ACADEMIC REGULATIONS

Applicable for students admitted into M.Tech. Programme from 2014-15

The Jawaharlal Nehru Technological University Anantapur shall confer M.Tech. Post graduate degree to candidates who are admitted to the Master of Technology Programmes and fulfill all the requirements for the award of the degree.

1. ELIGIBILITY FOR ADMISSIONS:

Admission to the above programme shall be made subject to the eligibility, qualifications and specialization prescribed by the competent authority for each programme, from time to time.

Admissions shall be made either on the basis of merit rank obtained by the qualifying candidates at an Entrance Test conducted by the University or on the basis of GATE/PGECET score, subject to reservations or policies framed by the Government of Andhra Pradesh policies from time to time.

2. ADMISSION PROCEDURE:

As per the existing stipulations of AP State Council for Higher Education (APSCHE), Government of Andhra Pradesh, admissions are made into the first year as follows

a) Category-A seats are to be filled by Convenor through PGECET/GATE score.

b) Category-B seats are to be filled by Management as per the norms stipulated by Government of A. P.

3. SPECIALIZATION:

The following specializations are offered at present for the M.Tech. programme.

Sl. No.	**Specialization**
1.	CAD/CAM
2	Machine Design
2.	Digital Electronics and Communication Systems
3.	Embedded Systems
4.	VLSI System Design
5.	Computer Science and Engineering
6.	Electrical Power Engineering
7.	Electrical Power Systems
8	Structural Engineering

and any other specialization as approved by the concerned authorities from time to time.

4. COURSE WORK:

4.1. A Candidate after securing admission must pursue the M. Tech. programme of study for four semesters duration.

4.2. Each semester shall be of 20 weeks duration including all examinations.

4.3. A candidate admitted in to the programme should complete it within a period equal to twice the prescribed duration of the programme from the date of admission.

5. ATTENDANCE

5.1. A candidate shall be deemed to have eligibility to write end semester examinations if he has put in at least 75% of attendance aggregate in all subjects/courses in the semester.

5.2. Condonation of shortage of attendance up to 10% i.e., between 65% and above and less than 75% may be granted by the Institute Academic committee.

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

5.4. Condonation of shortage of attendance shall be granted only on genuine and valid reasons on representation by the candidate with supporting evidence.

5.5. A stipulated fee shall be payable towards condonation of shortage of attendance to the institute as per following slab system

1st Slab: Less than 75% attendance but equal to or greater than 70% a normal condonation fee can be collected from the student.

2nd Slab: Less than 70% but equal to or greater than 65%, double the condonation fee can be collected from the student.

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

5.7. A student will not be promoted to the next semester unless he satisfies the attendance requirements of the current semester, as applicable.

5.8. A student detained due to shortage of attendance, will have to repeat that semester when offered next.

6. CREDIT SYSTEM NORMS:

	Period(s)/week	**Credits**
Theory	01	01
Practical	03	02
Seminar	01	01
Project	-	16

TABLE 1

7. EVALUATION:

7.1 Distribution of marks

S. No	Examination	Marks	Examination and Evaluation	Scheme of Evaluation
1.	Theory	60	Semester-end examination (External evaluation)	The question paper shall be of descriptive type with 5 questions with internal choice are to be answered in 3hours duration of the examination.
		40	Mid - Examination of 120 Min. duration (Internal evaluation). 4 descriptive type questions with internal choice are to be answered and evaluated for 30 marks, and the reaming 10 marks are to be allotted for 3-5 assignments to be submitted by the student. The assignment marks are to be awarded based on the completeness of the assignment, correctness of the assignment and in-time submission, evaluated for 10 marks and average of the total assignment marks are rounded to the next integer.	Two mid-exams 30 marks each are to be conducted. Better one to be considered. **Mid-I:** After first spell of instructions (I&II Units). **Mid-II:** After second spell of instructions (III - V Units).

S. No	Examination	Marks	Examination and Evaluation		Scheme of Evaluation
2	Laboratory	60	Semester-end Lab Examination (External evaluation)		**For laboratory courses:** **3** hours duration. One External and One Internal examiners.
		40	30	Day to Day evaluation (Internal evaluation)	Performance in laboratory experiments.
			10	Internal evaluation	Practical Tests (one best out of two tests includes viva-voce)
3	Seminar in each of the semesters. 2 hours /week	100	Internal Evaluation 20 Marks for Report 20 Marks for subject content 40 Marks for presentation 20 Marks for Question and Answers		Continuous evaluation during a semester by the Departmental Committee (DC)
4	Project work	Grade A (95%)	12 credits	External evaluation	End Project Viva-Voce Examination by Committee as detailed under sect. 9.
		Grade B (85%)	4 credits	Internal evaluation	Continuous evaluation by the DC. as detailed under sect. 9.5

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

7.3 A candidate has to secure a minimum of 50% to be declared successful.

7.4 In case the candidate does not secure the minimum academic requirement in any of the subjects/practical, he has to reappear for the Examination either supplementary or regular in that

subject/practical along with the next batch students. A separate supplementary examinations will be conducted for the I semester students at the end of II semester.

7.5 **Revaluation / Recounting:** Students shall be permitted to request for recounting/ revaluation of the end theory examination answer scripts within a stipulated period after payment of prescribed fee. After recounting or revaluation, records are updated with changes if any and the student will be issued a revised memorandum of marks. If there are no changes, the student shall be intimated the same through a letter or a notice.

8. RE-REGISTRATION FOR IMPROVEMENT OF INTERNAL EVALUATION MARKS(for theory subjects only):

8.1 Out of the subjects the candidate has failed in the examination due to internal evaluation marks secured being less than 50%, the candidate shall be given one chance for each theory subject and for a maximum of **Three** theory subjects for improvement of internal evaluation marks.

8.2 The candidate can re-register for the chosen subjects and fulfill the academic requirements. Re-registration shall not be permitted after the commencement of class work for that semester. The candidate can re-register for 1st semester subjects when he is in his 3rd semester and for 2nd semester subjects when he is in his 4th semester else the candidate can re-register after completion of 2 years course work.

8.3 For each subject re-registered, the candidate has to pay a fee equivalent to one third of the semester tuition fee.

8.4 In the event of re-registration, the internal evaluation marks as well as the End Examinations marks secured in the previous attempt(s) for those subjects stand cancelled.

9. EVALUATION OF PROJECT WORK:

Every candidate shall be required to submit thesis/dissertation after taking up a topic approved by the Departmental Committee.

9.1 The Departmental Committee (DC) consisting of HOD, Project supervisor and two internal senior experts shall monitor the progress of the project work. A Project Review Committee (PRC) shall be constituted with Principal as Chair Person, Heads of the departments of the M.Tech Programs and Two other senior faculty members, as members of the PRC. PRC will come into action when the DC is not able to resolve the issues.

9.2 Registration of Project work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the courses (theory, practical and seminar of I & II semesters).

9.3 After satisfying 9.2, a candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work to the DC for approval. Only after obtaining the approval of DC, the student can initiate the project work.

9.4 The work on the project shall be initiated in the penultimate semester and continued in the final semester. The duration of the project is for two semesters. The candidate can submit Project thesis with the approval of DC after 36 weeks from the date of registration at the earliest but not later than one calendar year from the date of registration for the project work. Extension of time within the total permissible limit for completing the programme is to be obtained from the Head of the Institution.

9.5 The Internal Evaluation shall be made by the DC to grade, on the basis of two seminars presented by the student on the topic of his project.

9.6 The student must submit status report at least in two different phases during the project work period. These reports must be approved by the DC before submission of the Project Report.

9.7 A candidate shall be allowed to submit the thesis / dissertation only after passing all the prescribed subjects (theory, practical, seminar and project work internal evaluation).

9.8 A candidate has to prepare four copies of the thesis/dissertation certified in the prescribed format by the supervisor and HOD. Out of which three copies shall be submitted in the examination section.

9.9 Viva-voce examination shall be conducted by a board consisting of the supervisor, Head of the department and the examiner. The board shall jointly report candidate's work as.

A Very Good performance
B Moderate Performance
C Failure Performance

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

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

10. CREDIT POINT AVERAGE AND CUMULATIVE CREDIT POINT AVERAGE:

10.1. CREDIT POINT AVERAGE (CPA):

$$\textbf{CPA} = \frac{\sum_i C_i T_i}{10\sum_i C_i}$$

Where C_i= Credits earned for Course i in any semester/year.

T_i= Total marks obtained for course i in any semester/year.

10.2. CUMULATIVE CREDIT POINT AVERAGE (CCPA):

$$\textbf{CCPA} = \frac{\sum_n \sum_i C_{ni} T_{ni}}{10 \sum_n \sum_i C_{ni}}$$

Where ***n*** refers to the semester in which such courses were credited.

The CCPA is awarded only when a student earns all the credits prescribed for the programme.

10.3. OVERALL PERFORMANCE:

CCPA	Classification of Final Results
7.0 and above	First Class with Distinction
6.0 and above but below 7.0	First Class
5.0 and above but below 6.0	Second Class

11. TRANSCRIPTS:

After successful completion of the entire programme of study, a transcript containing performance of all the academic years will be issued as a final record. Duplicate transcripts will be issued if required, after payment of requisite fee. Partial transcript will also be issued up to any point of study to a student on request.

12. ELIGIBILITY:

A student shall be eligible for the award of M.Tech Degree if he fulfills all the following conditions:

i. Registered and successfully completed all the components prescribed in the programme of study to which he was admitted.
ii. Successfully acquired all **72 credits** as specified in the curriculum corresponding to the branch of his study within the stipulated time.
iii. No disciplinary action is pending against him.

13. AWARD OF DEGREE:

The Degree will be conferred and awarded by Jawaharlal Nehru Technological University Anantapur, Anantapur on the recommendations of the Principal, AITS (Autonomous) based on the eligibility as mentioned in clause 11.

14. WITHHOLDING OF RESULTS:

If the candidate has any dues to the Institute or if any case of in-discipline is pending against him, the result of the candidate shall be withheld and he will not be allowed / promoted into the next higher semester. The issue of degree is liable to be withheld in such cases.

15. TRANSITORY REGULATIONS:

Candidates who have discontinued or have been detained for want of attendance or who have failed after having undergone the course in earlier regulations and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered. Whereas, he continues to be in the academic regulations he was first admitted.

16. AMENDMENTS OF REGULATIONS:

The Chairman, Academic Council of Annamacharya Institute of Technology and Sciences, Rajampet (Autonomous) reserves the right to revise, amend, or change the Regulations, Scheme of Examinations and/or Syllabi or any other policy relevant to the needs of the society or industrial requirements etc., without prior notice.

17. GENERAL:

Where the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.

18. Any legal issues are to be resolved in Rajampet Jurisdiction.

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Curriculum for the Programmes under Autonomous Scheme								
Regulation	R 2014							
Department	Department of Electrical And Electronics Engineering							
Programme Code & Name	**P7,M.Tech-Electrical Power Systems**							
Semester I								
Subject Code	Course Name	Hours/ Week			Credit	Maximum marks		
		L	T	P	C	Internal	External	Total
	THEORY							
4P6217	**Advanced Power System Analysis**	4	0	0	4	40	60	100
4P7211	**Power System Control & Stability**	4	0	0	4	40	60	100
4P6213	**EHV AC/DC Transmission**	4	0	0	4	40	60	100
4P6214	**Reactive Power Compensation & Management**	4	0	0	4	40	60	100
	Elective-I							
4P7212	**Soft Computing Techniques**	4	0	0	4	40	60	100
4P6311	**Embedded Systems**							
4P6216	**Power Quality**							
	Elective-II							
4P6312	**Advanced Digital Signal**	4	0	0	4	40	60	100
4P6211	**Modern control Theory**							
4P6218	**Energy Auditing , Conservation & Management**							
4P7213	**SEMINAR-I**	0	0	2	2	40	60	100
4P6219	**Machines &Power Systems Lab**	0	0	3	2	40	60	100
Total		**24**	**0**	**5**	**28**	**800**		
Semester II								
Subject Code	Course Name	Hours/ Week			Credit	Maximum marks		
		L	T	P	C	Internal	External	Total
	THEORY							
4P6221	**Operation & Control Of Power System**	4	0	0	4	40	60	100
4P6222	**Flexible AC Transmission System**	4	0	0	4	40	60	100
4P6223	**Advanced Power System protection**	4	0	0	4	40	60	100
4P7221	**Energy Conversion Systems**	4	0	0	4	40	60	100
	Elective-III							
4P6225	**Power System Reliability**	4	0	0	4	40	60	100
4P6226	**Modern Power Electronics**							
4P7222	**Power System Dynamics**							
	Elective-IV							
4P7223	**Distribution Automation**	4	0	0	4	40	60	100
4P6229	**Transients In Power Systems**							
4P622A	**Restructured Power System**							
4P7224	**SEMINAR-II**	0	0	2	2	40	60	100
4P622B	**Power System Simulation Lab**	0	0	3	2	40	60	100
Total		**24**	**0**	**5**	**28**	**800**		

Note: L - Lecture; P – Practice; C – Credits

Curriculum for the Programmes under Autonomous Scheme					
Regulation	R 2014				
Department	Department of Electrical And Electronics Engineering				
Programme Code & Name	**P7,M.Tech-Electrical Power Systems**				
Semester III & SEMESTER IV					
Subject Code	Course Name	Credits	Maximum marks		
			Internal	External	Total
4P7231	**PROJECT WORK**	16	**GRADE (A/B/C)**		
	TOTAL	**16**	**GRADE**		

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

M.Tech (EPS) I Semester

(4P6217)ADVANCED POWER SYSTEM ANALYSIS

UNIT-I:FORMATION OF SPARSE MATRIX: Admittance Model and Network Calculations, Branch and Node Admittances, Mutually Coupled Branches in YBUS , An Equivalent Admittance Network, Modification of YBUS, Network Incidence Matrix and YBUS ,Method of Successive Elimination, Node Elimination, Triangular Factorization, Sparsity and Near Optimal Ordering.

UNIT-II: ZBUS CALCULATIONS: Impedance Model and Network Calculations, the BUS Admittance and Impedance Matrices, Thevenin's Theorem and ZBUS ,Algorithms for building ZBUS Modification of existing ZBUS, Calculation of ZBUS elements from YBUS, Power Invariant Transformations, Mutually Coupled Branches in ZBUS.

UNIT-III: LOAD FLOW STUDIES: Types of buses in Power systems, load flow problem Gauss Seidel method, N-R Method in polar, rectangular coordinated forms, Decoupled method, fast decoupled method, and comparison between power flow solutions. Three phase load flows.

UNIT-IV: SHORT CIRCUIT ANALYSIS: Computer method for fault analysis using ZBUS and sequence components. Derivation of equations for bus voltages, fault current and line currents, both in sequence and phase domain using Thevenin‟s equivalent and ZBUS matrix for different faults, problems.

UNIT-V: NUMERICAL INTEGRATIONMETHODS: Introduction, Numerical Integration Methods: Euler and Fourth Order Runge-Kutta methods, Algorithm for simulation of SMIB and multi-machine system with classical synchronous machine model; Factors influencing transient stability, Numerical stability and implicit Integration methods.

Text Books:

1. Computer Techniques in Power System Analysis- M.A. Pai, Tata Mc-Graw Hill New Delhi.
2. Computer Methods in Power System Analysis- Stagg and El.Abiad, Mc-Graw Hill (International Student Edition.)
3. A.J. Wood & W.F. Wollenberg, 'Power Generation, Operation, and Control', 2nd Edn, John Wiley & Sons, New York, 1996

Reference Books:

1. Computer Analysis of Power Systems-J.Arrilinga, C.P.Arnold. Wiely Eastern Ltd.
2. Optimization Techniques-S.S.Rao, Wiely Eastern Ltd, New Delhi
3. Computer Aided Power System operation and Analysis-R.N.Dhar, Tata Mc- Graw Hill New Delhi
4. Modern Power System Engineering, Nagrath and Kothari (Tata McGraw Hill)
5. Electrical Energy System Theory–an introduction- Olle Elgerd. TMH Publishing Company, New Delhi
6. Power Generation Operation and Control – Allen Wood, Wiley Publications.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

M.Tech (EPS) I Semester

(4P7211)POWER SYSTEM CONTROL & STABILITY

UNIT-I THE ELEMENTARY MATHEMATICAL MODEL:A Classical model of one machine connected to an infinite bus – Classical model of multi machine system – Problems Effect of the excitation system on Transient stability.

UNIT-II SYSTEM RESPONSE TO SMALL DISTURBANCES: The unregulated synchronous Machine – Effect of small changes of speed – modes of oscillation of an unregulated Multi machine system – regulated synchronous machine – voltage regulator with one time lag – Governor with one time lag – Problems. Concept of Dynamic stability – state space model of one machine system connected to infinite bus – effect of excitation on Dynamic stability – examination of dynamic stability by Routh's criterion

UNIT-III POWER SYSTEM STABILIZERS: Introduction to supplementary stabilizing signals- Block diagram of the linear system- Approximate model of the complete exciter generator system – Lead compensation – Stability aspect using Eigen value approach

UNIT-IV EXCITATION SYSTEMS: Excitation system response – Non-continuously regulated systems – continuously regulated systems – Excitation system compensation – state space description of the excitation system- simplified linear model – effect of excitation on generator power limits. Type –2 systems: rotating rectifier system, Type-3 system: Static with terminal potential and current supplies - Type –4 systems: non – continuous acting - Block diagram representation – state space modeling equations of these types.

UNIT-V VOLTAGE STABILITY: Voltage stability –voltage collapse, voltage security, physical relation indicating dependence of voltage and reactive power flow, Factors affecting voltage instability and collapse – Previous case of voltage collapse incidences. PV curve-QV curve- Control of voltage instability. Voltage Stability analysis-Static & Dynamic Analysis-The Continuation Power Flow Analysis-Prevention of voltage collapse

TEXT BOOKS

1. P.M.Anderson, A.A.Fouad, "Power System Control and Stability", IOWA State University Press, Galgotia Publications, Vol-I, 1st Edition.
2. 'Power system stability and control" by Prabha Kundur,MC Grawhill-Inc

REFERENCE BOOKS

1. M.A.Pai, Power System Stability – Analysis by the direct method of Lyapunov. North Holland Publishing Company, Newyork, 1981.
2. K.R. Padiyar, Power System Dynamics (Stability & Control), 2nd Edition B.S.Publications, 2002.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)
M.Tech (EPS) I Semester
(4P6213) EHVAC/DC 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 high electrostatic field on biological organisms and human beings, surface voltage gradients and maximum gradients of actual transmission lines – voltage gradients on sub conductor. Electrostatic induction in un energized lines – measurements of field and voltage gradients for three phase single and double circuit lines – unenergised lines.

UNIT-III: 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. Corona in E.H.V. lines – Corona loss formulae attenuation of traveling waves due to Corona – Audio noise due to Corona, its generation, characteristic and limits.

UNIT-IV: H.V.DC Transmission: General consideration, Power Handling Capabilities of HVDC lines, Basic Conversion principles, static converter configuration. Static Power Converters: 3 pulse, 6 pulse & 12 pulse converters, converter station and terminal equipment communication process, Rectifier and inverter operation, equivalent circuit for converter-special futures of converter transformers.

UNIT-V: Harmonics in HVDC systems, harmonicas elimination, AC & DC filter Control of HVDC converter 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 HVAC & DC systems –voltage interaction, harmonic instability problems and DC power modulation.

TEXT BOOKS:
1. Extra High Voltage AC Transmission Engineering –Rokosh Das Begamudre, Wile EASTERN LTD., NEW DELHI – 1987.
2. K.R.Padiyar: High Voltage Direct current Transmission, Wiley Eastern Ltd

REFERENCE BOOKS:
1. EHV Transmission line reference Books – Edison Electric Institution (GEC 1968).
2. E.W.Kimbark: Direct current Transmission, Wiley inter Science- New york.
3. J.Arillaga: H.V.D.C.Tranmission peter peregrilnus ltd., London UK 1983
4. E.Uhlman: Power Transmission by Direct Current Springer Verlag, Berrlin

M.Tech (EPS) I Semester

(4P6214)REACTIVE POWER COMPENSATION AND MANAGEMENT

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 AND TRANSIENT STATE REACTIVE POWER COMPENSATION IN TRANSMISSION SYSTEM

Uncompensated line – types of compensation – Passive shunt and series and dynamic shunt compensation – examples.Characteristic time periods – passive shunt compensation – static compensations- series capacitor compensation –compensation using synchronous condensers – examples.

UNIT-III: REACTIVE POWER COORDINATION AND DEMAND SIDE MANAGEMENT

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.

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

UNIT-VI: DISTRIBUTION AND USER SIDE REACTIVE POWER MANAGEMENT

System losses –loss reduction methods – examples – Reactive power planning – objectives Economics Planning capacitor placement – retrofitting of capacitor banks. KVAR requirements for domestic appliances – Purpose of using capacitors – selection of capacitors – deciding factors – types of available capacitor, characteristics and Limitations.

UNIT-V: REACTIVE POWER MANAGEMENT IN ELECTRIC TRACTION SYSTEMS AND ARC 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.

Text Books:

1. Reactive power control in Electric power systems" by T.J.E.Miller, John Wiley and sons, 1982.
2. "Reactive power Management" by D.M.Tagare, Tata McGraw Hill, 2004 .

Reference Books:

1. S. Sivanagaru & G. Sreenivasan, Power System Operation and Control, Pearson Publications.

M.Tech (EPS) I Semester

(4P7212)SOFT COMPUTING TECHNIQUES
(ELECTIVE –I)

UNIT-I: ARTIFICIAL NEURAL NETWORKS

Introduction, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN. Types of Neuron Activation Function, ANN Architectures, Taxonomy of ANN, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Applications.

UNIT-II: SUPERVISED LEARNING NETWORKS

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

ADALINE, MADALINE, Back Propagation Network, BP Learning Rule, Input Layer Computation, Hidden Layer Computation, output Layer computation, Radial Basis Function.

UNIT-III: FUZZY LOGIC & ITS CONTROLLERS

Introduction to classical sets – Properties, Operations and Relations; Fuzzy sets, Membership, Uncertainty, Operations, Properties, Fuzzy Relations, Cardinalities, Membership Functions. Fuzzification, Membership Value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

UNIT-IV :GENETIC ALGORITHMS

Introduction, Basic operators and Terminologies in GA, Traditional Vs Genetic Algorithm, Encoding, Fitness Function, Selection, Crossover and Mutation Operators.

UNIT-V: APPLICATIONS TO ELECTRICAL SYSTEMS

ANN Based Short Term Load Forecasting, Load Flow Studies, Fuzzy Logic Based Unit Commitment And Genetic Algorithms Based Economic Dispatch.

TEXT BOOK:

1. “Introduction to Artificial Neural Systems”, by JacekM.Zurada, Jaico Publishing House, 1997.
2. “Principles of Soft Computing Techniques” by S.N. Sivanandam and S.N.Deepa, WILEY-INDIA Edition

REFERENCE BOOKS:

1. “Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications” by Rajasekharan and Rai- PHI Publication.
2. “Neural and Fuzzy Systems: Foundation, Architectures and Applications”, - N. Yadaiah and S. BapiRaju, Pearson Education
3. “Neural Netwroks“, by James A Freeman and Davis Skapura, Pearson, 2002
4. “Neural Netwroks and Fuzzy Logic System”, by BrokKosko, PHI Publications

M.Tech (EPS) I Semester

(4P6311)EMBEDDED SYSTEMS

(Elective-I)

UNIT-I OVERVIEW OF EMBEDDED SYSTEM& PROCESSOR&MEMORY ORGANIZATION

Embedded System,types of Embedded System,Requirements of Embedded System,Issues in Embedded software development,Applications. Structural units in a processor, processor selection, Memory devices,Memoryselection,MemoryAllocation⤅Interfacing.

UNIT-II DEVICES& BUSES FOR DEVICE NETWORKS

I/O devices, Timer& Counter devices, Serial Communication, Communication between Devices using different buses.Device drivers, Parallel and Serial port device drives in a system , Interrupt servicing Mechanism, context and periods for context switching, Deadline and Interrupt Latency.

UNIT-III PROGRAM MODELING CONCEPTS& SOFTWARE ENGINEERING PRACTICES

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

UNIT-IV 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.

UNIT-V RTOS

OS Services, I/O sub systems, Real Time and Embedded Systems OS, Interrupt routines in RTOS Environment, RTOS Task Scheduling Models

TEXT BOOKS:

1.Embedded Systems: Architecture, Programming and Design-RajKamal,TMH,2003.

2.Programming for Embedded System: Dream Tech Software Team-John Wiley,2002.

REFERENCES:

1.Embedded Systems & Robots by SubrataGhoshal, CENGAGE Learning.

M.Tech (EPS) I Semester

(4P6216)POWER QUALITY
(ELECTIVE-I)

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. Interruptions – Definition – Difference between failure, outage, Interruptions – causes of Long Interruptions – Origin of Interruptions – Limits for the Interruption frequency – Limits for the interruption duration – costs of Interruption.

UNIT-II SHORT INTERRUPTIONS& VOLTAGE SAG – CHARACTERIZATION

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

UNIT-III PQ CONSIDERATIONS IN INDUSTRIAL POWER SYSTEMS

Voltage sag – equipment behaviour 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-IV MITIGATION OF INTERRUPTIONS AND VOLTAGE SAGS& HARMONICS

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. Harmonic Distortion – Voltage Vs Current distortion – Harmonics verses Transients – Harmonic Indexes – Harmonic Sources from Commercial Loads – Harmonic Sources from industrial Loads – locating harmonic sources.

UNIT-V POWER QUALITY MONITORING

Monitoring Considerations – Historical Perspective of Power Quality measuring Instruments – Power Quality measurement Equipment – Assessment of Power Quality Measurement Data – Application of Intelligent Systems – Power Quality Monitoring Standards.

TEXT BOOKS:

1. "Understanding Power Quality Problems" by Math H J Bollen. IEEE Press.
2. Electrical Power Systems Quality'' by Roger C. Dugan, Mark E. Mc. Granaghan, Surya Santoso and H. Wayne Beaty,"Mc. Graw Hill, Second Edition.

REFERENCES

1. Arindam Ghosh "Power Quality Enhancement Using Custom Power Devices", Kluwer Academic Publishers, 2002
2. G.T.Heydt, "Electric Power Quality", Stars in a Circle Publications, 1994(2nd edition)
3. Power Quality - R.C. Duggan

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
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M.Tech (EPS) I Semester

(4P6312) ADVANCED DIGITAL SIGNAL PROCESSING
(ELECTIVE-II)

UNIT I : INTRODUCTION TO DIGITAL SIGNAL PROCESSING

Introduction, A Digital Signal-Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Decimation and Interpolation, Digital Filters, FIR Filters, IIR Filters.

UNIT II : WAVE LET TRANSFORM

Introduction to continuous wavelet transform- discrete wavelet transform -orthogonal wavelet decomposition- Multi resolution Analysis-Wavelet function-DWT, bases, orthogonal Basis-Scaling function, Wavelet coefficients- ortho normal wavelets and their relationship to filter banks- Digital filtering interpolation (i) Decomposition filters, (ii) reconstruction, the signal-Example MRA- Haar & Daubechies wavelet.

UNIT III : ARCHITECTURES OF COMMERCIAL DIGITAL SIGNAL PROCESSORS

Introduction, categorization of DSP Processors, Fixed Point (Black fin),Floating Point (SHARC),TI TMS 320c6xxx & OMAP processors TMS320C54X & 54xx on Basic Architecture – comparison : of functional variations of Computational building blocks, MAC, Bus Architecture and memory, Data Addressing, Parallelism and pipelining, Parallel I/O interface, Memory Interface, Interrupt, DMA (one example Architecture in each of these case studies).

UNIT IV : INTERFACING I/O PERIPHERALS FOR DSP BASED APPLICATIONS

Introduction, External Bus Interfacing Signals, Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I / O Direct Memory Access (DMA).-Introduction, Design of Decimation and Interpolation Filter, FFT Algorithm, PID Controller ,Application for Serial Interfacing, DSP based Power Meter, Position control , CODEC Interface.

UNIT V : VLSI IMPLEMENTATION

Low power Design-need for Low power VLSI chips-Basics of DSP system architecture design using VHDL programming, Mapping of DSP algorithm onto hardware, Realization of MAC & Filter structure.

TEXT BOOKS:

1. John G Proaks, Dimitris G. Manolakis, “Digital Signal Processing”, Pearson Education 2002.
2. Avatar Sing, S. Srinivasan, “Digital Signal Processing- Implementation using DSP Microprocessors with Examples from TMS320C54xx”, Thomson India,2004.

REFERENCES:

1. Lars Wanhammer, “DSP Integrated Circuits”, Academic press, 1999,NewYork.
2. Lyla B Das,” Embedded Systems-An Integrated Approach”,Pearson2013
3. Ashok Ambardar,”Digital Signal Processing: A Modern Introduction”,Thomson India edition, 2007.
4. Raghuveer M.Rao and Ajit S. Bapardikar, Wavelet transforms- Introduction to theory and applications, Pearson Education, 2000.
5. K.P. Soman and K.L. Ramchandran,Insight into WAVELETS from theory to practice, Eastern Economy Edition, 2008
6. Ifeachor E. C., Jervis B. W ,”Digital Signal Processing: A practical approach, Pearson-Education, PHI/ 2002
7. B Venkataramani and M Bhaskar **“**Digital Signal Processors**”**, TMH, 2nd, 2010
8. Peter Pirsch **“**Architectures for Digital Signal Processing”, John Weily, 2007
9. Vinay K.Ingle,John G.Proakis,”DSP-A Matlab Based Approach”,Cengage Learning,2010
10. Taan S.Elali,”Discrete Systems and Digital Signal Processing with Matlab”,CRC Press2009.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
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M.Tech (EPS) I Semester

(4P6211)MODERN CONTROL THEORY
(ELECTIVE-II)

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

UNIT-II STATE VARIABLE ANALYSIS: Linear Continuous time models for Physical systems–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.

UNIT-III: MODAL CONTROL: Controllable and Observable Canonical forms of State model- State feedback controller design through Pole Assignment – State observers: Full order and reduced order.

UNIT-IV: 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-V: 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.

OPTIMAL CONTROL: Introduction to optimal control - Formulation of optimal control problems – calculus of variations – fundamental theorem of Calculus of variations — Linear Quadratic regulator

TEXT BOOKS BOOKS:

1. M.Gopal , *Modern Control System Theory* New Age International -1995
2. Ogata.K ,*Modern Control Engineering,* Prentice Hall of India, Fifth edition,2010

REFERENCES:

1. Donald E Kirck *Optimal control Theory*–Dover Publications,2004
2. Astrom.K.J, and Wittenmark.B, "Adaptive control", Addison-Wesley Longman Publishing Co, Second Edition,1994.
3. Brian.D, Anderson.O, John Barratt Moore, "*Optimal Control*" Prentice Hall,1990.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
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M.Tech (EPS) I Semester

(4P6218)ENERGY AUDITING, CONSERVATION & MANAGEMENT
(ELECTIVE-II)

UNIT-I: BASIC PRINCIPLES OF ENERGY AUDIT: Energy audit- definitions, concept , types of audit, energy index, cost index ,pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit.

UNIT-II: ENERGY MANAGEMENT: Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting. Energy manger, Qualities and functions, language, Questionnaire - check list for top management

UNIT-III: ENERGY EFFICIENT MOTORS: Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics - variable speed, variable duty cycle systems, RMS hp-voltage variation-voltage unbalance- over motoring- motor energy audit

UNIT- IV: POWER FACTOR IMPROVEMENT, LIGHTINGENERGY INSTRUMENTS

Power factor – methods of improvement, location of capacitors, Pf with non linear loads, effect of harmonics on p.f., p.f motor controllers - Good lighting system design and practice, lighting control, lighting energy audit. Energy Instruments watt meter, data loggers, thermocouples, pyrometers, lux meters, tongue testers, application of PLC's.

UNIT- V ECONOMIC ASPECTS AND ANALYSIS

Economics Analysis-Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, and life cycle costing analysis - Energy efficient motors. Calculation of simple payback method, net present worth method - Power factor correction, lighting - Applications of life cycle costing analysis, return on investment.

TEXT BOOKS:

1."Energy management" by W.R. Murphy & G. Mckay Butter worth, Heinemann publications.

2."Energy management "by Paul o Callaghan, Mc-graw Hill Book company-1st edition, 1998.

REFERENCE BOOKS:

1."Energy efficient electric motors" by John C. Andreas, Marcel Dekker Inc Ltd-2nd edition, 1995.

2."Energy management hand book" by W.C.Turner, john Wiley and sons

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M.Tech (EPS) I Semester

(4P6219)MACHINES & POWER SYSTEMS LAB

Any Ten Experiments:

1. Characteristics of IDMT Over Current Relay (Electromagnetic Type).
2. Characteristics of Negative Phase Sequence relay (Static Type).
3. Characteristics of Percentage biased differential Relay (static type).
4. Characteristics of Over Voltage Relay (Electromagnetic Type).
5. Characteristics of over voltage/under voltage relay (Micro processor Based Type).
6. Characteristics of Percentage Biased Differential Relay (Electromagnetic Type).

7. Equivalent Circuit of three winding transformer.
8. Scott Connection.
9. Fault Analysis – I
   A. LG Fault
   B. LL Fault

10. Fault Analysis – II
    A. LLG Fault
    B. LLLG Fault

11. Power Angle Characteristics of Salient pole Synchronous machine.
12. Determination of Sub transient Reactance of Salient pole Synchronous Machine.
13. Separation of No-Load Losses of Three Phase Squirrel cage Induction motor.

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M.Tech (EPS) II Semester
(4P6221)OPERATION AND CONTROL OF POWER SYSTEM

UNIT-I: Economic operation and Unit Commitment: Load forecasting - Unit commitment – Economic dispatch problem of thermal units – Gradient method- Newton's method –Base point and participation factor method - Optimal Unit Commitment, Constraints in unit commitment - Unit commitment Solution methods- Priority-List methods, Dynamic Programming solution. Backward DP Approach, Forward DP Approach

UNIT-II: Hydrothermal co-ordination: Short-term hydrothermal scheduling problem – gradient approach – Hydro units in series - pumped storage hydro plants-hydro-scheduling using Dynamic programming and linear programming.

UNIT-III: Need for frequency and voltage control - Plant and system level control - modeling of LFC of single area system - static and dynamic analysis - LFC of two area system - static and dynamic analysis - Tie line bias control -development of state variable model of single and two area system
Automatic generation control - features **-** implementation

UNIT-IV: Interchange of Power & Energy-Economic interchange between interconnected utilities – Inter utility energy evaluation – Power pools – Transmission effects and Issues Limitations – Wheeling

UNIT-V: Power system security-Contingency analysis – linear sensitivity factors – AC power flow methods – contingency selection – concentric relaxation –security constrained optimal power flow-Interior point algorithm-Bus incremental costs**.-** Maximum likelihood Weighted least squares equation – orthogonal Decomposition estimation method – Algorithm

TEXT BOOKS:
1. Allen J.Wood and Wollenberg B.F., 'Power Generation Operation and control', John Wiley & Sons, Second Edition.
2. Nagrath, I.J. and Kothari D.P., 'Modern Power System Analysis', TMH,N.Delhi,1980

REFERENCES:

1. D.P.Kothari & J.S.Dhillon, Power System Optimization, PHI, 2004

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
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M.Tech (EPS) II Semester

(4P6222)FLEXIBLE A.C. TRANSMISSION SYSTEMS

UNIT-I: FACTS CONCEPTS: Loading capability limits - dynamic stability considerations - importance of controllable parameters - basic types of FACTS controllers - benefits from FACTS controllers.

UNIT-II: VOLTAGE SOURCE CONVERTERS: 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 voltage source and current source converters - comparison of CSC and VSC.

UNIT-III: STATIC SHUNT COMPENSATION: Objectives of shunt compensation - mid-point regulation - voltage instability prevention - improvement of transient stability - power oscillation damping - methods of controllable VAR generation - variable impedance type VAR generators - switching converter type VAR generators - hybrid VAR generators.

UNIT-IV: SVC AND STATCOM: The regulation slope - transfer function and dynamic performance - transient stability Enhancement - 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 - GTO thyristor controlled series capacitor (GCSC) - Thyristor Switched Series Capacitor (TSSC), and Thyristor Controlled Series Capacitor (TCSC), control schemes for GCSC, TSSC and TCSC.

Text Book:
1.“Understanding FACTS Devices” N. G. Hingorani and L. Guygi. IEEE Press Publications

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M.Tech (EPS) II Semester

(4P6223)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 comparator.

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: Introduction-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 a 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 length and source impedance on distance relays

UNIT-V: Microprocessor based protective relays:

Over current relays – impedance relays – directional relay – reactance relay (Block diagram and flow chart approach only)

Generalized mathematical expression for distance relays - measurement of resistance and reactance – MHO and offset MHO relays –Realization of MHO characteristics – Realization of offset MHO characteristics (Block diagram and flow chart approach only) Basic principle of Digital computer relaying.

TEXT BOOKS:

1. T.S.Madhava Rao, “Power system Protection static relay”, Tata McGraw Hill Publishing company limited , second edition,1989

2. Badri Ram and D.N.Vishwakarma, “ Power system Protection and Switchgear “, Tata McGraw Hill Publication company limited First Edition -1995

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
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M.Tech (EPS) II Semester

(4P7221)ENERGY CONVERSION SYSTEMS

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, Co-generation and energy storage, combined cycle co-generation, energy storage.

Global energy position and environmental effects: energy units, global energy position.

UNIT-V: Principles of EMF generation, description of fuel cells , 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

REFERENCE BOOKS:

1. Ramesh & Kumar, Renewable Energy Technologies , Narosa.
2. K Mittal, Non-Conventional Energy Systems , Wheeler
3. D.P.Kothari,K.C.Singhal,Renewable energy sources and emerging technologies , Prentice Hall of Iindia.
4. G.D. Rai, Solar Energy Utilization , Khanna Publishers, Delhi, 2001.
5. G.N.Tiwari and M.K. Ghosal. Fundamentals of Renewable energy resources. Narosa, New Delhi, 2007.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
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M.Tech (EPS) II Semester
(4P6225) POWER SYSTEM RELIABILITY
(ELECTIVE-III)

UNIT-I: GENERATING SYSTEM RELIABILITY ANALYSIS – I : Generation system model – capacity outage probability tables – Recursive relation for capacitive model building – sequential addition method – unit removal – Evaluation of loss of load and energy indices – Examples.

UNIT-II: GENERATING SYSTEM RELIABILITY ANALYSIS-II: Frequency and Duration methods – Evaluation of equivalent transitional rates of identical and non-identical units – Evaluation of cumulative probability and cumulative frequency of non- identical generating units – 2- level daily load representation - merging generation and load models – Examples.

UNIT-III: OPERATING RESERVE EVALUATION: Basic concepts - risk indices – PJM methods – security function approach – rapid start and hot reserve units – Modelling using STPM approach. Bulk Power System Reliability Evaluation: Basic configuration – conditional probability approach – system and load point reliability indices – weather effects on transmission lines – Weighted average rate and Markov model – Common mode failures.

UNIT-IV: INTER CONNECTED SYSTEM RELIABILITY ANALYSIS: Probability array method – Two inter connected systems with independent loads – effects of limited and unlimited tie capacity - imperfect tie – Two connected Systems with correlated loads – Expression for cumulative probability and cumulative frequency. Distribution System Reliability Analysis – I (Radial configuration): Basic Techniques – Radial networks – Evaluation of Basic reliability indices, performance indices – load point and system reliability indices – customer oriented, loss and energy oriented indices – Examples.

UNIT-V: DISTRIBUTION SYSTEM RELIABILITY ANALYSIS - II (PARALLEL CONFIGURATION): Basic techniques – inclusion of bus bar failures, scheduled maintenance – temporary and transient failures – weather effects – common mode failures –Evaluation of various indices – Examples Substations and Switching Stations: Effects of short-circuits - breaker operation – Open and Short-circuit failures – Active and Passive failures – switching after faults – circuit breaker model – preventive maintenance – exponential maintenance times.

TEXT BOOKS:

1. Roy Billinton and Ronald N Allen. Reliability Evaluation of Engineering Systems. Plenum press, New York and London (BS Publications Revised edition), 2007.
2. Charles E. Ebeling. An Introduction to Reliability and Maintainability Engineering. TATA McGraw -Hill Edition, 2000.

REFERENCE BOOKS:

1. LS Sainath. *Reliability Engineering*. 3rd Edition Affiliated East West Pvt. Ltd., 1991.
2. BalaguruSwamy. *Reliability Engineering.* TATA McGrawHill Edition. 1984.

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M.Tech (EPS) II Semester

(4P6226) MODERN POWER ELECTRONICS

(Elective-III)

UNIT-I HIGH-POWER SEMICONDUCTOR DEVICES: Introduction, High-Power Switching Devices, Diodes, Silicon-Controlled Rectifier (SCR), Gate Turn-Off (GTO) Thyristor, Gate-Commutated Thyristor (GCT), Insulated Gate Bipolar Transistor (IGBT), Other Switching Devices, Operation of Series-Connected Devices, Main Causes of Voltage Unbalance ,Voltage Equalization for GCTs,

UNIT-II CASCADED H-BRIDGE MULTILEVEL INVERTERS: Introduction, Sinusoidal PWM ,Modulation Scheme ,Harmonic Content, Over modulation,Third Harmonic Injection PWM, Space Vector Modulation , Switching States , Space Vectors, Dwell Time Calculation, Modulation Index , Switching Sequence, Spectrum Analysis, Even-Order Harmonic Elimination, Discontinuous Space Vector Modulation.

Introduction, H-Bridge Inverter, Bipolar Pulse-Width Modulation, Unipolar Pulse-Width Modulation.

UNIT-III DIODE-CLAMPED MULTILEVEL INVERTERS: Three-Level Inverter , Converter Configuration, Switching State ,Commutation, Space Vector Modulation, Stationary Space Vectors , Dwell Time Calculation, Relationship Between *V_ref*Location and Dwell Times, Switching Sequence Design, Inverter Output Waveforms and Harmonic Content , Even-Order Harmonic Elimination, Neutral-Point Voltage Control, Causes of Neutral-Point Voltage Deviation , Effect of Motoring and Regenerative Operation, Feedback Control of Neutral-Point Voltage

UNIT-IV DC-DC SWITCH-MODE CONVERTERS& SWITCHING DC POWER SUPPLIES Control of dc-dc converter,Buck converter, boost converter, buck-boost converter, cuk dc-dc converter, full-bridge dc-dc converter, dc-dc converter comparison.Introduction, linear power supplies, overview of switching power supplies, dc-dc converters with electrical isolation, control of switch mode dc power supplies, power supply protection, and electrical isolation in the feedback loop, designing to meet the power supply specifications.

UNIT-V RESONANT CONVERTERS& POWER CONDITIONERS AND UNINTERRUPTIBLE POWER SUPPLIES Classification of resonant converters, basic resonant circuit concepts, load-resonant converters, resonant-switch converters, zero-voltage-switching, resonant-dc-link inverters with zero-voltage switching's, high frequency-link integral-half cycle converters.Power line disturbances, Introduction to Power Quality, power Conditioners, uninterruptible power supplies, Applications.

TEXT BOOKS:

1. Power electronics circuits, Devices and applications - M.H. Rashid PHI –I edition – 1995.

2. "Power Electronics converters, Applications and Design" Ned Mohan, Tore M. Undeland and William P. Robbins, A John Wiley & Sons, Inc., Publication 3rd Edition.

REFERENCES:

1. **"High-Power Converters And Ac Drives"** Bin Wu,A John Wiley & Sons, Inc., Publication(Free down load from rapidshire.com)

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M.Tech (EPS) II Semester

(4P7222) POWER SYSTEM DYNAMICS
(ELECTIVE-III)

UNIT-I SYNCHRONOUS MACHINE MODELING: Power system stability status of operation and system security, system dynamics problems, system model analysis of steady state stability and transient stability, simplified representation of excitation control.Synchronous Machine modeling – mathematical description of a synchronous machine – The dqo transformation – equivalent circuits for direct and quadrature axes – steady state analysis – electrical transient performance characteristics – equations of motion.

UNIT-II POWER SYSTEM LOADS& SMALL – SIGNAL STABILITY: Power system loads – Basic load modeling concepts – modeling of Induction motors – Synchronous motor model – acquisition of load – model parameters. Small – Signal Stability – fundamental concepts of stability of dynamic systems – Eigen properties of the state matrix – small signal stability of a single machine infinite bus system – effects of excitation system

UNIT-III MODELING OF EXCITATION SYSTEMS: Excitation system requirements, Elements of an excitation system, types of excitation systems-Control and protective functions, Excitation System Modeling, Excitation System Block Diagram.

UNIT-IV TRANSIENT STABILITY ANALYSIS & POWER SYSTEM STABILIZER

Transient Stability – an elementary view of transient stability – numerical integration methods – simulation of power system dynamic response – analysis of unbalanced faults – performance of protective relaying – case study of transient stability a large system – direct method transient stability analysis. Basic Concepts in applying PSS, control signals, Structure and Tu8ning of PSS Washoutcircuit, Dynamic compensator analysis of single machine infinite bus system with and without PSS.

UNIT-V SUB SYNCHRONOUS OSCILLATIONS: Sub synchronous oscillations – turbine generator torsional characteristics – torsional interaction with power system controls – sub synchronous resonance – Impact of network switching disturbances – torsional interaction between closely coupled units – Hydro generator torsional characteristics.

TEXT BOOKS:

1. **"Power System Stability and Control" by** P.Kundur McGraw-Hill Inc.
2. "**P. W. Sauer and M. A. Pai,**" Power System Dynamics and Stability", Stipes Publishing Co, 2007 .

REFERENCES:

1. IEEE Committee Report, "Dynamic Models for Steam and Hydro Turbines in Power System Studies", IEEE Trans., Vol.PAS-92, pp 1904-1915, November/December, 1973. on Turbine- Governor Model.
2. P.M Anderson and A.A Fouad, "Power System Control and Stability", Iowa State University Press, Ames, Iowa, 1978.

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M.Tech (EPS) II Semester

(4P7223) DISTRIBUTION AUTOMATION
(ELECTIVE-IV)

UNIT–I: GENERAL CONCEPTS OF DISTRIBUTION SYSTEMS: Introduction to distribution systems, Load modeling and characteristics. Coincidence factor, contribution factor, loss factor - Relationship between the load factor and loss factor. Classification of loads and their characteristics. Classification of Distribution Systems, Requirements and Design features of Distribution Systems, Numerical Problems.

UNIT – II A.C. DISTRIBUTION SYSTEMS: Design Considerations of Distribution Feeders: Radial and loop types of primary feeders, voltage levels, feeder loading. Voltage Drop Calculations in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages, Numerical Problems. Secondary Distribution System .Objectives of Distribution System Protection, Types of Common Faults and Procedure for Fault Calculations. Protective Devices: Principle of operations, Coordination of Protective Devices, General coordination procedure.

UNIT-III: INTRODUCTION TO DISTRIBUTION AUTOMATION SYSTEMS: Introduction: Need of Distribution Automation, DA concept, Distribution Automation System (DAS), basic architectures and implementation strategies for DA, Functions of DAS, Benefits of DA. SCADA System, Functions of SCADA, SCADA applied to DA.

UNIT–IV INTRODUCTION TO DISTRIBUTION MANAGEMENT SYSTEMS: Distribution Management Systems (DMS), Distribution Management Functions, Focus of DM: real time control, Outage Management, Decision Support Applications, Database Structures And Interfaces. Functionalities of DAS/DMS.

UNIT – V DISTRIBUTION AUTOMATION AND CONTROL FUNCTIONS: Distribution Automation and Control Functions: Introduction, Demand Side Management, Voltage/Var control, Fault Detection, Restoration Function, Reconfiguration of Distribution Systems, Power Quality.

TEXT BOOKS

2. "Electric Power Distribution system, Engineering" – by TuranGonen, McGraw-hill Book Company.
3. "Electric Power Distribution Automation, Protection and Control" –by James A. Momoh, CRC Press, Taylor and Francis, 2008.

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M.Tech (EPS) II Semester

(4P6229) TRANSIENTS IN POWER SYSTEMS
(ELECTIVE-IV)

UNIT I TRAVELLING WAVES ON TRANSMISSION LINE & COMPUTATION OF POWER SYSTEM TRANSIENTS: Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behaviour of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion – Multi-conductor system and Velocity wave. Principle of digital computation – Matrix method of solution, Modal analysis, Z transforms, Computation using EMTP – Simulation of switches and non-linear elements.

UNIT II LIGHTNING SURGES: Review of various types of power system transients - effect of transients on power systems -relevance of the study and computation of power system transients - electrification of thunder clouds - lightning current stages - lightning current parameters and their values - stroke to tower and midspan - induced lightning surges.

UNIT III SWITCHING SURGES: Closing and reclosing of lines - load rejection - fault initiation - fault clearing - short line faults - ferro resonance - isolator switching surges - temporary over voltages - surges on anintegrated systems - switching - harmonics.

UNIT IV IMPULSEVOLTAGES: Generation of high AC and DC-impulse voltages, currents-measurement using sphere gaps-peak vpltmeters-potential dividers and CRO.Initial and Final voltage distribution - Winding oscillation - traveling wave solution - Behaviour of the transformer core under surge condition – Rotating machine – Surge in generator and motor.

UNIT V CURRENT CHOPPING PHENOMENON& INSULATION CO-ORDINATION: Current chopping in circuit breakers. Short line fault condition and its relation to circuit breaker duty. Trapped charge effects. Effect of source and source representation in short line fault studies. Control of transients .Principle of insulation co-ordination in Air Insulated substation (AIS) and Gas Insulated Substation (GIS), insulation level, statistical approach, co-ordination between insulation and protection level – overvoltage protective devices – lightning arresters, substation earthing.

TEXT BOOKS

1. Allan Greenwood, 'Electrical Transients in Power Systems', Willey Inter science, New York, 1971.
2. Klaus Ragaller, 'Surges in High Voltage Networks', Plenum Press, New York, 1980.

REFERENCES

1.W. Diesendorf, 'Over Voltage on High Voltage Systems', Renselaer Bookstore, Troy New York, 1971.
2. H.A. Peterson, 'Transient in Power Systems', Dover Publication, New York, 1963.
3. Rakosh das Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Ltd, 1990.

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M.Tech (EPS) II Semester

(4P622A) RESTRUCTURED POWER SYSTEM
(ELECTIVE-IV)

UNIT I: Key Issues in Electric Utilities: Introduction – Restructuring models – Independent System Operator (ISO) – Power Exchange - Market operations – Market Power – Standard cost – Transmission Pricing – Congestion Pricing – Management of Inter zonal/Intra zonal Congestion. Structure of OASIS - Posting of Information – Transfer capability on OASIS.

UNIT II: Available Transfer Capability (ATC)& Electricity Pricing: Transfer Capability Issues – ATC – TTC – TRM – CBM Calculations – Calculation of ATC based on power flow.Introduction – Electricity Price Volatility Electricity Price Indexes – Challenges to Electricity Pricing – Construction of Forward Price Curves – Short-time Price Forecasting.

UNIT III: Power System Operation in Competitive Environment: Introduction – Operational Planning Activities of ISO- The ISO in Pool Markets – The ISO in Bilateral Markets – Operational Planning Activities of a GENCO.

UNITIV: Market Power& Transmission Congestion Management: Different types of market Power – Mitigation of Market Power - Examples.Introduction - Transmission Cost Allocation Methods : Postage Stamp Rate Method - Contract Path Method - MW-Mile Method – Unused Transmission Capacity Method - MVA-Mile method – Comparison of cost allocation methods.

UNIT V: Ancillary Services Management: Introduction – Reactive Power as an Ancillary Service – a Review – Synchronous Generators as Ancillary Service Providers.

TEXT BOOKS

1. **Operation of Restructured Power System**, Kankar Bhattacharya, Math H.J. Boller and JaapE.DaalderKulwer Academic Publishers, 2001.
2. **Restructured Electrical Power Systems**, Mohammad Shahidehpour and Muwaffaqalomoush, Marcel Dekker, Inc., 2001.

REFERENCES:

1. **Power System Restructuring and Deregulation**, Loi Lei Lai, John Wiley & Sons Ltd.England.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
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M.Tech (EPS) II Semester

(4P622B) POWER SYSTEMS SIMULATION LAB

1. Line Performance of transmission line on MATLAB.
2. Modeling of long transmission line on MATLAB.
3. Simulation of Compensation Techniques of Transmission Line on MATLAB.
4. Y-Bus / Z-Bus formation using MATLAB.
5. Load flow analysis using MATLAB.
6. Develop a program to solve swing equation by point by point method using MATLAB.
7. Step response of two area system with integral control and estimation of tie line power deviation & Frequency deviation using SIMULINK.
8. Transfer function of a given dynamical system from input mode to state variable model and vice versa.
9. Short Circuit Analysis using MATLAB.
10. Transient Stability Analysis Using Equal Area Criterion.
11. Solution of Swing equation by Point By Point Method using MATLAB.
12. PSPICE Simulation of single Phase AC Voltage Controller with RL Load.
13. PSPICE Simulation of single phase full converter using RL and RLE Load.
14. PSPICE Simulation of three phase inverter with PWM controller.
15. PSPICE Simulation of three phase full converter using RL and RLE loads.