ACADEMIC REGULATIONS

COURSE STRUCTURE
AND
DETAILED SYLLABUS

M.Tech (ELECTRICAL POWER SYSTEMS)

(ELECTRICAL & ELECTRONICS ENGINEERING)

M. Tech. Two Year Degree Course

(Applicable for the batches admitted from 2014-15)

(MR-14 Regulations)

MALLA REDDY ENGINEERING COLLEGE

(AUTONOMOUS)

(An Autonomous institution, Autonomy granted by UGC and affiliated to JNTUH, Accredited by NAAC with 'A' Grade, Accredited by NBA (2008-11) & Recipient of World Bank Assistance under TEQIP phase – II S.C.1.1for the period (2011-14))

Maisammaguda, Dhulapally (Post. Via Kompally), Secunderabad – 500 100

Website: www.mrec.ac.in Email: mrec.2002@gmail.com

MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)
Maisammaguda, Dhulapally (Post via. Kompally), Secunderabad – 500100

ACADEMIC REGULATIONS MR 14 FOR M. TECH. (REGULAR) DEGREE COURSE

(Effective for the students admitted into first year from the academic year 2014-2015)

The M.Tech Degree of Malla Reddy Engineering College, Hyderabad shall be conferred on candidates by the Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad who are admitted to the program and fulfill all the requirements for the award of the Degree.

1.0 ELIGIBILITY FOR ADMISSIONS

Admission to the above program shall be made subject to the eligibility, qualifications and Specialization as prescribed by the university/college from time to time.

Admissions shall be made on the basis of merit/rank obtained by the qualifying candidate at an Entrance Test conducted by the University/college or on the basis of any other order of merit approved by the University/college (say **PGECET/GATE)** subject to reservations as laid down by the Government from time to time.

2.0 AWARD OF M. TECH. DEGREE

2.1 A student shall be declared eligible for the award of the M. Tech. Degree, if he pursues a course of study in not less than two and not more than four academic years. 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 COURSES OF STUDY

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

1. Advanced Manufacturing Systems(AMS) - Shift II
2. Computer Science(CSe) - Shift I
3. Computer Science and Engineering(CSE) - Shift I & II
4. Control Systems(CS) - Shift I & II
5. Digital Systems and Computer Electronics(DSCE) - Shift I
6. Electrical Power Systems (EPS) - Shift I
7. Embedded Systems(ES) - Shift I
8. Geotechnical Engineering(GTE) - Shift I
9. Machine Designs (MD) - Shift I
10. Power Electronics and Electrical Drives(PEED) - Shift II
11. Structural Engineering(SE) - Shift I
12. Transportation Engineering(TE) - Shift II
13. Thermal Engineering(THE) - Shift I
14. VLSI System Design(VLSI SD) - Shift I

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

Branch	Specialization	Specialization Code
Civil Engineering	1. Structural Engineering (SE) 2. Transportation Engineering (TE) 3. Geotechnical Engineering (GE)	11 12 13
Electrical and Electronics Engineering	1. Control Systems (CS) 2. Power Electronics and Electrical Drives (PEED) 3. Electrical Power Systems (EPS)	22 23 24
Mechanical Engineering	1. Thermal Engineering (TE) 2. Advanced Manufacturing Systems (AMS) 3. Machine Designs (MD)	31 32 33
Electronics and Communication Engineering	1.Digital Systems and Computer Electronics (DSCE) 2. VLSI System Design (VLSI SD) 3. Embedded Systems (ES)	41 42 43
Computer Science and Engineering	1. Computer Science and Engineering (CSE) 2. Computer Science (CSe)	51 52

4.0 ATTENDANCE

The programs are offered on a unit basis with each subject being considered as 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 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 practical's, 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 2 questions to be answered out of 4 questions each question for 10 marks and Part B with 4 questions to be answered out of 6 questions each question for 5 marks. If any candidate is absent for any subject of a mid -term examination, an additional exam will be conducted in the deserving cases based on the recommendations of the College Academic Committee. End semester examination is conducted for 60 marks with 5 questions to be answered out of 8 questions, each question carries 12 marks.

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 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 after taking up a topic approved by the Project Review Committee (PRC).

6.1 A Project Review Committee shall be constituted with Principal as chair person, Head of the Department, Coordinator, Supervisor 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 (theory and practical subjects).

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 its approval. Only after obtaining the approval of the Departmental Academic Committee can the student initiate the Project work. Departmental Academic Committee (DAC) Consists of Head of the Department as Chairman, along with two Senior Professors and few subject experts too.

6.4 If a candidate wishes to change his supervisor or topic of the project he can do so with approval of Departmental Committee. However, the Departmental Committee shall examine whether the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of topic as the case may be.

6.5 Candidate shall submit 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 in the beginning of the second year and the duration of the project is for two semesters. A candidate is permitted to submit Project Thesis only after successful completion of theory and practical course with 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 shall make an oral presentation/demonstration before the PRC.

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

6.8 The thesis shall be adjudicated by one examiner selected by the College. For this, Head of the Department shall submit a panel of 3 examiners to the Chief Controller of Examinations of the College, who are eminent in that field with the help of the concerned guide and Head of the department.

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

6.10 If the report of the examiner is favorable, Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the Thesis. The Board shall jointly report the candidate's work as one of the following:

A. Excellent
B. Good
C. Satisfactory
D. Not Satisfactory

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 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 unless he is asked to revise and resubmit by the Board.

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 WITH-HOLDING OF RESULTS

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

9.0 TRANSITORY REGULATIONS

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 MR14 academic regulations.

10.0 GENERAL

10.1 The academic regulations should be read as a whole for purpose of any interpretation.
10.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.
10.3The College may change or amend the academic regulations and syllabus at any time and the changes and amendments made shall be applicable to all the students with effect from the date notified by the College.
10.4 Wherever the word he, him or his occur, it will also include she, her and hers.
10.5 Wherever the word 'Subject' occurs in the above regulations, it implies the 'Theory Subject' and 'Practical Subject' or 'Lab'.
10.6 Transfers not allowed among group colleges.

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 mark son 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 shallot 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 tithe 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 the 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 cases 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 toward 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.

MALLA REDDY ENGINEERING COLLEGE (Autonomous)

M.Tech (Electrical Power Systems) MR14

Course Structure and Syllabus

I Year I Semester

Code	Group	Subject	L	P	Credits
42401		Advanced Power System Analysis	3	0	3
42402		Advanced Power System Protection	3	0	3
423D3		Renewable Energy Systems	3	0	3
42303		Modern Control Theory	3	0	3
424A1	Elective –I	High Voltage Engineering	3	0	3
424A2		EHV AC Transmission			
44114		Microcontrollers and Applications			
423C1	Elective -II	Power Quality	3	0	3
423A1		HVDC Transmission			
424B1		Distribution Automation			
42403	Lab	Power Systems Lab-I	0	3	2
42404		Seminar-1	-	-	2
Total Credits			18	3	22

I Year II Semester

Code	Group	Subject	L	P	Credits
42405		Power System Dynamics	3	0	3
42309		Flexible AC Transmission Systems (FACTS)	3	0	3
42406		Power System Operation and Deregulation	3	0	3
42407		AI Techniques in Electrical Power Engineering	3	0	3
424C1	Elective -III	Gas Insulated Systems(GIS)	3	0	3
424C2		Electric Smart Grid			
424C3		Energy Auditing, Conservation and Management			
424D1	Elective –IV	Reactive Power Compensation and Management	3	0	3
424D2		Power System Reliability			
424D3		Voltage Stability			
42408	Lab	Power Systems Lab-II	0	3	2
42409		Seminar-2	-	-	2
Total Credits			18	3	22

II Year I&II Semester

Code	Group	Subject	L	P	Credits
42410		Comprehensive Viva-voce	-	-	4
42411		Project work & Seminar	0	3	40
Total Credits			-	-	44

L- Theory;
T-Tutorial;
P-Practical;

MALLA REDDY ENGINEERING COLLEGE
(Autonomous)

M.Tech (EPS) I year I Semester

L	T/P	C
3	-/-	3

ADVANCED POWER SYSTEM ANALYSIS

Objective: To expose the students with applications of matrices in power systems, which makes the easy computing in power flow studies, short circuit analysis.

UNIT-I Power System Network Matrices-1

Admittance Model and Network Calculations, Branch and Node Admittances, Mutually Coupled Branches in Y_{BUS} , An Equivalent Admittance Network, Modification of Y_{BUS} Network Incidence Matrix and Y_{BUS} , Method of Successive Elimination, Node Elimination, Triangular Factorization, Sparsity and Near Optimal Ordering.

UNIT-II Power System Network Matrices-2

Impedance Model and Network Calculations, the BUS Admittance and Impedance Matrices, Thevenin's Theorem and Z_{BUS} ,Algorithms for building Z_{BUS} Modification of existing $Z_{BUS,}$ Calculation of Z_{BUS} elements from $Y_{BUS,}$ Power Invariant Transformations, Mutually Coupled Branches in $Z_{BUS.}$

UNIT-III Load Flow Studies

Gauss Seidel method, N-R Method, Decoupled method, fast decoupled method, comparison between power flow solutions. DC load flow.

UNIT-IV Contingency Analysis

Z_{BUS} Method in Contingency Analysis, Adding and Removing Multiple Lines, Piecewise Solution of Interconnected Systems, Analysis of Single Contingencies, Analysis of Multiple Contingencies, Contingency Analysis of DC Model, System Reduction for Contingency and Fault Studies.

UNIT-V Fault Analysis

Fault Analysis: Symmetrical faults-Fault calculations using Z_{BUS}- Fault calculations using Z_{BUS} equivalent circuits – Selection of circuit breakers- Unsymmetrical faults-Problems on various types of faults.

TEXT BOOK:

1. Power System Analysis by John J. Grainger and W.D. Stevenson, T.M.H.Edition.

REFERENCE BOOKS*:*

1. Power System Analysis and Design by J.Duncan Glover and M.S.Sarma., Cengage.
2. Electric Energy systems Theory – by O.I.Elgerd, Tata Mc Graw-hill Publishing Company Ltd.,
3. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
4. Power System Analysis by C.L.Wadhwa, New Age International.

MALLA REDDY ENGINEERING COLLEGE
(Autonomous)

M.Tech (EPS) I year I Semester

L	T/P	C
3	-/-	3

ADVANCED POWER SYSTEM PROTECTION

Objective: This course introduces advanced switchgear equipments like static relays, phase comparators, static differential relays, multi input comparators and microprocessor based protective relays.

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. Power System Protection and Switchgear by Badri Ram and D.N.Vishwakarma, TMH publication.

REFERENCE BOOKS:

1. Static Relays by T.S.Madhava Rao, TMH publication.
2. Protection and Switchgear, Bhavesh Bhalja, R. P. Mahesheari, Nilesh G. Chothani, Oxford University Press.
3. Electrical Power System Protection, C. Christopoulos and A. Wright, Springer International.

2014-15 **CODE: 423D3**

MALLA REDDY ENGINEERING COLLEGE
(Autonomous)

M.Tech (EPS) I year I Semester

L	T/P	C
3	-/-	3

RENEWABLE ENERGY SYSTEMS

Objective: To understand the operation of Photo voltaic power Generation, Principles of MHD power generation, Tides and Tidal power and types of fuel cells.

UNIT-I PHOTOVOLTAIC POWER GENERATION

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 MHD & WIND POWER GENERATION

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 TIDAL POWER GENERATION

Tides and tidal power stations, modes of operation, tidal project examples, turbines and generators for tidal power generation.
Wave Energy Conversion: properties of waves and power content, vertex motion of Waves, device applications. Types of ocean thermal energy conversion systems. Application of OTEC systems examples.

UNIT-IV MISCELLANEOUS ENERGY CONVERSION SYSTEMS

Coal gasification and liquefaction, biomass conversion, geothermal energy, thermo electric energy conversion, principles of EMF generation, description of fuel cells, Co-generation and energy storage, combined cycle co-generation, energy storage.
Global Energy Position and Environmental Effects: energy units, global energy position.

UNIT-V 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.
2. Renewable Energy Resources by John Twidell and Tony Weir, Fspon & Co

2014-15 **CODE: 42303**

MALLA REDDY ENGINEERING COLLEGE
(Autonomous)

M.Tech (EPS) I year I Semester

L	T/P	C
3	-/-	3

MODERN CONTROL THEORY

Objective: To understand the concepts of controllability and observability, analysis of state variables, Concept of State Feedback Controllers and Basic concept of Optimal control problems

UNIT-I MATHEMATICAL PRELIMINARIES

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

UNIT-II STATE VARIABLE ANALYSIS

Linear Continuous time models for Physical systems– Existence and Uniqueness of Solutions to Continuous-Time State Equations – Solutions of Linear Time Invariant Continuous-Time State Equations – State transition matrix and its properties. General concept of controllability – General concept of Observability – Controllability tests for Continuous-Time Invariant Systems – Observability tests for Continuous-Time Invariant Systems – Controllability and Observability of State Model in Jordan Canonical form – Controllability and Observability Canonical forms of State model.

UNIT-III NON LINEAR SYSTEMS -I

Introduction – Non Linear Systems - Types of Non-Linearity – 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 non-linear control systems.

UNIT- IV STABILITY ANALYSIS

Stability in the sense of Lyapunov, Lyapunov's stability and Lypanov's instability theorems - Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method – Generation of Lyapunov functions – Variable gradient method – Krasooviski's method. State feedback controller design through Pole Assignment – State observers: Full order and Reduced order

UNIT-V OPTIMAL CONTROL

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Optimal Control by Kircks, Dover Publications

2014-15 **CODE: 424A1**

MALLA REDDY ENGINEERING COLLEGE
(Autonomous)

M.Tech (EPS) I year I Semester

L	T/P	C
3	-/-	3

HIGH VOLTAGE ENGINEERING
(Elective-I)

Objective: This subject deals with the detailed analysis of breakdown occur in gaseous, liquids and solid dielectrics. Information about generation and measurement of High voltage and current. In addition the high voltage testing methods are also discussed.

UNIT- I INTRODUCTION TO HIGH VOLATGE ENGINEERING

Electric Field Stresses, Gas / Vacuum as Insulator, Liquid Dielectrics, Solids and Composites, Estimation and Control of Electric Stress, Numerical methods for electric field computation, Surge voltages, their distribution and control, Applications of insulating materials in transformers, rotating machines, circuit breakers, cable power capacitors and bushings.

UNIT- II BREAK DOWN IN DIELECTRIC MATERIALS

Gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law. Liquid as Insulator, pure and commercial liquids, breakdown in pure and commercial liquids. Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, Breakdown in composite dielectrics, solid dielectrics used in practice.

UNIT-III GENERATION & MEASUREMENT OFHIGH VOLTAGES & CURRENTS

Generation of High Direct Current Voltages, Generation of High alternating voltages, Generation of Impulse Voltages, Generation of Impulse currents, Tripping and control of impulse generators. Measurement of High Direct Current voltages, Measurement of High Voltages alternating and impulse, Measurement of High Currents-direct, alternating and Impulse, Oscilloscope for impulse voltage and current measurements.

UNIT-IV OVER VOLTAGES & INSULATION CO-ORDINATION

Natural causes for over voltages – Lightning phenomenon, Overvoltage due to switching surges, system faults and other abnormal conditions, Principles of Insulation Coordination on High voltage and Extra High Voltage power systems.

UNIT- V TESTING OF MATERIALS & ELECTRICAL APPARATUS

Measurement of D.C Resistivity, Measurement of Dielectric Constant and loss factor, Partial discharge measurements. Testing of Insulators and bushings, Testing of Isolators and circuit breakers, testing of cables, Testing of Transformers, Testing of Surge Arresters, and Radio Interference measurements.

TEXT BOOKS:

1. High Voltage Engineering by M.S.Naidu and V. Kamaraju, TMH Publications, 3rd Edition
2. High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl, J.Kuffel, Elsevier, 2nd Edition.

REFERENCE BOOKS:

1. High Voltage Engineering by C.L.Wadhwa, New Age Internationals (P) Limited.
2. High Voltage Insulation Engineering by Ravindra Arora, Wolfgang Mosch, New Age International (P) Limited.

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MALLA REDDY ENGINEERING COLLEGE
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M.Tech (EPS) I year I Semester

L	T/P	C
3	-/-	3

EHV AC TRANSMISSION
(Elective-I)

Objective: This subject deals with the necessity of EHV AC transmission and modes of propagation with examples. It also discussed with corona effects, voltage control and travelling wave theory.

UNIT- I E.H.V.A.C. TRANSMISSION
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
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 UN-ENERGIZED LINES
Electrostatic induction in un-energized 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 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
Design of EHV lines based on steady state and transient limits - EHV cables and their characteristics.

TEXT BOOKS:

1. EHVAC Transmission Engineering by R. D. Begamudre, New Age International (p) Ltd.
2. HVAC and DC Transmission by S. Rao, Khanna Publisher.

REFERENCE BOOKS:

1. Extra High Voltage AC Transmission Engineering, Rokosh Das Begamudre, Wiley Eastern LTD.
2. EHV Transmission Line by Edison, Electric Institution (GEC 1968).

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3	-/-	3

MICROCONTROLLERS AND APPLICATIONS
(Elective-I)

Objective: To develop an in-depth understanding of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques.

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. Microcontrollers Architecture, Programming, Interfacing and System Design by Raj Kamal, Pearson Education.
2. The 8051 Microcontroller and Embedded Systems, Mazidi and Mazidi, PHI.

REFERENCE BOOKS:
1. Microcontrollers (Theory & Applications) byA.V. Deshmuk, WTMH.
2. Design with PIC Microcontrollers by John B. Peatman, Pearson Education.

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M.Tech (EPS) I year I Semester

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3	-/-	3

POWER QUALITY
(Elective – II)

Objective: To understand the basic concepts of Power Quality problems, Long & Short interruptions, Characteristics of Single phase and 3- phase Voltage Sag, Industrial Power Quality analysis,

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

UNIT-II LONG & SHORT INTERRUPTIONS
Interruptions – Definition – Difference between failures, outage, Interruptions – causes of Long Interruptions – Origin of Interruptions – Limits for the Interruption frequency – Limits for the interruption duration – costs of Interruption – Overview of Reliability evaluation to power quality, comparison of observations and reliability evaluation.
Short Interruptions: definition, origin of short interruptions, basic principle, fuse saving, voltage magnitude events due to re-closing, voltage during the interruption, monitoring of short interruptions, difference between medium and low voltage systems. Multiple events, single phase tripping – voltage and current during fault period, voltage and current at post fault period, stochastic prediction of short interruptions.

UNIT III 1 & 3-PHASE VOLTAGE SAG CHARACTERIZATION
Voltage sag – definition, causes of voltage sag, voltage sag magnitude, and monitoring, theoretical calculation of voltage sag magnitude, voltage sag calculation in non-radial systems, meshed systems, and voltage sag duration.
Three phase faults, phase angle jumps, magnitude and phase angle jumps for three phase unbalanced sags, load influence on voltage sags.

UNIT-IV POWER QUALITY CONSIDERATIONS IN INDUSTRIAL POWER SYSTEMS
Voltage sag – equipment behavior of Power electronic loads, induction motors, synchronous motors, computers, consumer electronics, adjustable speed AC drives and its operation.
Mitigation of AC Drives, adjustable speed DC drives and its operation, mitigation methods of DC drives.

UNIT-V MITIGATION OF INTERRUPTIONS & VOLTAGE SAGS
Overview of mitigation methods – from fault to trip, reducing the number of faults, reducing the fault clearing time changing the power system, installing mitigation equipment, improving equipment immunity, different events and mitigation methods. System equipment interface – voltage source converter, series voltage controller, shunt controller, combined shunt and series controller.
Power Quality and EMC Standards**:** Introduction to standardization, IEC Electromagnetic compatibility standards, European voltage characteristics standards, PQ surveys.

TEXT BOOKS:
1. Understanding Power Quality Problems - Math H J Bollen, IEEE Press.

REFERENCE BOOK:
1. Power Quality VAR Compensation in Power Systems by R. SastryVedam, CRC Press.
2. Power Quality by C. Sankaran, CRC Presss.
3. Electrical Power Systems Quality by Roger C. Dugan, Mark F. Mc Granaghan, Surya Santoso, H. Wayne Beaty, Tata McGraw Hill Education Private Ltd.

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HVDC TRANSMISSION
(Elective-II)

Objective: To understand the basic concept of HVDC transmission, Control of HVDC converter systems and Basic Faults and Protection of HVDC system

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 HVAC and HVDC 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.

TEXT BOOKS:
1. HVDC Transmission by J. Arillaga- Peter Peregrinus ltd- London UK- 1983
2. Direct Current Transmission by E.W. Kimbark- Wiely Inter Science – New York.
3. High Voltage Direct Current Transmission by KR Padiyar - Wiely Esatern Ltd -New Delhi – 1992.
4. Power Transmission by Direct Current by E. Uhlman - Springer Verlag- Berlin Helberg. 1985.

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M.Tech (EPS) I year I Semester

L	T/P	C
3	-/-	3

DISTRIBUTION AUTOMATION
(Elective-II)

Objective: To understand the importance of distribution automation in distribution system and to know about the functions of distribution automation, technical benefits and economic evolution methods.

UNIT-I DISTRIBUTION AUTOMATION AND THE UTILITY SYSTEM
Introduction to Distribution Automation (DA), control system interfaces, control and data requirements, centralized (Vs) decentralized control, DA System (DAS), DA Hardware, DAS software.

UNIT-II DISTRIBUTION AUTOMATION FUNCTIONS
DA capabilities, Automation system computer facilities, management processes, Information management, system reliability management, system efficiency management, voltage management, Load management.

UNIT-III COMMUNICATION SYSTEMS FOR DA
DA communication requirements, Communication reliability, Cost effectiveness, Data rate Requirements, Two way capability, Ability to communicate during outages and faults, Ease of operation and maintenance, Conforming to the architecture of data flow

Communication systems used in DA : Distribution line carrier (Power line carrier), Ripple control, Zero crossing technique, telephone, cable TV, Radio, AM broadcast, FM SCA, VHF Radio, UHF Radio, Microwave satellite. Fiber optics, Hybrid Communication systems, Communication systems used in field tests.

UNIT-IV TECHNICAL BENEFITS
DA benefit categories, Capital deferred savings, Operation and Maintenance savings, Interruption related savings, Customer related savings, Operational savings, improved operation, Function benefits, Potential benefits for functions, and function shared benefits, Guidelines for formulation of estimating equations, Parameters required, economic impact areas, Resources for determining benefits, impact on distribution system, integration of benefits into economic evaluation.

UNIT-V ECONOMIC EVALUATION METHODS
Development and evaluation of alternate plans, Select study area, Select study period, Project load growth, Develop Alternatives, Calculate operating and maintenance costs, Evaluate alternatives. Economic comparison of alternate plans, Classification of expenses and capital expenditures, Comparison of revenue requirements of alternative plans, Book Life and Continuing plant analysis, Year by year revenue requirement analysis, short term analysis, end of study adjustment, Break even analysis, Sensitivity analysis computational aids.

REFERENCES:
1. IEEE Tutorial Course “Distribution Automation”
2. IEEE Working Group on “Distribution Automation”
3. Control and Automation of Electrical Distribution Systems by James. Northcote – Green Robert Wilson, CRC Press.
4. Electric Power Distribution Automation by Dr. M. K. Khedkar and Dr. G.M.Dhole, University Science press.

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POWER SYSTEMS LAB – I

1. Develop MATLAB program for Y_{BUS} formation.
2. Develop MATLAB program for G-S Load Flow Analysis.
3. Develop MATLAB program for N-R Load Flow Analysis.
4. Develop MATLAB program for FDLF Load Flow Analysis.
5. Develop MATLAB program for Short Circuit Analysis.
6. Transient Stability Analysis for Single Machine connected to Infinite Bus by Point by Point Method.
7. Develop PSPICE Program for Generation System Reliability Analysis.
8. Develop PSPICE Program for Distribution System Reliability Analysis.
9. Simulation of RLC Circuit using PSPICE.
10. Simulation of Single Phase Full Converter with RLE Load using PSPICE
11. Develop MATLAB model for Closed Loop Speed Control of Separately Excited D.C Motor.
12. Develop MATLAB model for Sinusoidal Pulse Width Modulation.

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POWER SYSTEM DYNAMICS

Objective: To understand the basic concepts of power system stability and system security, importance of modeling of synchronous machine, excitation system, application of power system stabilizers.

UNIT-I BASIC CONCEPTS

Power system stability, states of operation and system security - system dynamics – problems, system model analysis of steady state stability and transient stability - simplified representation of Excitation control.

UNIT-II MODELING OF SYNCHRONOUS MACHINE

Synchronous machine - park's Transformation-analysis of steady state performance, per unit quantities-Equivalent circuits of synchronous machine-determination of parameters of equivalent circuits.

UNIT-III EXCITATION SYSTEM

Excitation system modeling-excitation systems block Diagram - system representation by state equations- Dynamics of a synchronous generator connected to infinite bus - system model Synchronous machine model-stator equations, rotor equations - Synchronous machine model with field circuit - one equivalent damper winding on q axis (model 1.1) - calculation of Initial conditions.

UNIT-IV ANALYSIS OF SINGLE MACHINE SYSTEM

Small signal analysis with block diagram - Representation Characteristic equation and application of Routh- Hurwitz criterion- synchronizing and damping torque analysis-small signal model - State equations.

UNIT-V APPLICATION OF POWER SYSTEM STABILIZERS

Basic concepts in applying PSS - Control signals - Structure and tuning of PSS - Washout circuit - Dynamic compensator analysis of single machine infinite bus system with and without PSS.

TEXT BOOK:

1. Power system dynamics by K.R. Padiyar, B.S. Publications.

REFERENCE BOOKS:

1. Power system control and stability by P.M. Anderson and A.A. Fouad, IEEE Press.
2. Power Systems Dynamics by R. Ramanujam, PHI Publications.

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FLEXIBLE AC TRANSMISSION SYSTEMS (FACTS)

Objectives: To understand basic concepts of FACTS, Voltage Source Converters, Analysis of Static shunt and series compensation and STATCOM including types**.**

UNIT-I FACTS CONCEPTS

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

UNIT-II VOLTAGE SOURCE CONVERTERS

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

UNIT-III STATIC SHUNT COMPENSATION

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

UNIT-IV SVC AND STATCOM

The regulation and slope transfer function and dynamic performance, transient stability enhancement and power oscillation, damping operating point control and summary of compensator control.

UNIT-V STATIC SERIES COMPENSATORS

Concept of series capacitive compensation, improvement of transient stability, power oscillation damping, and functional requirements of GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC), Control schemes for GSC, TSSC and TCSC.

TEXT BOOKS:

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

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POWER SYSTEM OPERATION AND DEREGULATION

Objective: To study about optimal power flow, importance of power system security and state estimation power system, need of power system deregulation and available transfer capability.

UNIT- I OPTIMAL POWER FLOW

Introduction- Solution to the optimal power flow-gradient method-Newton's method-Linear sensitivity analysis- Linear programming methods- Security constrained OPF-Interior point algorithm- Bus incremental costs

UNIT-II POWER SYSTEM SECURITY

Introduction –Factors affecting power system security-Contingency analysis-Detection of network problems-Linear sensitivity analysis-AC power flow methods-contingency selection-concentric relaxation-Bounding area method

UNIT-III STATE ESTIMATION IN POWER SYSTEMS

Introduction- Power system state estimation- Maximum likelihood Weighted Least squares estimation-Matrix formulation- State estimation of AC network- State estimation by orthogonal decomposition- detection and identification of Bad measurements- Estimation of quantities not being measured- Network observability and pseudo measurements

UNIT-IV POWER SYSTEM DEREGULATION

Introduction- motivation for restructuring of power systems- Electricity market entities model-benefits of deregulation-terminology-deregulation in Indian power sector-Operations in power markets-power pools-transmission networks and electricity markets.

UNIT-V AVAILABLE TRANSFER CAPABILITY

Introduction methods: of determination of ATC - ATC calculation considering the effect of contingency analysis-Transmission open access and pricing-cost components of transmission system- transmission pricing methods-Incremental cost based transmission pricing.

TEXT BOOKS:

1. Power Generation Operation and Control by A.J.Wood & B.F.Woollenberg, John Wiley.
2. Electrical power systems: Analysis, security, Deregulation by P.Venkatesh. B.V.Manikandan, S.Charles Raja-A.Srinivasan, PHI.

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M.Tech (EPS) I year II Semester

L	T/P	C
3	-/-	3

AI TECHNIQUES IN ELECTRICAL POWER ENGINEERING

Objective: To study about basics of artificial neural networks, fuzzy logic and genetic algorithms, it also discuss about the applications of AI techniques in power systems.

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 –Boltzman 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. Neural Networks, Fuzzy Logic & Genetic Algorithms by S.Rajasekaran and G.A.V.Pai, PHI, New Delhi, 2003.

REFERENCE BOOKS:

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

2014-15 **CODE: 424C1**

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M.Tech (EPS) I year II Semester

L	T/P	C
3	-/-	3

GAS INSULATED SYSTEMS (GIS)
(Elective–III)

Objective: To study about the design and construction of gas insulated sub stations, lay out of GIS stations, special problems in GIS and GIS diagnostics.

UNIT–I INTRODUCTION TO GIS AND PROPERTIES 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 PHENOMENA IN GIS
Introduction- Disconnect or 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. Gas Insulated Substations by M. S. Naidu, IK International Publishing House.

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3	-/-	3

ELECTRIC SMART GRID
(Elective – III)

Objective: To study about the basic concepts of smart grid, dc distribution and smart grid, smart energy efficient end use devices and efficient electric end –use technology alternatives.

UNIT–I INTRODUCTION

Introduction to smart grid- Electricity network-Local energy networks- Electric transportation- Low carbon central generation-Attributes of the smart grid- Alternate views of a smart grid.

Smart Grid to Evolve a Perfect Power System: Introduction- Overview of the perfect power system configurations-Device level power system- Building integrated power systems- Distributed power systems- Fully integrated power system-Nodes of innovation.

UNIT–II: DC DISTRIBUTION AND SMART GRID

AC versus DC sources-Benefits of and Drives of DC power delivery systems-Powering equipment and appliances with DC-Data centers and information technology loads-Future neighborhood-Potential future work and research.

Intelligrid Architecture for the Smart Grid: Introduction- Launching intelligrid-Intelligrid today- Smart grid vision based on the intelligrid architecture-Barriers and enabling technologies.

UNIT–III DYNAMIC ENERGY SYSTEMS CONCEPT

Smart energy efficient end use devices-Smart distributed energy resources-Advanced whole building control systems-Integrated communications architecture-Energy management-Role of technology in demand response- Current limitations to dynamic energy management-Distributed energy resources-Overview of a dynamic energy management-Key characteristics of smart devices- Key characteristics of advanced whole building control systems-Key characteristics of dynamic energy management system.

UNIT–IV ENERGY PORT AS PART OF THE SMART GRID

Concept of energy -Port, generic features of the energy port.

Policies and Programs to Encourage End – Use Energy Efficiency: Policies and programs in action -multinational -national-state-city and corporate levels.

Market Implementation: Framework-factors influencing customer acceptance and response-program planning-monitoring and evaluation.

UNIT–V EFFICIENT ELECTRIC END – USE TECHNOLOGY ALTERNATIVES

Existing technologies – lighting - Space conditioning - Indoor air quality - Domestic water heating - hyper efficient appliances - Ductless residential heat pumps and air conditioners - Variable refrigerant flow air conditioning-Heat pump water heating - Hyper efficient residential appliances - Data center energy efficiency- LED street and area lighting - Industrial motors and drives - Equipment retrofit and replacement - Process heating - Cogeneration, Thermal energy storage - Industrial energy management programs - Manufacturing process-Electro-technologies, Residential, Commercial and industrial sectors.

TEXT BOOKS:

1. The Smart Grid, Enabling Energy Efficiency and Demand Side Response by Clark W Gellings, CRC Press, 2009
2. Smart Grid: Technology and Applications by Yokoyama, Nick Jenkins, Wiley, 2012.
3. Smart Grid: Fundamentals of Design and Analysis by James Momoh, Wiely IEEE Press.

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ENERGY AUDITING, CONSERVATION AND MANAGEMENT
(Elective-III)

Objective: To study about the basic principles of energy audit and energy management, and also discuss about power factor improvement and economic aspects and analysis.

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, LIGHTING AND ENERGY INSTRUMENTS
Power factor – methods of improvement, location of capacitors, Pf with non linear loads, effect of harmonics on power factor, power factor motor controllers - Good lighting system design and practice, lighting control ,lighting energy audit - Energy Instruments- wattmeter, 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, 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 .

REFERENCE BOOKS:
1. Energy management by W.R. Murphy AND G. Mckay Butter worth, Heinemann publications.
2. Energy management by Paul o' Callaghan, Mc-graw Hill Book company-1st edition, 1998
3. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd-2nd edition, 1995-
4. Energy management hand book by W.C.Turner, John wiley and sons
5. Energy management and good lighting practice : fuel efficiency- booklet12-EEO

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3	-/-	3

REACTIVE POWER COMPENSATION AND MANAGEMENT
(Elective-IV)

Objective: To study about the load compensation in transmission system, reactive power coordination, demand side management and consumer side reactive power 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 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 systems:

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
2. Reactive Power Management by D.M.Tagare,Tata McGraw Hill,2004.

2014-15 **CODE: 424D2**

MALLA REDDY ENGINEERING COLLEGE
(Autonomous)

M.Tech (EPS) I year II Semester

L	T/P	C
3	-/-	3

POWER SYSTEM RELIABILITY
(Elective-IV)

Objective: To study about system reliability analysis, operating reserve evolution, inter connected system reliability and distribution system reliability analysis.

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 – Modeling 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.

REFERENCE BOOKS:

1. Reliability Evaluation of Power Systems by Roy Billinton and Ronald N. Allan, Plenum press, New York and London (Second Edition), 1996.
2. Reliability Modeling in Electric Power Systems by J. Endrenyi, John Wiley and Sons, 1978. (First Edition)

2014-15 **CODE: 424D3**

MALLA REDDY ENGINEERING COLLEGE
(Autonomous)

M.Tech (EPS) I year II Semester

L	T/P	C
3	-/-	3

VOLTAGE STABILITY
(Elective – IV)

Objective: Introduction voltage stability, study of graphical analysis of voltage stability, power system loads and voltage stability margin.

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; OLTCs; 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 BOOK:

1. Power System Voltage Stability by C.W.Taylor, Mc Graw Hill, 1994.

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MALLA REDDY ENGINEERING COLLEGE
(Autonomous)

M.Tech(EPS) I year II Semester

L	T/P	C
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POWER SYSTEMS LAB – II

1. Determination of Equivalent circuit of a 3-Winding Transformer.
2. Determination of Sequence Impedances of a Cylindrical Rotor Synchronous Machine.
3. Fault Analysis:
    a. Single Line to Ground fault (L-G).
    b. Line to Line fault (L-L).
    c. Double Line to Ground fault (L-L-G).
    d. Triple Line to Ground fault (L-L-L-G).
4. Determination of Sub-transient reactance's of a Salient Pole Synchronous Machine.
5. Determination of Sequence Impedances of Three Phase Transformer
6. Characteristics of Over Current Relays
    a. IDMT Electromagnetic Relay (7051 A).
    b. Microprocessor based Relay (7051 B)
7. Characteristics of Percentage biased Differential Relay.
    a. Electromagnetic Relay (7054 A).
    b. Static Relay (7054 B).
8. Characteristics of Over Voltage Relay.
    a. Electromagnetic Relay (7053 A).
    b. Microprocessor based Relay (7053 B).
9. Characteristics of Under Voltage (UV) and Negative sequence Relays
    a. UV Electromagnetic Relay (7052 A).
    b. UV Microprocessor based Relay (7052 B).
    c. Static Negative Sequence Relay (7055 B).
10. Performance and Testing of Generator Protection System.
11. Performance and Testing of Transformer Protection System.
12. Performance and Testing of Feeder Protection System.
13. Performance and Testing of Transmission Line Model.
14. Differential protection on Single Phase Transformer.