGH VOLTAGES

UNIT-I:

Electrostatic Fields and Field Stress Control : Electric fields in homogeneous Isotropic materials and in multi dielectric media – Simple configurations – field stress control. Methods of computing electrostatic fields – conductive analogues - Impedance networks, Numerical techniques – finite difference method – finite element method and charge simulation method.

UNIT-II:

Generation of High voltages and Currents :

Direct Voltages: AC to DC conversion methods, electrostatic generators – Cascaded Voltage Multipliers,

Alternating Voltages: Testing transformers – Resonant circuits and their applications.

Impulse Voltages: Impulse voltage specifications – Impulse generation circuits – Operation, construction and design of Impulse generators, generation of switching and long duration impulses.

Impulse Currents: Generation of high impulse currents and high current pulses.

UNIT-III:

Measurement of High Voltages

Measurement of high DC Voltages: Series resistance meters, voltage dividers and generating voltmeters.

Measurement of high AC Voltages: Series impedance meters, electrostatic voltmeters, potential transformers and CVTS – voltage dividers and their applications.

UNIT-IV:

Measurement of peak Voltage : Sphere gaps, uniform field gaps, rod gaps. Chubbs – Fortesuere methods. Passive and active rectifier circuits for voltage dividers.

UNIT-V:

Measurement of Impulse Voltages & Currents

Measurement of Impulse Voltage: Voltage dividers and impulse measuring systems – generalized voltage measuring circuits – transfer characteristics of measuring circuits – L.V. Arms for voltage dividers – compensated dividers.

Measurement of Impulse Currents: Resistive shunts – current transformers – Hall Generators and Faraday generators and their applications – Impulse Oscilloscopes.

REFERENCE BOOKS:

1. High Voltage engineering E Kuffel and W.S.Zaengl. Pergamon press, Canada Ltd., 1984.
2. High voltage engineering M.S.Naidu and V.Kamaraju, Tata Mcgraw Hill Book Co., New Delhi, 3nd edition 2004.
3. High voltage technology – LL Alston,Oxford University press, 1968.
4. High voltage Measuring Techniques – A Schwab, MIT press Cambridge, USA 1972.
5. HV Engineering – Sabeer Ray.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PS H.V. Engg. / H.V. Engg.)

DIELECTRICAL AND INSULATION ENGINEERING

UNIT-I:

Dielectrics and Insulating Material

Review of Dielectric Phenomenon: Complex permittivity – Polarization – Relaxation and resonant models. Solid, Liquid and Gaseous insulating materials.

UNIT-II:

Properties of Dielectrics and Insulating Materials : Physical Thermal & Electrical properties-Classification of Insulating Materials.

Solid Materials: Organic Fiber materials Ceramics & Synthetic polymeric and their applications.

Liquid Materials: Insulating oils their properties and applications.

Gaseous Materials: Air and SF6 – applications in electrical apparatus.

UNIT-III:

Breakdown Phenomenon-I : Insulation and decay process-transition from self sustained discharges to breakdown. Townsend and streamer discharge paschen's law penning effect-Time lags-Surge breakdown voltage.

UNIT-IV:

Breakdown Phenomenon-II : Breakdown in non uniform fields-Vacuum insulation and vacuum breakdown. Breakdown Phenomenon in Liquid and Solid insulation: pure and commercial liquids-suspended particle and bubble theories-stressed oil volume theory.

UNIT-V:

Breakdown Phenomenon-III : Breakdown in solid insulation intrinsic breakdown-Treeing and tracking phenomenon-Thermal breakdown-Breakdown in composite dielectrics.

REFERENCE BOOKS:

1. High Voltage Engineering – by E.Kuffel and W.S.Zaenal Pergamon press. Oxford 1984.
2. High Voltage Engineering – by M.S.Naidu and V.Kamarajuu, Tata Mc Graw Hill Book Co., New Delhi, 2nd edition, 1995.
3. Electrical Engineering Materials – B.Tareev, M.I.R. Publlications, Moscow.
4. APhysice of Dielectrics – B.Tareev, M.I.R. Publlications, Moscow.
5. High Voltage Technology – LL Alston, Oxford University Press 1968.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PS H.V. Engg. / H.V. Engg.)

HVDC TRANSMISSION

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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PS H.V. Engg. / H.V. Engg.)

FLEXIBLE AC TRANSMISSION SYSTEMS

(FACTS)

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 BOOK:

1. “Understanding FACTS Devices” N.G. Hingorani and L. Guygi, IEEE Press Publications 2000.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PS H.V. Engg. / H.V. Engg.)

GAS INSULATED SYSTEMS (GIS)

(Elective–I)

UNIT–I:

Introduction to GIS and Poperties of SF_6 : Characteristics of GIS- Introduction to SF_6 - Physical properties- Chemical properties - Electrical properties-Specification of SF_6 gas for GIS application - Handling of SF_6 gas before use - Safe handling of Sf_6 gas in electrical equipment - Equipment for handling the SF_6 Gas - SF_6 and environment.

UNIT–II:

Layout of GIS Stations : Advancement of GIS station - Comparison with Air Insulated Substation - Economics of GIS - User Requirements for GIS - Main Features for GIS - Planning and Installation components of a GIS station.

UNIT–III:

Design and Construction of GIS Station : Introduction - Rating of GIS components - Design Features - Estimation of different types of Electrical Stresses -Design Aspects of GIS components - Insulation Design for Components - Insulation Design for GIS - Thermal Considerations in the Design of GIS - Effect of very Fast Transient Over-voltages (VFTO) on the GIS design - Insulation Coordination systems - Gas handling and Monitoring System Design.

UNIT-IV:

Fast Transient pPhenomena in GIS : Introduction- Disconnector Switching in Relation to Very fast Transients-Origin of VFTO-Propagation and Mechanism of VFTO-VFTO Characteristics- Effects of VFTO-Testing of GIS for VFTO.

UNIT–V:

Special Problems in GIS and GIS Diagnostics : Introduction - particles their effects and their control-Insulating Spacers and their Reliability - SF_6 Gas Decomposition - Characteristics of imperfections in insulation - Insulation Diagnostic methods - PD Measurement and UHF Method.

TEXT BOOK:

1. M. S. Naidu," Gas Insulated Substations"- IK International Publishing House.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PS H.V. Engg. / H.V. Engg.)

AI TECHNIQUES

(Elective–I)

UNIT – I:

Artificial Neural Networks : Introduction-Models of Neural Network - Architectures – Knowledge representation – Artificial Intelligence and Neural networks–Learning process – Error correction learning – Hebbian learning –Competitive learning –Boltzmann learning –Supervised learning – Unsupervised learning – Reinforcement learning- learning tasks.

UNIT- II:

ANN Paradigms : Multi – layer perceptron using Back propagation Algorithm-Self – organizing Map – Radial Basis Function Network – Functional link, network – Hopfield Network.

UNIT – III:

Fuzzy Logic : Introduction – Fuzzy versus crisp – Fuzzy sets - Membership function – Basic Fuzzy set operations – Properties of Fuzzy sets – Fuzzy cartesion Product –Operations on Fuzzy relations – Fuzzy logic – Fuzzy Quantifiers-Fuzzy Inference-Fuzzy Rule based system-Defuzzification methods.

UNIT – IV:

Genetic Algorithms : Introduction-Encoding –Fitness Function-Reproduction operators-Genetic Modeling –Genetic operators-Crossover-Single – site crossover-Two point crossover –Multi point crossover-Uniform crossover – Matrix crossover-Crossover Rate-Inversion & Deletion –Mutation operator –Mutation –Mutation Rate-Bit-wise operators-Generational cycle-convergence of Genetic Algorithm.

UNIT–V:

Applications of AI Techniques : Load forecasting – Load flow studies – Economic load dispatch – Load frequency control – Single area system and two area system – Small Signal Stability (Dynamic stability) Reactive power control – speed control of DC and AC Motors.

TEXT BOOK:

1. S.Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic & Genetic Algorithms”- PHI, New Delhi, 2003.

REFERENCE BOOKS:

1. P.D.Wasserman,Van Nostrand Reinhold,”Neural Computing Theory & Practice”- New York,1989.
2. Bart Kosko,”Neural Network & Fuzzy System” Prentice Hall, 1992.
3. G.J.Klir and T.A.Folger,”Fuzzy sets,Uncertainty and Information”-PHI, Pvt.Ltd,1994.
4. D.E.Goldberg,” Genetic Algorithms”- Addison Wesley 1999.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PS H.V. Engg. / H.V. Engg.)

VOLTAGE STABILITY

(Elective – I)

UNIT–I:

Introduction to Voltage Stability *:* Definitions: Voltage Stability, Voltage Collapse, Voltage Security; Physical relation indicating dependency of voltage on reactive power flow; Factors affecting Voltage collapse and instability; Previous cases of voltage collapse incidences.

UNIT–II:

Graphical Analysis of Voltage Stability : Comparison of Voltage and angular stability of the system; Graphical Methods describing voltage collapse phenomenon: P-V and Q-V curves; detailed description of voltage collapse phenomenon with the help of Q-V curves.

UNIT–III:

Analysis of Voltage Stability : Analysis of voltage stability on SMLB system: Analytical treatment and analysis.

Voltage Stability Indices: Voltage collapse proximity indicator; Determinant of Jacobin as proximity indicators; Voltage stability margin.

UNIT–IV:

Power System Loads : Loads that influences voltage stability: Discharge lights, Induction Motor, Air-conditioning, heat pumps, electronic power supplies, OH lines and cables.

Reactive Power Compensation: Generation and Absorption of reactive power; Series and Shunt compensation; Synchronous condensers, SVC s; OLTC s; Booster Transformers.

UNIT–V:

Voltage Stability Margin : Stability Margin: Compensated and un-compensated systems.

Voltage Security : Definition; Voltage security; Methods to improve voltage stability and its practical aspects.

TEXT BOOKS:

1. “Performance, operation and control of EHV power transmission system”- A.CHAKRABARTHY, D.P.KOTARI and A.K.MUKOPADYAY, A.H.Wheeler Publishing, I Edition, 1995.
2. “Power System Dynamics: Stability and Control” – K.R.PADIYAR, II Edition, B.S.Publications.

REFERENCE:

1. “Power System Voltage Stability”- C.W.TAYLOR, Mc Graw Hill, 1994.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PS H.V. Engg. / H.V. Engg.)

MICROCONTROLLERS AND ITS APPLICATIONS

(Elective-II)

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 Control

Interrupts: 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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PS H.V. Engg. / H.V. Engg.)

REACTIVE POWER COMPENSATION AND MANAGEMENT

(Elective-II)

UNIT-I:

Load Compensation : Objectives and specifications – reactive power characteristics – inductive and capacitive approximate biasing – Load compensator as a voltage regulator – phase balancing and power factor correction of unsymmetrical loads- examples.

UNIT-II:

Steady – State Reactive Power Compensation in Transmission System : Uncompensated line – types of compensation – Passive shunt and series and dynamic shunt compensation –examples

Transient State Reactive Power Compensation in Transmission System : Characteristic time periods – passive shunt compensation – static compensations- series capacitor compensation –compensation using synchronous condensers – examples.

UNIT-III:

Reactive Power Coordination : Objective – Mathematical modeling – Operation planning – transmission benefits – Basic concepts of quality of power supply – disturbances- steady –state variations – effects of under voltages – frequency –Harmonics, radio frequency and electromagnetic interferences.

UNIT-IV:

Demand Side Management : Load patterns – basic methods load shaping – power tariffs- KVAR based tariffs penalties for voltage flickers and Harmonic voltage levels.

Distribution Side Reactive Power Management: System losses –loss reduction methods – examples – Reactive power planning – objectives – Economics Planning capacitor placement – retrofitting of capacitor banks.

UNIT-V:

User Side Reactive Power Management : KVAR requirements for domestic appliances – Purpose of using capacitors – selection of capacitors – deciding factors – types of available capacitor, characteristics and Limitations.

Reactive Power Management in Electric Traction Systems and are Furnaces: Typical layout of traction systems – reactive power control requirements – distribution transformers- Electric arc furnaces – basic operations- furnaces transformer –filter requirements – remedial measures –power factor of an arc furnace.

REFERENCE BOOKS:

1. Reactive power control in Electric power systems by T.J.E.Miller, John Wiley and sons, 1982 (Units I to IV).
2. Reactive power Management by D.M.Tagare,Tata McGraw Hill,2004.(Units V to VIII).

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PS H.V. Engg. / H.V. Engg.)

BREAKDOWN PHENOMENON IN INSULATION

(Elective-II)

UNIT-I:

Introduction: Electric stress and Electric strength, Breakdown mechanisms, Estimation and control of electric stress, Field sketching, high voltage measurements.

UNIT-II:

Mechanisms Oo Spark Breakdown in Gases: Basic process in gas breakdown-Primary process-secondary process, Mechanisms of breakdown-Townsend Mechanism, breakdown in electronegative gases, Time lags of spark breakdown,

Breakdown Characteristics in Gases: Phenomenon in uniform fields, Phenomenon in non uniform fields, Surface flashover, dielectric recovery.

UNIT-III:

Electrical Properties of High Vacuum: Pre-breakdown conduction, Factors affecting the breakdown voltage, Breakdown hypotheses, Vacuum breakdown criterion, Flashover across solid insulators.

The Electrical Conduction and Strength of Pure Liquids: pure liquids, purification, test cells, natural conduction, induced conduction, process of conduction, breakdown phenomenon and electric strength of liquids, breakdown process.

UNIT-IV:

Breakdown of Commercial Liquid and Liquid-Solid Dielectrics: breakdown due to gaseous inclusions, breakdown due to liquid globules, breakdown due to solid particles, deterioration due to internal discharges, electrochemical deterioration.

Intrinsic and Related Forms of Breakdown in Solids: definition of intrinsic strength, theories of intrinsic strength, its measurements, comparison of theory with experiment, current problems in measurement of intrinsic strength.

UNIT-V:

Thermal Breakdown Chemical and Electro Chemical Deterioration: thermal breakdown, chemical deterioration-oxidation, chemical stability, hydrolysis, leaching of chemically active substances, incompatibility of materials, electrochemical deterioration-nature, electrochemical effects in insulation with and without moisture.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PS H.V. Engg. / H.V. Engg.)

HIGH VOLTAGE LABORATORY

1. Determination of Breakdown strength of oil by Variable Distance Electrodes.
2. Milli Volt Drop Test (Calibration of Tong-tester).
3. Breakdown characteristics of Sphere air gap.
4. Breakdown characteristics of Plane Rod gap.
5. Breakdown Voltage of pin Insulator & Measurement of Leakage Current.
6. Measurement of Leakage current & Breakdown voltage of Suspension Insulators.
7. Voltage Distribution of String Insulators.
8. Measurement of Leakage current & Insulation resistance of Poly propylene Rope.
9. Measurement of Leakage current & Insulation resistance of Poly propylene Scale.
10. Fault analysis of 3-phase Alternator.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

HIGH VOLTAGE TESTING TECHNOLOGY

UNIT-I:

Non Destructive Testing Techniques : Measurement of DC Resistivity – Dielectric loss and dielectric constant of insulating materials – Schering bridge method – Transformer ration arm bridge for high voltage and high current applications – null detectors.

UNIT-II:

High Voltage Testing of Power a Apparatus : Need for testing standards – Standards for porcelain / Glass insulator – Classification of porcelain / glass insulator tests- Tests for cap and pin porcelain/ Glass insulators. High voltage AC testing methods, power frequency tests- Over voltage tests on insulators, Isolators, Circuit Breakers and power cables.

UNIT-III:

Artificial Contamination Tests : Contamination flashover phenomena – Contamination Severity- Artificial contamination tests- Laboratory Testing versus in-Service Performance –Case study.

Impulse Testing: Impulse testing of transformers – Surge diverters –and other apparatus.

UNIT-IV:

Partial Discharge Measurement : PD equivalent model-PD currents-PD currents PD measuring circuits – Straight and balanced detectors- Location and estimation of PD in power apparatus- PD measurement by non electrical methods-Calibration of PD detectors.

RIV Measurements: Radio Interference – RIV- Measurement of RI and RIV in laboratories and in field Different test arrangements and their limitations.

UNIT-V:

Insulators Fail : Handling –Vandalism –Quality control – Application problems Detecting defective Non Ceramic insulators. Making Insulators work in contaminated environments: Cleaning Modification of Insulator design – Mobile protective coatings-Solid water Repellent coating –line voltage reduction.

REFERENCES:

1. High Voltage Engineering – by E. KUFFEL and W.S. ZAEGNL Pergamon press oxford 1984.
2. High Voltage Engineering- by M.S. Naidu and V. Kamaraju Tata McGraw Hill Publishing Company Limited New Delhi 2001.
3. Discharge Detection in H.V. Equivpment – by KREUGER F.H. Haywood Londor- 1964.
4. Outdoor Insulators- by Gorur & Cherney.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

EHV AC TRANSMISSION

UNIT-I:

E.H.V.A.C. Transmission line trends and preliminary aspect standard transmission voltages – Estimation at line and ground parameters-Bundle conductor systems-Inductance and Capacitance of E.H.V. lines – positive, negative and zero sequence impedance – Line Parameters for Modes of Propagation.

UNIT-II:

Electrostatic field and voltage gradients – calculations of electrostatic field of AC lines – effect of high electrostatic field on biological organisms and human beings - surface voltage gradients and maximum gradients of actual transmission lines – voltage gradients on sub conductor.

UNIT-III:

Electrostatic induction in unenergized lines – measurement of field and voltage gradients for three phase single and double circuit lines – un energized lines. Power Frequency Voltage control and over-voltages in EHV lines: No load voltage – charging currents at power frequency-voltage control – shunt and series compensation – static VAR compensation.

UNIT-IV:

Corona in E.H.V. lines – Corona loss formulae- attention of traveling waves due to Corona – Audio noise due to Corona, its generation, characteristic and limits. Measurements of audio noise radio interference due to Corona - properties of radio noise – frequency spectrum of RI fields – Measurements of RI and RIV.

UNIT-V:

Design of EHV lines based on steady state and transient limits - EHV cables and their characteristics.

REFERENCE BOOKS:

1. Rokosh Das Begamudre,"Extra High Voltage AC Transmission Engineering"– Wiley Eastern LTD., NEW DELHI – 1987.
2. Edison,"EHV Transmission line"- Electric Institution (GEC 1968).

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

SURGE PHENOMENA AND INSULATION COORDINATION

UNIT-I:

Traveling Waves: Transmission line equation, attenuation, distortion, types of traveling waves, Reflection of traveling waves at a transition point, typical cases.

Successive Reflections: Reflection lattice, line with different terminations, line-cable connection, line-cable-transformer connection.

UNIT-II:

Lightning: Mechanism of the lightning stroke, Mathematical model of lightning stroke. Over voltage due to lightning. Power frequency over voltages, over voltages due to faults. Switching over voltages, switching over voltage reduction techniques.

UNIT-III:

High voltage AC circuit breakers : Opposing forces during closing and opening operation, inter locks, indication and auxiliary switches, CB time, auto re-closure, transient recovery voltage, single frequency transient, double frequency transient, rate of rise of TRV, resistance switching, damping of TRV, opening resistors.

UNIT-IV:

Protection of power system against over voltages : General principles of lighting protection, ground wires, surge arresters, counter poises, tower footing resistances, protection of rotating machines against surges.

UNIT-V:

Insulation characteristics of long air gaps: Types of electrode geometries, breakdown characteristics of long air gaps, breakdown models of long gaps with non uniform fields, CFO and withstand voltages of long air gaps.

Insulation Coordination: Protective characteristics of rod gaps, surge arrestors, insulation withstand voltage characteristics, correlation between insulation and protective levels, and illustration of insulation coordination in an EHV substation.

REFERENCE BOOKS:

1. Traveling waves of Transmission systems – by LV Bewley.
2. Insulation Co-ordination ELBS in H.V. Electrical Power Systems by W.Diesendorf, Butter worth publications, London, 1974.
3. E.H.V. Transmission Engineering: Rakosh Das Begamudre, Wiley Eastern Ltd., New Delhi, 1986.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

ADVANCED POWER SYSTEM PROTECTION

UNIT-I:

Static Relays : Advantages of static relays-Basic construction of static relays-Level detectors-Replica impedance –Mixing circuits-General equation for two input phase and amplitude comparators-Duality between amplitude and phase comparators.

Amplitude Comparators: Circulating current type and opposed voltage type- rectifier bridge comparators, Direct and Instantaneous comparators.

UNIT-II:

Phase Comparators : Coincidence circuit type- block spike phase comparator, techniques to measure the period of coincidence-Integrating type-Rectifier and Vector product type- Phase comparators.

Static Over Current Relays: Instantaneous over-current relay-Time over-current relays-basic principles – definite time and Inverse definite time over-current relays.

UNIT-III:

Static Differential Relays : Analysis of Static Differential Relays –Static Relay schemes –Duo bias transformer differential protection –Harmonic restraint relay.

Static Distance Relays: Static impedance-reactance–MHO and angle impedance relay-sampling comparator –realization of reactance and MHO relay using sampling comparator.

UNIT-IV:

Multi-input Comparators : Conic section characteristics-Three input amplitude comparator –Hybrid comparator-switched distance schemes –Poly phase distance schemes- phase fault scheme –three phase scheme – combined and ground fault scheme.

Power Swings: Effect of power swings on the performance of distance relays –Power swing analysis-Principle of out of step tripping and blocking relays-effect of line and length and source impedance on distance relays.

UNIT-V:

Microprocessor Based Protective Relays : (Block diagram and flowchart approach only)-Over current relays–impedance relays-directional relay-reactance relay .Generalized mathematical expressions for distance relays-measurement of resistance and reactance –MHO and offset MHO relays-Realization of MHO characteristics- Realization of offset MHO characteristics -Basic principle of Digital computer relaying.

TEXT BOOK:

1. Badri Ram and D.N.Vishwakarma, “Power system protection and Switch gear “, TMH publication New Delhi 1995.

REFERENCE:

1. T.S.Madhava Rao, “Static relays”, TMH publication, second edition 1989.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

PARTIAL DISCHARGES IN HIGH VOLTAGE EQUIPMENT

(Elective-III)

UNIT-I:

Types of partial discharges and its occurrence and recurrence and magnitudes: Definition of partial discharges, inception of internal discharges, inception of corona discharges.

UNIT-II:

Discharges by electrical treeing : Discharges at AC Voltages corona discharges at D.C. Voltages discharges at impulse voltages. Object of discharge detection, Quantities related to the magnitude of discharges, choice of PD as a measure for discharges.

UNIT-III:

Electrical discharge detection & Detection circuits: Basic diagram, amplification of impulse, sensitivity, resolution, observation, Straight detection. Balanced detection, calibrators, Interferences, choice between straight detection & balance detection, common mode rejection.

UNIT-IV:

Location of Partial discharges : Non – electric location, location by separation of electrodes, location with electrical probes. Location by traveling waves, PD location in cables & switchgear by traveling waves. Evaluation of discharges; Recognition, mechanisms of deterioration, evaluation, specification.

UNIT-V:

Detection in actual specimen: Detection in capacitors, cables, bushings. Transformers, machine insulation, Gas – insulated switchgear.

REFERENCE:

1. Partial Discharge in HV Equipment by F. Kruguer, Butterworths & Co, Publications Ltd 1989.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

PROGRAMMABLE LOGIC CONTROLLERS AND THEIR APPLICATIONS

(Elective–III)

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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

POWER SYSTEM TRANSIENTS

(Elective-III)

UNIT-I:

Basic Concepts and Simple Switching Transients: Switching an LR, LC, RLC circuits.

Transients Analysis of Three-Phase power Systems: Symmetrical components in Three-phase Systems, Sequence Components for Unbalanced Network Impedances, the Sequence Networks, analysis of Unsymmetrical Three-Phase Faults-single line-to-Ground Fault, Three phase-to-ground faults.

UNIT-II:

Travelling Waves: Velocity of Travelling waves and Characteristic Impedance, Energy Contents of Travelling Waves, Attenuation and Distortion of Electromagnetic Waves, telegraph equations-lossless line, distortion less line, Reflection and Refraction of Travelling Waves, Reflection of Travelling Waves against Transformer-and-Generator-windings, the Origin Transient Recovery voltages, the lattice diagram.

UNIT-III:

Circuit Breakers: Switching arc, Oil Circuit Breakers, Air-Blast, SF6 Circuit Breakers, Vacuum Circuit Breakers, Modelling of the Switching Arc, Arc-Circuit Interaction.

Switching Transients: Interrupting Capacitive currents, Capacitive Inrush currents, Interrupting Small Inductive Currents, Transformer Inrush currents, Short Line Fault.

UNIT-IV:

Power System Transient Recovery Voltages: Characteristics of the Transient Voltage- Short-circuit test duties based on IEC 60056 (1987),ANSI/IEEE Standards, the Harmonization between IEC and ANSI/IEEE Standards with respect to Short-circuit Test duties, Transient recovery voltage for Different types of faults.

UNIT-V:

Lightning –Induced Transients: Mechanism of Lightning, Wave shape of the lightning current, direct lighting Stroke to transmission line towers, direct lightening stroke to a line.

Numerical simulation of electrical transients: The Electromagnetic Transient Program, The MNA Program, The X- Trans Program.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

HIGH VOLTAGE TRANSFORMERS

(Elective-IV)

UNIT–I:

Working Principle of a Transformer : Brief idea about a transformer and how it operates in the distribution system. The working principle in respect of induced EMF, Transformer core and winding. End turns, Losses. Future requirement of transformers with the growth of the power scenario in India.

UNIT-II:

Requirements of Transformer Specifications form End – Users : The basic information that buyers should pass on to the manufacturer while placing an order. Preparing specifications in respect of mandatory, Supplementary and additional requirements.

UNIT-III:

Basic Materials of Transforms : The processing of three basic new materials, viz. CRGO steel, winding wires and strips and transformer oil, raw material processors.

UNIT–IV:

The Basic Concept of Design : Design concepts, a commercial design, the design approach in respect of core and winding. The procedure of handling computer aided design, the design inputs and outputs, and operation. Two standard designs of 250 kVA and 400 kVA. 11/0.433 kV.

UNIT–V:

Dry – Type Distribution Transformers : Basic constructional details and superiority of resign impregnated dry type transformers have been compared with oil filled and resin cast transformers. VPI plant requirements, application of dry type transformers.

TEXT BOOK:

1. Design of Transformers, Indirajit Dasgupta, Tata Mc Graw Hill.

REFERENCE:

1. Transformers, BHEL, Tata Mc.Graw Hill Publishers.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

PULSE POWER ENGINEERING

(Elective-IV)

UNIT-I:

Static and Dynamic Breakdown Strength of Dielectric Materials : Introduction-Gases-static breakdown-pulsed breakdown-spark formation-liquids-basic electrical Process-steamer breakdown-practical considerations-solids-General observations-charge Transport, injection and Breakdown-statistical Interpretation of breakdown Strength Measurements.

UNIT-II:

Energy Storage : Pulse Discharge Capacitors-Marx Generators-classical Marx generators-LC Marx Generator-Basic Pulsed-Power Energy Transfer Stage-inductive energy storage-power and voltage multiplication-rotors and homo polar Generators.

Switches: Closing switches-gas switches-semi conductor closing switches-magnetic switches-summary-opening switches-fuses-mechanical interrupters-superconducting opening switches-plasma opening switches-plasma flow switches-semiconductor opening switches.

UNIT-III:

Pulse Forming Networks : Transmission lines-terminations and junctions-transmission lines with losses-the finite transmission line as a circuit element-production of pulses with lossless transmission lines-RLC networks-circuit simulation with LEITER.

UNIT-IV:

Pulse Transmission and Transformation : Self magnetic insulation in vacuum lines-vacuum break down in metallic surfaces-qualitative description of self magnetic insulation-quantitative description of self magnitude insulation-pulse Transformers-High Voltage Power supplies-Capacitor-Charging Techniques-Cascade Circuits-Transformation Lines.

UNIT-V:

Power and Voltage Adding : Adding of Power-Voltage Adding-voltage adding by transit-time Isolation-voltage adding by Inductive Isolation-Blumlein Generators-Cumulative Pulse Lines.

Examples of Pulsed-Power Generators: Single-pulse generators-KALIF-PBFA 2 and the Z-Machine-HERMES III.

Repetitive Generators: RHEPP and Generators with opening switches.

TEXT BOOK:

1. Pulsed Power Engineering by Professor Dr.Hasjoachim Bluhm.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

ADVANCED EM FIELDS

(Elective-IV)

UNIT–I:

Electrostatics : Electrostatic Fields – Coulomb's Law – Electric Field Intensity (EFI) – EFI due to a line and a surface charge – Work done in moving a point charge in an electrostatic field – Electric Potential – Properties of potential function – Potential gradient – Gauss's law – Application of Gauss's Law – Maxwell's first law, div (D)=ρv – Laplace's and Poisson's equations – Solution of Laplace's equation in one variable.

UNIT–II:

Electric Fields-I : Introduction, Analytical calculation of space-charge-free fields, simple geometries, transmission conductors to ground, fields in multi-dielectric media, experimental analogs for space-space-charge-free fields, electrolytic tank, semi conducting paper analog, resistive-mesh analog. Numerical computation of space-charge –free fields, successive imaging technique, the dipole method, charge-simulation technique, finite-difference technique, combined charge-simulation and finite-difference technique, finite-element technique, combined charge-simulation and finite-element technique, boundary-element method, integral-equations technique, monte-cario technique.

UNIT–III:

Electric Fields-II : Analytical Calculations Of Fields With Space Charges, Numerical Computation Of Fields With Space Charges, Finite Element Technique, Finite Element Technique Combined With The Method Of Characteristics, Charge-Simulation Technique Combined With The Method Of Residues, Electric Stress Control And Optimization, Electric Stress Control, Electric Stress Optimization.

UNIT–IV:

Conductors, Dielectrics, Dipole and Capacitance : Behavior of conductors in an electric field – Conductors and Insulators – Electric field inside a dielectric material – polarization – Dielectric – Conductor and Dielectric – Dielectric boundary conditions – Energy stored and energy density in a static electric field – Current density – conduction and Convection current densities – Ohm's law in point form – Equation of Electric dipole – Dipole moment – potential and EFI due to an electric dipole – Torque on an Electric dipole in an electric field – Capacitance – Capacitance of parallel plate and spherical capacitors. continuity.

UNIT–V:

Magneto Statics Time Varying Fields : Biot-Savart's law – Magnetic field intensity (MFI), magnetic flux density and MFI, Ampere's circuital law and its applications Point form of Ampere's circuital law. Scalar Magnetic potential and its limitations – vector magnetic potential and its properties, vector Poisson's equations. Energy stored and density in a magnetic field. Magnetic force - Moving charges in a Magnetic field – Lorentz force equation — a differential current loop as a magnetic dipole ,Time varying fields – Faraday's laws of electromagnetic induction – Its integral and point forms ,Statically and Dynamically induced EMFs -Modification of Maxwell's equations for time varying fields – Displacement current.

TEXT BOOKS:

1. "Engineering Electromagnetics" by William H. Hayt & John. A. Buck Mc. Graw-Hill Companies, 7th Editon.2005.
2. "Electromagnetics" by J. D Kraus Mc Graw-Hill Inc. 4th edition 1992.

REFERENCE BOOKS:

1. Field Theory “, Gangadhar, Khanna Publishers.
2. Elements of Electromagnetic field theory “, Sadiku, Oxford Publ.
3. “Electromagnetics” by J P Tewari.
4. “Introduction to E-Magnetics” by CR Paul and S.A. Nasar, Mc-Graw Hill Publications.
5. “Introduction to Electro Dynamics” by D J Griffiths, Prentice-Hall of India Pvt.Ltd, 2nd editon.
6. “Electromagnetics” by Plonsy and Collin.
7. “Engineering Electro magnetics” by Nathan Ida, Springer(India) Pvt. Ltd. 2nd Edition.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

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 model to state variable model and vic 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 Gauss-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.