ACADEMIC REGULATIONS, COURSE STRUCTURE AND DETAILED SYLLABUS

From the Academic Year 2020-21 onwards

M. Tech. Two Year Degree Course

(MR20 Regulations)

in

Electrical Power Systems (EPS)

Department of Electrical & Electronics Engineering

MALLA REDDY ENGINEERING COLLEGE (Autonomous)

(An UGC Autonomous Institution, Approved by AICTE and Affiliated to JNTUH Hyderabad,
Recognized under 2(f) &12 (B) of UGC Act 1956, Accredited by NBA & NAAC with 'A' Grade (II Cycle)
Maisammaguda, Dhulapally (Post Via Kompally), Secunderabad-500 100
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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

MR18 ACADEMIC REGULATIONS (CBCS)

For M. Tech. (REGULAR) DEGREE PROGRAMME

Applicable for the students of M. Tech. (Regular) programme admitted from the Academic Year ***2020-21*** and onwards.

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

INSTITUTION VISION

To be a premier center of professional education and research, offering quality programs in a socio-economic and ethical ambience.

INSTITUTION MISSION

- To impart knowledge of advanced technologies using state-of-the-art infrastructural facilities.
- To inculcate innovation and best practices in education, training and research.
- To meet changing socio-economic needs in an ethical ambience.

DEPARTMENT VISION

To become a reputed centre for imparting quality education and research in the field of Electrical and Electronics Engineering with human values, ethics and social responsibility.

DEPARTMENT MISSION

- To impart quality education and research to undergraduate and postgraduate students in Electrical and Electronics Engineering.
- To produce professionally competent and ethically committed engineers to meet changing socio-economic needs.
- To impart knowledge of advanced technologies for continual improvement in teaching, learning and research.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1 : Graduates are competent enough to meet the industrial requirements, have a better career and pursue higher studies in electrical power systems.

PEO2 : Graduates are kindled to foresee the technical challenges in power system and optimal ways to handle them through research for the benefit of the society.

PEO3 : Graduates are able to explore their skills to invent, design and realize new technology.

PEO4 : Graduates are capable of working in a team to accomplish the professional and organizational goals with ethical and moral values.

PEO5 : Graduates keep themselves abreast of emerging technologies, continually learn new skills to nourish ever-developing careers.

PROGRAMME OUTCOMES (POs)

PO1: An ability to independently carry out research /investigation and development work to solve practical problems

PO2: An ability to write and present a substantial technical report/document

PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

PO4: Ability to develop innovative thinking in solving Engineering problems.

PO5: Engage in Life-long learning independently with a high level of passion and profession.

PO6: Apply contextual Knowledge to axis societal, safety legal issues, relevant to professional Engineering.

1.0 **Post-Graduate Degree Programmes in Engineering & Technology (PGP in E&T) Malla Reddy Engineering College (Autonomous) (MREC-A)** offers **Two** Year (**Four** Semesters) full-time **Master of Technology (M. Tech.)** Post Graduate programmes, under Choice Based Credit System (CBCS) in different branches of Engineering and Technology with different specializations.

2.0 Eligibility for Admissions:

2.1 Admission to the above programme shall be made subject to eligibility, qualification and specialization as prescribed by the Affiliating University from time to time. Admissions shall be made on the basis of merit/rank obtained by the candidates at the qualifying Entrance Test conducted by the Government of Telangana or on the basis of any other order of merit as approved by the University, subject to reservations as laid down by the Govt. from time to time.

2.2 The medium of instructions for all PG Programmes will be **ENGLISH** only.

3.0 M.Tech. Programme (PGP in E&T) Structure and Award of Degree:

3.1 The M.Tech. Programmes in E & T are of Semester pattern, with **Four** Semesters consisting of **Two** academic years, each academic year having **Two** Semesters (First/ Odd and Second/ Even Semesters). Each Semester shall be of 22 weeks duration (inclusive of Examinations), with a minimum of 90 instructional days per Semester.

3.2 A student shall be declared eligible for the award of the M.Tech. Degree, if the student pursues a course of study in not less than two and not more than four academic years. However, the student is permitted to write the examinations for two more years after four academic years of course work, failing which the student shall forfeit the seat in M. Tech. programme.

3.3 The student shall register for all **68** credits and secure all the **68** credits.

3.4 **UGC/ AICTE** specified definitions/ descriptions are adopted appropriately for various terms
and Abbreviations used in these PG academic regulations, as listed below:

3.4.1 Semester Scheme

Each Semester shall have 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) are taken as 'references' for the present set of Regulations. The terms 'SUBJECT' and 'COURSE' imply the same meaning here and refer to 'Theory Subject', or 'Lab Course', or 'Design/ Drawing Subject', or 'Seminar', or 'Project', or "Technical Paper Writing" as the case may be.

3.4.2 Credit Courses

All subjects/courses are to be registered by the student in a semester to earn credits which shall be assigned to each subject/course in an L: T: P: C (Lecture Periods: Tutorial Periods: Practical Periods: Credits) structure based on the following general pattern:

- One credit for one hour/week/semester for theory/lecture (L) / tutorials (T) courses
- One credit for two hours/ week/semester for laboratory/ practical (P) courses

Other student activities like study tour, guest lecture, conference/workshop participations, technical paper presentations, and identified mandatory/audit courses, if any, will not carry credits.

3.4.3 Subject / Course Classification

All subjects / courses offered for the Post-Graduate Programme in E & T (M.Tech Degree Programme) are broadly classified as follows. The Institution has followed in general, the guidelines issued by AICTE/UGC.

S.No	Broad Course Classification	Course Group/ Category	Course Description
1	Core Courses (CC)	PC- Professional Core	Includes subjects related to the parent discipline/ department/ branch of Engineering
		Project Work	M.Tech Project / Dissertation
		Seminar	Seminar/ Colloquium based on core contents related to parent discipline/ department/ branch of Engineering
2	Elective Courses (EC)	PE - Professional Electives	Includes elective subjects related to the parent discipline/ department/ branch of Engineering
		OE - Open Electives	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering
3	Audit Courses (AC)	Audit Courses	These courses are non-credit courses without evaluation.
Total Number of Credits – 68 credits			

3.4.4 Courses of Study:

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

S.No.	Dept.	Specialization Code	Specialization	Intake
1	CE	11	Structural Engineering (SE)	30
2	EEE	24	Electrical Power Systems (EPS)	30
3	ME	31	Thermal Engineering (TE)	30
4		33	Machine Design (MD)	30
5	ECE	41	VLSI and Embedded Systems	30
6	CSE	51	Computer Science and Engineering (CSE)	30

Any other programme as approved by the University from time to time.

4 Course Registration:

4.1 A 'Faculty Advisor or Counselor' shall be assigned to each student, who will advise him on the Post Graduate Programme (PGP), its Course Structure and Curriculum, Choice/ Option for Subjects/ Courses, based on his competence, progress, pre-requisites and interest.

4.2 The Academic Section of the College invites 'Registration Forms' from students within 15 days from the commencement of class work for the first semester through 'ON-LINE SUBMISSIONS', ensuring 'DATE and TIME Stamping'. The ON-LINE Registration Requests for any 'SUBSEQUENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'CURRENT SEMESTER'.

4.3 A Student can apply for ON-LINE Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from the Faculty Advisor, which should be submitted to the College Academic Section through the Head of Department (a copy of it being retained with Head of Department, Faculty Advisor and the Student).

4.4 If the Student submits ambiguous choices or multiple options or erroneous entries during ON-LINE Registration for the Subject(s) / Course(s) under a given/ specified Course Group/ Category as listed in the Course Structure, only the first mentioned Subject/ Course in that Category will be taken into consideration.

4.5 Subject/ Course Options exercised through ON-LINE Registration are final and CANNOT be changed, nor can they be inter-changed; further, alternate choices will also not be considered. However, if the Subject/ Course that has already been listed for Registration (by the Head of Department) in a Semester could not be offered due to any unforeseen or unexpected reasons, then the Student shall be allowed to have alternate choice - either for a new Subject (subject to offering of such a Subject), or for another existing Subject (subject to availability of seats), which may be considered. Such alternate arrangements will be made by the Head of Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that Semester.

5 Attendance Requirements:

The programmes are offered on a module basis with each subject/course being considered as a module.

5.1 Attendance in all classes (Theory/Laboratories/Seminar/Project Work) is compulsory. The minimum required attendance in each theory / Laboratory etc. is 75% including the attendance of mid-term examination / Laboratory and the days of attendance in sports, games, NCC and NSS activities for appearing for the Semester End Examination (SEE). A student shall not be permitted to appear for the Semester End Examinations (SEE) if his attendance is less than 75%.

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

5.3 Shortage of Attendance below 65% in each subject shall not be condoned.

5.4 Students whose shortage of attendance is not condoned in any subject are not eligible to write their Semester End Examination of that subject and their registration shall stand cancelled.

5.5 A stipulated fee prescribed by the CAC, shall be payable towards Condonation for shortage of attendance.

5.6 A candidate shall put in a minimum required attendance in at least three (3) theory subjects in I Year I semester for promoting to I Year II Semester. In order to qualify for the award of the M.Tech. Degree, the candidate shall complete all the academic requirements of the subjects, as per the course structure.

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

6 Academic Requirements:

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item 5.

6.1 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 Semester End Examination and a minimum of 50% of the total marks in the Semester End Examination and Continuous Internal Evaluation taken together. In case the candidate does not secure the minimum academic requirement in any subject he has to reappear for the Semester End Examination in that subject. A candidate shall be given one chance to re-register for the subject if the internal marks secured by the candidate are less than 50% and failed in that subject. This is allowed for a maximum of three subjects and should register within two weeks of commencement of that semester class work. In such a case, the candidate must re-register for the subjects and secure the required minimum attendance. The candidate's attendance in the re-registered subject(s) shall be calculated separately to decide upon the eligibility for writing the Semester End Examination in those subjects. In the event of the student taking another chance, the student's Continuous Internal Evaluation (CIE) marks and Semester End Examination (SEE) marks obtained in the previous attempt stands cancelled.

6.2 If the student secured 'F' grade in any subject he/she can apply for recounting / revaluation by paying prescribed fee. If the student is not satisfied after the results declaration of recounting / revaluation he/she can apply for challenge valuation with the prescribed fee. College appoints a faculty member; student can bring another faculty member who taught the

respective subject at least once (proof should be provided). The faculty member should be from any autonomous college affiliated to JNTUH or JNTUH constituent colleges.

7 Evaluation - Distribution and Weightage of Marks:

The performance of a student in each semester shall be evaluated subject - wise (irrespective of credits assigned) for 100 marks for Theory, Practicals, Seminar, Drawing / Design, Project, and Minor Courses etc., The Theory / Practical courses are evaluated with two components. 1. Continuous Internal Evaluation (CIE), 2. Semester End Examination (SEE). The distribution shall be 30 marks for CIE and 70 marks for SEE decided in the Academic Council.

7.1 Theory Courses:

7.1.1 Continuous Internal Evaluation (CIE):

CIE shall be conducted for all courses of PG Programmes twice in a semester (2 Midterm examinations) with the help of objective, subjective evaluation and regular assignments. Each midterm examination consists of objective, subjective paper and one assignment. The objective and subjective test shall be evaluated to 40 % and 50 % for duration of 120 mins and the assignment evaluated for 10 % of the allocated internal marks.

The division of marks for CIE is as given below:

Mid – Term Examination				
Part	**Type of Questions**	**No. of questions**	**Marks per question**	**Total**
Part A	Multiple-choice questions	10	1	10
	Fill-in the blanks	10	1	10
	Sub-Total			20
Part B	Compulsory questions	5	5	25
			Mid-Term Exam Total	45
			Assignment	05
			Grand Total	50

*The CIE will be conducted for 50 marks and scaled to 30 marks.

The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus. First Assignment should be submitted before the conduct of the first mid-term examinations, and the Second Assignment should be submitted before the conduct of the second midterm examinations. The weightage for the midterm examination shall be given as 70% of the best performing midterm examination and 30% of the other performing midterm examination.

The student shall appear for both midterm examinations. In case for any specific reason the student appears only for one midterm examination, only 70% weightage of that examination shall be considered.

7.1.2 Semester End Examination (SEE):

Semester End Examination (SEE) shall be conducted for all courses of PG Programmes at the end of the Semester. Duration of the examination is 3 hours. The paper setting and evaluation of all courses carried out by external examiners. The examiners will be selected by the chief controller of examination/ Principal.

Type of Questions	No. of Questions	Marks per Question	Total
Essay Type Answer Questions [For each question there will be an 'either or choice', which means that there will be two questions from each module and the student should answer either of the two questions.]	5	14	70

7.2 Practical Courses:

7.2.1 Continuous Internal Evaluation (CIE):

CIE marks shall be awarded with a distribution of 40% for day - to-day performance and timely submission of lab records, 40% for internal lab exam (best out of two exams) and 20% for viva-voce. The CIE will be conducted for 50 marks and scaled to 30 marks.

7.2.2 Semester End Examination (SEE):

SEE marks shall be awarded with a distribution of 20% for design/procedure/schematic diagram of the given experiment, 40% for conduction of experiment, 20% for results and 20% for viva - voce. For conducting SEE (with duration of 3 hours), one internal examiner and one external examiner will be appointed by the Chief Controller of Examinations/Principal of the college. The external examiner should be selected from outside the college among the autonomous / reputed institutions from a panel of three examiners submitted by the concerned Head of the Department.

7.3 Seminar:

There shall be a seminar presentation during III 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 Department PG Coordinator, Supervisor and two other senior faculty members of the department. For Seminar there will be only internal evaluation. Out of the total allocated marks distribution of marks shall be 30% for the report, 50% for presentation and 20% for the queries. A candidate has to secure a minimum of 50% of marks to be declared successful. If the student fails to fulfill minimum marks, the student has to reappear during the supplementary examinations. There shall be no semester end examinations for the seminar.

7.4 Evaluation of Project/ Dissertation Work:

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

7.4.1 A Project Review Committee (PRC) shall be constituted with Head of the Department as Chairperson/Department PG Coordinator, Project Supervisor and one senior faculty member of the Departments offering the M. Tech. programme.

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

7.4.3 After satisfying 7.4.2, a candidate has to submit, in consultation with his Project Supervisor, the title, objective and action plan of his project work to the PRC for approval. Only after obtaining the approval of the PRC the student can initiate the Project work.

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

7.4.5 A candidate shall submit his project status report in two stages at least with a gap of 2 months between them.

7.4.6 The work on the project shall be initiated at the beginning of the III Semester and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of all theory and practical courses 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 Head of the Department and make an oral presentation before the PRC.

Note: *The project supervisor/guide has to ensure that the student has to publish a minimum of one paper based on his/her thesis in an International Journal of repute preferably in UGC CARE-Group I list.*

7.4.7 For the final approval by the PRC, the soft copy of the thesis should be submitted for ANTI-PLAGIARISM check for the quality and the plagiarism report should be included

in the final thesis. If the similarity information is less than 24%, then only thesis will be accepted for submission.

7.4.8 Three copies of the Project Thesis certified by the supervisor, HOD shall be submitted to the Chief Controller of Examinations /Principal for project evaluation (Viva Voce).

7.4.9 For Project/Dissertation phase-I in III Semester is internal evaluation only. The evaluation marks shall be carried out with a distribution of 70% evaluated by the PRC and 30% by Supervisor. The Supervisor and PRC will examine the Problem Definition, Objectives, Scope of Work and Literature Survey in the same domain. A candidate has to secure a minimum of 50% of the allocated marks to be declared successful for Project work Part-I. If the student fails to fulfill minimum marks, the student has to reappear during the supplementary examination.

7.4.10 For Project/Dissertation phase-II in IV Semester is an external evaluation. The evaluation shall be carried out by the External examiner appointed by the Chief Controller of Examinations/Principal. For this, the Head of the Department shall submit a panel of 3 examiners, eminent in that field, with the help of the supervisor/guide concerned. The distribution of marks followed by Quality of the work (Plagiarism), Paper publication, nature of the work (Tools & software used and Innovative ideas), presentation and Viva-Voce - each for 20% of allocated marks. The candidate has to secure minimum of 50% marks in Project Evaluation (Viva-Voce) examination.

7.4.11 If the student fails to fulfill as specified in 7.4.10, based on the recommendation of the external examiner, the student will reappear for the Viva-Voce examination with the revised thesis only after three months. In the reappeared examination also, fails to fulfill, the student will not be eligible for the award of the degree.

7.4.12 The Head of the Department shall coordinate and make necessary arrangements for the conduct of Project Viva-Voce examination.

7.5 Non-Credit Courses:

7.5.1 Audit Courses:

Audit Courses offered in any Semester, a '**Satisfactory Participation Certificate**' shall be issued to the student from the concerned authorities, only after securing $\geq$ 65% attendance in such a course. No marks or Letter Grade shall be allotted for these activities.

8 Examinations and Assessment - The Grading System:

8.1 Grades will be awarded to indicate the performance of each student in each Theory Subject, or Lab / Practicals, or Seminar, or Project, etc., based on the % marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 6 above, and a corresponding Letter Grade shall be given.

8.2 As a measure of the student's performance, a 10-point Absolute Grading System using

the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed:

% of Marks Secured (Class Intervals)	Grade Points	Letter Grade (UGC Guidelines)
≥ 90%,	10	O (Outstanding)
(≥ 80%, <90%)	9	A+ (Excellent)
(≥ 70%, < 80%)	8	A (Very Good)
(≥ 60%, < 70%)	7	B+ (Good)
(≥ 55%, < 60%)	6	B (Average)
(≥ 50%, < 55%)	5	C (Pass)
(< 50%)	0	F(Fail)
Absent	0	Ab

8.3 A student obtaining F Grade in any Subject shall be considered 'failed' and is be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when conducted. In such cases, his Internal Marks (CIE Marks) in those Subjects will remain the same as those he obtained earlier.

8.4 A student not appeared for examination then 'Ab' Grade will be allocated in any Subject shall be considered 'failed' and will be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when conducted.

8.5 A Letter Grade does not imply any specific Marks percentage and it will be the range of marks percentage.

8.6 In general, a student shall not be permitted to repeat any Subject/ Course (s) only for the sake of 'Grade Improvement' or 'SGPA/ CGPA Improvement'.

8.7 A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him in that Subject/ Course. The corresponding 'Credit Points' (CP) is computed by multiplying the Grade Point with Credits for that particular Subject/ Course.

Credit Points (CP) = Grade Point (GP) x Credits …. For a Course

8.8 The Student passes the Subject/ Course only when he gets GP ≥ 5(C Grade or above).

8.9 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (∑CP) secured from ALL Subjects/ Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as:

$$\mathbf{SGPA} = \left\{\sum_{i=1}^{N} C_i G_i\right\} / \left\{\sum_{i=1}^{N} C_i\right\} \ldots \textbf{ For each Semester}$$

where 'i' is the Subject indicator index (takes into account all Subjects in a Semester), 'N'is the no. of Subjects 'REGISTERED' for the Semester (as specifically required and listed under the Course Structure of the parent Department), C_i is the no. of Credits allotted to the i^{th} Subject, and G_i represents the Grade Points (GP) corresponding to the

Letter Grade awarded for that i^{th} Subject.

8.10 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the II Semester onwards, at the end of each Semester, as per the formula:

$$\mathbf{CGPA} = \left\{\sum_{j=1}^{M} C_j G_j\right\} / \left\{\sum_{j=1}^{M} C_j\right\} \textbf{ … for all S semesters registered}$$

(i.e., upto and inclusive of S semesters, S ≥ 2)

where 'M' is the TOTAL no. of Subjects (as specifically required and listed under the Course Structure of the parent Department) the Student has 'REGISTERED' from the 1stSemester onwards upto and inclusive of the Semester S (obviously M > N), 'j' is the Subject indicator index (takes into account all Subjects from 1 to S Semesters), C_j is the no. of Credits allotted to the j^{th} Subject, and G_j represents the Grade Points (GP)corresponding to the Letter Grade awarded for that j^{th} Subject. After registration and completion of I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of SGPA

Course/Subject	Credits	Letter Grade	Grade Points	Credit Points
Course 1	3	A	8	3X8=24
Course 2	3	O	10	3X10=30
Course 3	3	B	6	3X6=18
Course 4	3	A+	9	3X9=27
Course 5	2	B+	7	2X7=14
Course 6	2	A	8	2X8=16
Course 7	2	B	6	2X6=12
	18			141
SGPA = 141/18 = 7.83				

Illustration of calculation of CGPA

Semester	Credits	SGPA	Credits X SGPA
Semester I	18	7	18 X 7 = 126
Semester II	18	6	18 X 6 = 108
Semester III	16	6.5	16 X 6.5 = 104
Semester IV	16	7.25	16 X 7.25 = 116
	68		454
CGPA = 454/68 = 6.67			

8.11 For Calculations listed in Item 8.6 – 8.10, performance in failed Subjects/ Courses (securing 'F' Grade) will also be taken into account, and the Credits of such Subjects/Courses will also be included in the multiplications and summations.

9. Award of Degree and Class:

9.1 A Student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Programme (PGP), and secures the required number of **68** Credits (with CGPA $\geq$ 5.0), shall be declared to have 'QUALIFIED' for the award of the M.Tech. degree in the chosen Branch of Engineering and Technology with specialization as he admitted.

9.2 Award of Class

After a student has satisfied the requirements prescribed for the completion of the programme and is eligible for the award of M. Tech. Degree, he shall be placed in one of the following three classes based on the CGPA:

Class Awarded	CGPA
First Class with Distinction	≥ 8.00
First Class	≥ 6.50 and < 8.00
Second Class	≥ 5.00 and < 6.50

9.3 A student with final CGPA (at the end of the PGP) < 5.00 will not be eligible for the Award of Degree.

9.4 Students will be eligible for the award of **'Gold Medal'**, if he/she passes all the subjects / courses in first appearance within the first academic years (or four sequential semesters) from the date of commencement of first year first semester and should have secure CGPA $\geq$ 8.00 at the end of four sequential semesters.

10 Withholding of Results:

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

11 Transitory Regulations:

11.1 If any candidate is detained due to shortage of attendance in one or more subjects, they are eligible for re-registration to maximum of two earlier or equivalent subjects at a time as and when offered.

11.2 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 MR18 Academic Regulations.

12. Student Transfers:

12.1 There shall be no Branch/Specialization transfers after the completion of Admission Process.

12.2 The students seeking transfer to MALLA REDDY ENGINEERING COLLEGE (Autonomous)- MREC(A) from various other Universities/ institutions have to pass the failed subjects which are equivalent to the subjects of MREC(A), and also pass the subjects of MREC(A) which the students have not studied at the earlier institution. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of MREC (A), the students have to study those subjects in MREC (A) in spite of the fact that those subjects are repeated.

12.3 The transfer students from other Universities / Institutions to MREC (A) who are on rolls will be provided one chance to write internal examinations in the failed subjects and/or subjects not studied as per the clearance letter issued by the JNTUH.

13. General:

13.1 **Credit**: A module by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.

13.2 **Credit Point:** It is the product of grade point and number of credits for a course.

13.3 Wherever the words “he”, “him”, “his”, occur in the regulations, they shall include “she”, “her” also.

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

13.5 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the College Academic Committee headed by the Principal is final.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR IMPROPER CONDUCT IN EXAMINATIONS

Sl.No.	Nature of Malpractices/ Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the SEE)	Expulsion from the examination hall and cancellation of the performance in that course 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 course 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 that course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester. The Hall Ticket of the candidate shall be cancelled.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The

		performance of the original candidate who has been impersonated, shall be cancelled in all the courses of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme 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 course.
6	Refuses to obey the orders of the Chief Controller of Examinations (CCE) / Controller of Examinations (CE)/ Assistant Controller of Examinations (ACE) / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester. The candidates also are debarred and forfeit their seats. In case of

	organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination	outsiders, they will be handed over to the police and a police cases registered against them.
7	Leaves the exam hall taking away answer scriptor 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 course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme 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 course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the

		remaining examinations of the courses of that semester. 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.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. 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 course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that SEE.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the CCE for further action toward suitable punishment.	

Note: ***The student(s) found indulging in malpractices during the CIE also will be punished based on the recommendations of the College Academic Committee.***

Malpractices identified by squad or special invigilators

1. Punishments to the students as per the above guidelines.

MALLA REDDY ENGINEERING COLLEGE (Autonomous)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE STRUCTURE FOR PG- M.Tech. ELECTRICAL POWER SYSTEMS

(MR20 Regulations - Effective from Academic Year 2020-21 onwards)

I Semester

S. No.	Category	Course Code	Name of the Course	Contact hours/week			Credits
				L	T	P	
1	PCC	A2101	Advanced Power System Analysis	3	1	-	4
2	PCC	A2102	Economic Operation of Power Systems	3	-	-	3
3	PEC - I	**Professional Elective–I**		3	-	-	3
		A2113	Smart Grid Technologies				
		A2114	Analysis of HVDC Systems				
		A2115	Renewable Energy Systems				
4	PEC - II	**Professional Elective–II**		3	-	-	3
		A2116	Power Quality				
		A2117	Reactive Power Compensation and Management				
		A2118	Hybrid Electric Vehicles				
5	HSMC	A0H18	Research Methodology and IPR	2	-	-	2
6	PCC	A2103	Power Systems Computation Lab-I	-	-	3	1.5
7	PCC	A2104	Advanced Power Systems Lab	-	-	3	1.5
8	AC	A0A04	English for Research Paper Writing	2	-	-	-
Total				**17**	**-**	**6**	**18**
Contact Hours: 23							

MALLA REDDY ENGINEERING COLLEGE (Autonomous)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE STRUCTURE FOR PG- M.Tech. ELECTRICAL POWER SYSTEMS

(MR20 Regulations - Effective from Academic Year 2020-21 onwards)

II Semester

S. No.	Category	Course Code	Name of the Course	Contact hours/week			Credits
				L	T	P	
1	PCC	A2105	Digital Protection of Power System	3	-	-	3
2	PCC	A2106	Power System Dynamics	3	-	-	3
3	PCC	A2107	Power System Operation and Deregulation	3	-	-	3
4	PEC - III	**Professional Elective–III**		3	-	-	3
		A2119	Restructured Power Systems				
		A2120	EHV AC Transmission				
		A2121	Industrial Load Modelling and Control				
5	PEC - IV	**Professional Elective–IV**		3	-	-	3
		A2122	AI Techniques in Power Systems				
		A2123	Modern Control Theory				
		A2124	Power System Reliability and Planning				
6	PCC	A2108	Power Systems Computation Lab-II	-	-	3	1.5
7	PCC	A2109	Power System Protection Lab	-	-	3	1.5
8	AC	A0A05	Value Education	2	-	-	-
Total				**17**	**-**	**6**	**18**
Contact Hours: 23							

MALLA REDDY ENGINEERING COLLEGE (Autonomous)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE STRUCTURE FOR PG- M.Tech. ELECTRICAL POWER SYSTEMS

(MR20 Regulations - Effective from Academic Year 2020-21 onwards)

III Semester

S. No.	Category	Course Code	Name of the Course	Contact hours/week			Credits
				L	T	P	
1	PEC - V	**Professional Elective–V**		3	-	-	3
		A2125	Power System Transients				
		A2126	Flexible AC Transmission Systems				
		A2127	Gas Insulated Systems				
2	OEC	**Open Elective–VI**		3	-	-	3
		A3228	Industrial Safety				
		A0B20	Advanced Optimization Techniques				
		A1128	Waste to Energy				
3	PROJ	A2110	Technical Seminar	-	-	4	2
4	PROJ	A2111	Project/ Dissertation Phase-I	-	-	16	8
Total				**6**	**-**	**20**	**16**
Contact Hours:26							

MALLA REDDY ENGINEERING COLLEGE (Autonomous)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE STRUCTURE FOR PG- M.Tech. ELECTRICAL POWER SYSTEMS

(MR20 Regulations - Effective from Academic Year 2020-21 onwards)

IV Semester

S. No.	Category	Course Code	Name of the Course	Contact hours/week			Credits
				L	T	P	
1	PROJ	A2112	Project/ Dissertation Phase-II	-	-	32	16
Total				**-**	**-**	**32**	**16**
Contact Hours: 32							

Category

- PCC - Professional Core Course
- PEC - Professional Elective Course
- OEC - Open Elective Course
- PROJ – Project

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: A2101	**ADVANCED POWER SYSTEM ANALYSIS**	**L**	**T**	**P**
Credits: 4		**3**	**1**	**-**

Prerequisites: Nil

Course Objectives:

To analyze a Power System Network using graph theory, interpret the formation of Network matrices. To construct the necessity of load flow studies and various methods of Analysis, examine short circuit analysis using Z_{BUS}.

MODULE I: Admittance Model and Network Calculations 13 Periods

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.

MODULE II: Impedance Model and Network Calculations 13 Periods

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}.

MODULE III: Power flow Analysis 13 Periods

A: Power flow analysis by Gauss Seidel method and N-R Method.

B: Power flow analysis by Decoupled method and fast decoupled method. Comparison between power flow solutions. DC load flow.

MODULE IV: Optimal Power Flow 13 Periods

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

MODULE V: Fault Analysis 12 Periods

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 BOOKS

1. P. Kundur, **"Power System Stability and Control"**, McGraw Hill Education, 1st Edition,

2006.
2. John J.Grainger and W.D. Stevenson, **"Power System Analysis"**, McGraw Hill Education, 1st Edition, 1994.

REFERENCES

1. I.J.Nagrath and D.P.Kothari, **"Modern Power System Analysis"**, Tata McGraw Hill, New Delhi, 4th Edition, 2011.
2. Olle. L.Elgard, **"Electrical Energy Systems Theory"**, McGraw Hill Education, 2nd Edition, 2001.
3. M.A. Pai, **"Computer Techniques in Power System Analysis"**, McGraw Hill, New Delhi, 3rd Edition, 2014.
4. Dr. K. Uma Rao, **"Power System: Operation and Control"**, Wiley India Pvt. Ltd., 2012.
5. Robert Miller and James Malinowski, **"Power System Operation (Electronics)"**, McGraw Hill Education, 3rd Edition, 1994.

E-RESOURCES

1. http://www.ieee-pes.org/ieee-transactions-on-power-systems
2. http://www.ieee-pes.org/
3. http://nptel.ac.in/courses/108105067/

Course Outcomes

At the end of the course, students will be able to

1. Obtain the different matrices to analyze the power network.
2. Form bus impedance matrix for the given network.
3. Apply numerical methods for power flow analysis.
4. Analyze the power system under single and multiple contingency.
5. Analyze the power system under fault condition.

CO-PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3		3	2	2	
CO2	2		2	2	2	
CO3	3		3	2	2	
CO4	2		3	2	2	
CO5	3		2	2	2	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: A2102	**ECONOMIC OPERATION OF POWER SYSTEMS**	**L**	**T**	**P**
Credits: 3		**3**	**-**	**-**

Prerequisites: Power System Generation & Distribution, Power System Analysis.

Course Objectives: This course deals with Economic operation of Power Systems, Hydrothermal scheduling and modelling of governors, turbines and generators. It emphasizes on single area and two area load frequency control and reactive power control.

MODULE I Economic Operation of Power Systems 10 Periods

Optimal operation of Generators in Thermal Power Stations - Heat rate Curve – Cost Curve – Incremental fuel and Production costs - Input - Output characteristics - Optimum generation allocation with line losses neglected.

Optimum generation allocation including the effect of transmission line losses – Loss Coefficients - General transmission line loss formula.

MODULE II Hydrothermal Scheduling 10 Periods

Hydrothermal scheduling problem: short term and long term-mathematical model, algorithm. Dynamic programming solution methodology for Hydro-thermal scheduling with pumped hydro plant: Optimization with pumped hydro plant-Scheduling of systems with pumped hydro plant during off-peak seasons: algorithm.

MODULE III Load Frequency Control – I 10 Periods

A: Modeling of Governor, Turbine and Generators with corresponding block diagram representation and transfer function.

B: Single Area Load Frequency Control: Necessity of keeping frequency constant. Definitions of control area – Single area control – Block diagram representation of an isolated power system – Steady state analysis – Dynamic response – Uncontrolled case.

MODULE IV Load Frequency Control – II 9 Periods

Proportional plus Integral control of single area and its block diagram representation - Steady state response – Load Frequency Control and economic dispatch control.

Load frequency control of two area system – Uncontrolled case and controlled case – Tie - Line bias control.

MODULE V Reactive Power Control 9 Periods

Overview of Reactive Power control – Reactive Power compensation in transmission systems – Advantages and disadvantages of different types of compensating equipment for transmission systems. Load compensation – Specifications of load compensator. Uncompensated and compensated transmission lines: Shunt and Series Compensation (qualitative treatment).

TEXT BOOKS

1. Abhijit Chakrabarthi and Sunita Halder, **"Power System Analysis Operation and Control"**, PHI Learning Pvt. Ltd., 3rd Edition, 2010.
2. I.J.Nagrath and D.P.Kothari, **"Modern Power System Analysis"**, Tata McGraw Hill Publishing Company Ltd, 4th Edition, 2011.

REFERENCES

1. C.L.Wadhwa, **"Electrical Power Systems"**, New Age International (P) Limited, Publishers, 4th Edition, 2005.
2. T.J.E. Miller, "**Reactive Power Control in Electric Systems"**, John Wiley & Sons, New York, 1982.
3. J.Duncan Glover, M.S.Sarma and Thomas J.Overbye, "**Power System Analysis and Design",** Global Engineering Publisher, 5th Edition, 2012.
4. O.I.Elgerd, **"Electric Energy Systems Theory"**, Tata McGraw - Hill Education, 2nd Edition, 2003.
5. John J Grainger, William D Stevenson Jr, **"Power System Analysis"**, Tata McGraw – Hill Education, 2003.

E - RESOURCES

1. http://nptel.ac.in/courses/108101040/
2. https://www.eeweb.com/power-management
3. http://nptel.ac.in/courses/108104052

COURSE OUTCOMES

At the end of the course, students will be able to

CO1: Compute the optimal scheduling of thermal power plants and allocation of affect of transmission line loss.

CO2: Compute the optimal scheduling of Hydro-thermal system.

CO3: Analyze the steady state behavior of the power system for voltage and frequency fluctuations.

CO4: Design suitable controller for the frequency and voltage steady state oscillations.

CO5: Describe reactive power control of a power system.

CO-PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2		2	2	2	
CO2	3		2	2	2	
CO3	2		2	2	2	
CO4	3		2	2	2	
CO5	3		2	2	2	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: A2113	**SMART GRID TECHNOLOGIES**	**L**	**T**	**P**
Credits: 3	(Professional Elective - I)	**3**	**-**	**-**

MODULE I: Introduction to Smart Grid **10 Periods**

Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self-Healing Grid, Present development & International policies in Smart Grid. Case study of Smart Grid . CDM opportunities in Smart Grid .

MODULE II: Smart Grid Technologies: Part 1 **10 Periods**

Introduction to Smart Meters, Real Time Pricing, Smart Appliances, Automatic Meter Reading(AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Phase Shifting Transformers.

MODULE III: Smart Grid Technologies: Part 2: **10 Periods**

A: Smart Substations, Substation Automation, Feeder Automation. Geographic Information System(GIS)

B: Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System(WAMS), Phase Measurement Unit(PMU).

MODULE IV: Micro grids and Distributed Energy Resources **9 Periods**

Concept of micro grid, need & applications of micro grid, formation of micro grid, Issues of interconnection, protection & control of micro grid. Plastic & Organic solar cells, Thin film solar cells, Variable speed wind generators, fuel cells, micro turbines, Captive power plants, Integration of renewable energy sources.

MODULE V: Power Quality Management in Smart Grid **9 Periods**

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Au

TEXT BOOKS

1. Ali Keyhani, Mohammad N. Marwali, Min Dai, **"Integration of Green and Renewable Energy in Electric Power Systems"**, Wiley.

2. Clark W. Gellings, **"The Smart Grid: Enabling Energy Efficiency and Demand Response"**,CRC Press.

REFERENCES

1. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama**," Smart Grid: Technology and Applications",** Wiley.
2. Jean Claude Sabonnadière, NouredineHadjsaïd, **"Smart Grids",** Wiley Blackwell.

E-RESOURCES

1. smartgrid.ieee.org/
2. ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5165411
3. nptel.ac.in/courses/108105067/

Course Outcomes

At the end of the course, students will be able to

1. Group the various aspects of smart grid.
2. Emphasize the use of smart meters and plug in hybrid electric vehicles..
3. Describe smart substations and it functions.
4. Understand the concept of micro grid and distributed energy resources.
5. Analyze the power quality management in smart grid.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**2**	**2**	**3**	
CO2	**1**		**2**	**2**	**3**	
CO3	**3**		**2**	**2**	**3**	
CO4	**1**		**2**	**2**	**3**	
CO5	**3**		**2**	**2**	**3**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: A2114	**ANALYSIS OF HVDC SYSTEMS**	**L**	**T**	**P**
Credits: 3	(Professional Elective - I)	**3**	**-**	**-**

Prerequisites: Nil

Course Objectives: To comprehend the conversion principles of HVDC Transmission and analyze 3, 6, 12 pulse converters, rectifier and inverter operations of HVDC converters. Also to identify the different types of Harmonics and reduction by using Filters and comprehend interaction between HVAC and DC systems in various aspects.

MODULE I: INTRODUCTION **10 Periods**

General consideration, Power Handling Capabilities of HVDC Lines, Basic Conversion principles, static converter configuration.

MODULE II: Static Power Converters **10 Periods**

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. VSC based HVDC and Hybrid HVDC systems. Back to back thyristor converter system.

MODULE III: Control of HVDC Converters and systems **10 Periods**

A: Constant current, constant extinction angle and constant ignition angle control, Individual phase control, Equidistant firing angle control.

B: DC power flow control. Interaction between HV AC and DC systems – Voltage interaction Harmonic instability problems and DC power modulation.

MODULE IV: MTDC SYSTEMS & OVER VOLTAGES **9 Periods**

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.

MODULE V: Converter faults & protection **9 Periods**

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

TEXT BOOKS

1. E.W. Kimbark: Direct current Transmission, Wiely Inter Science – New York.
2. J. Arillaga HVDC Transmission Peter Peregrinus ltd. London UK 1983

REFERENCES

1. K. R. Padiyar, "High Voltage Direct current Transmission", Wiely Esatern Ltd New Delhi – 1992
2. E. Uhlman, "Power Transmission by Direct Current", Springer Verlag, Berlin Helberg. 1985.

Course Outcomes

At the end of the course, students will be able to

1. Comprehend power handling capabilities of HVDC lines
2. Analyse the performance of static power converters
3. Evaluate the control methods of HVDC converters
4. Distinguish between HVDC and multi terminal DC systems
5. Design over voltage and over current protection circuits.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**1**		**3**	**3**	**2**	
CO2	**3**		**2**	**3**	**3**	
CO3	**2**		**3**	**3**	**3**	
CO4	**3**		**2**	**3**	**3**	
CO5	**3**		**3**	**2**	**3**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: A2115	**RENEWABLE ENERGY SYSTEMS**	**L**	**T**	**P**
Credits: 3	(Professional Elective - I)	**3**	**-**	**-**

Prerequisites: Nil

Course Objectives: To create the awareness of energy conservation in students. To identify renewable energy sources for electrical power generation. To analyze different energy storage methods. To have knowledge on environmental effects of energy conversion.

MODULE I: Solar Energy **10 Periods**

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.

MODULE II: Wind Energy and MHD Power Generation **10 Periods**

Wind Energy conversion: Power from wind, properties of air and wind, types of wind Turbines, operating characteristics.

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

MODULE III: Tidal and Wave Energy **10 Periods**

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

B: 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.

MODULE IV: Miscellaneous Energy Conversion Systems **9 Periods**

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.

MODULE V: Fuel Cell **9 Periods**

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.

REFERENCES

1. Understanding Renewable Energy Systems" , by Volker Quaschning, 2005, UK.
2. Renewable Energy Systems-Advanced Conversion, Technologies & Applications" by Faner Lin Luo Honer Ye, CRC press, Taylor & Francis group.

COURSE OUTCOMES

At the end of the course, students will be able to

1. Design and analyse the performance of PV system
2. Comprehend the operation and characteristics of Wind Turbines and MHD generator.
3. Recognize the operation and properties of Tidal and Wave energy generation
4. Distinguish the types of various energy conversion systems
5. Analyse the performance of fuel cells.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**		**2**	**3**	**2**	
CO2	**3**		**2**	**3**	**2**	
CO3	**1**		**2**	**3**	**2**	
CO4	**3**		**2**	**3**	**2**	
CO5	**3**		**2**	**3**	**2**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: A2116	**POWER QUALITY**	**L**	**T**	**P**
Credits: 3	(Professional Elective - II)	**3**	**-**	**-**

Prerequisites: Nil

Course Objectives:

This subject deals with power quality issues and solutions. It also discussed some of the power quality issues like interruptions and voltage sag with their reliability evaluation.

MODULE I: Voltage Sags And Interruptions **10 Periods**

Terms and definitions: Overloading, under voltage - sustained interruption; sags and swells; waveform distortion - Total Harmonic Distortion (THD) - Computer Business Equipment Manufacturers Associations (CBEMA) curve - Sources of sags and interruptions – estimating voltage sag performance - fundamental principles of protection - motor starting sags.

MODULE II: Transient Over voltages **10 Periods**

Sources of transient over voltages: Capacitor switching - magnification of capacitor switching transients – lightning - ferro resonance and other switching transients; Devices for over voltage protection: Surge arresters and transient voltage surge suppressors – isolation transformers - low pass filters - low impedance power conditioners - -utility surge arresters, utility system Lightning protection : shielding, line arresters - low side surges – cable protection and scout arrester scheme.

MODULE III: Fundamentals Of Harmonics **10 Periods**

A: Harmonic distortion: Voltage and current distortion - harmonic indices - harmonic sources from commercial and industrial loads.

B: Locating harmonic sources - system response characteristics: resonance.

MODULE IV: Applied Harmonics, Wiring And Grounding **9 Periods**

Effects of harmonic distortion - harmonic distortion evaluation, principles for controlling harmonics - devices for controlling harmonic distortion – inter harmonics caused by induction furnaces - IEEE standard 519-1992 – over view of IEC standards on harmonics – reasons for grounding – typical wiring and grounding problems – isolated ground – summary of wiring and grounding solutions.

MODULE V: Power Quality Monitoring **9 Periods**

Monitoring considerations: Disturbance analyzer - harmonic / spectrum analyzer – combination - Disturbance harmonic analyzer - flicker meters - smart power quality monitors - transducers

requirements - applications of expert system - power quality monitoring and the internet – EMI - Electromagnetic compatibility.

TEXT BOOKS

1. Roger.C.Dugan, Mark.F. Mc Granagham**, "Electrical Power Systems Quality"** 3rd Edition, McGraw Hill, 2012.
2. Ewald F. Fuchs, Mohammad A. S. Masoum**, "Power Quality in Power Systems and Electrical Machines"**, 2nd Edition, Academic Press, 2011.

REFERENCES

1. Francisco C. De La Rosa, **"Harmonics and Power Systems",** 1st Edition, CRC Press, 2006.
2. Angelo Baggiri, **"Handbook of Power Quality",** 1st Edition, John Wiley & Sons, 2008.
3. C. Sankaran, **"Power Quality",** 1st Edition, CRC Press, 2002.
4. P.S. Satnam P.S. Kang, **"Power Capacitor for Reactive Compensation",** 1st Edition, Dhanpat Rai & Sons Publications, 2008.

E-RESOURCES

1. http://www.elec.uow.edu.au/apqrc/links
2. http://technav.ieee.org/tag/1354/power-quality#concepts
3. http://nptel.ac.in/courses/108106025/

Course Outcomes

At the end of the course, students will be able to

1. Classify power quality disturbances and typical problems associated with it.
2. Describe the causes of transient over voltages and its mitigation methods.
3. Analyse the sources of current and voltage harmonics.
4. Comprehend the concepts of harmonic distortion and controlling methods.
5. List the different types of analyzer used in power quality monitoring.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**3**	**2**	**3**	
CO2	**1**		**3**	**2**	**3**	
CO3	**3**		**2**	**2**	**3**	
CO4	**1**		**3**	**2**	**3**	
CO5	**3**		**1**	**2**	**3**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: A2117	**REACTIVE POWER COMPENSATION AND MANAGEMENT** (Professional Elective - II)	**L**	**T**	**P**
Credits: 3		**3**	**-**	**-**

Prerequisites: Nil

Course Objectives:

To understand the necessity of reactive power compensation. To design load compensation. To analyze various types of reactive power compensation in transmission systems. To get exposed to distribution side and utility side reactive power management.

MODULE I: Load Compensation **10 Periods**

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.

MODULE II: Steady – State Reactive Power Compensation In Transmission System **10 Periods**

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.

MODULE III: Reactive Power Coordination **10 Periods**

A: Objective – Mathematical modeling – Operation planning – transmission benefits – Basic concepts of quality of power supply – disturbances- steady –state variations.

B: Effects of under voltages – frequency –Harmonics, radio frequency and electromagnetic interferences.

MODULE IV: Demand Side Management **9 Periods**

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.

MODULE V: User Side Reactive Power Management **9 Periods**

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.

TEXT BOOKS

1. T.J.E.Miller, **"Reactive Power Control in Electric Power Systems",** John Wiley and sons, 1982.
2. D.M.Tagare , **"Reactive Power Management",**Tata McGraw Hill,2004.

REFERENCES

1. A.Chakrabarti, D.P Kothari, A.K Mukhopadhyay and D.E Abinandan, **"An Introduction to Reactive Power Control and Voltage Stability in Power Transmission Systems",**PHI, 2010.
2. George J. Wakileh, **"Power Systems Harmonics; Fundamentals, Analysis and Filter Design"**, Spinger,2014.

E-RESOURCES

1. technav.ieee.org/tag/8412/reactive-power-control
2. ieeexplore.ieee.org/iel5/5/32985/01545767.pdf
3. nptel.ac.in/courses/108106025/Chapter%203.pdf

Course Outcomes

At the end of the course, students will be able to

1. Analyse the importance of load compensation in symmetrical as well as unsymmetrical loads.
2. Analyze the various compensation methods in transmission lines.
3. Design the mathematical model for reactive power coordination.
4. Recognize the different load patterns and distribution side reactive power management
5. Comprehend user side reactive power management and reactive power management in electric traction systems and furnaces.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**3**	**3**	**1**	
CO2	**2**		**3**	**1**	**3**	
CO3	**3**		**2**	**3**	**3**	
CO4	**2**		**3**	**3**	**1**	
CO5	**3**		**2**	**3**	**3**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: A2118	**HYBRID ELECTRIC VEHICLES** (Professional Elective – II)	**L**	**T**	**P**
Credits: 3		**3**	**-**	**-**

Prerequisites: DC Machines and Transformers and AC Machines.

Course Objectives: To present a comprehensive overview of Electric and Hybrid Electric Vehicles

MODULE I Introduction to Hybrid Electric Vehicles 10 Periods

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance.

MODULE II Hybrid Electric Drive-trains 10 Periods

Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

MODULE III Electric Propulsion unit & Energy Storage 10 Periods

A: Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives

B:Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices.

MODULE IV Sizing the drive system 9 Periods

Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power

MODULE V Communications, supporting subsystems 9 Periods

Communications, supporting subsystems: In vehicle networks- CAN, Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies

Text Book:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003

References:

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
2. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.

E-RESOURCES:

1. https://en.wikipedia.org/wiki/Digital_library
2. https://ieeexplore.ieee.org/document/4168013/
3. www.ieahev.org/
4. web.mit.edu/evt/links.html

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: Distinguish the performance and characteristics of conventional and electric vehicles.
CO 2: Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources
CO3: Design and develop basic schemes of electric vehicles and hybrid electric vehicles.
CO4: Choose proper energy storage systems for vehicle applications
CO5: Categorize various communication protocols and technologies used in vehicle networks

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**1**		**3**	**3**	**1**	
CO2	**3**		**2**	**3**	**3**	
CO3	**1**		**3**	**2**	**3**	
CO4	**3**		**2**	**3**	**1**	
CO5	**2**		**3**	**3**	**3**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: A0H18	**RESEARCH METHODOLOGY AND IPR**	**L**	**T**	**P**
Credits: 2		**2**	**-**	**-**

Prerequisites: NIL

Course Objectives: The objective of the course is to make students familiar with the basics of research methodology and various types of Intellectual Properties, IPR legislations and policies.

MODULE-I Research Problem **6 Periods**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

MODULE – II Technical Writing and Research Proposal **7 Periods**

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

MODULE – III Intellectual Property Rights **6 Periods**

A: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development.

B: International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

MODULE – IV Patent Rights **6 Periods**

Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

MODULE – V Case Studies **7 Periods**

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

1. Prabhuddha Ganguli: ‘ Intellectual Property Rights” Tata Mc-Graw –Hill, New Delhi
2. M.Ashok Kumar and Mohd.Iqbal Ali: “Intellectual Property Right” Serials Pub.
3. Carlos M.Correa- **‘‘Intellectual property rights , The WTO and Developing countries”**-Zed books
4. Law relating to patents, trademarks, copyright designs, Wadehra, B.L. & 2 ed. Universal

Law Publishing 2000.
5. C.R.Kothari, **"Research Methodology"** New Age International Publishers, Fourth edition, 2018.
6. Donald Cooper & Pamela Schindler, **"Business Research Methods",** TMGH, 9th edition.
7. Alan Bryman & Emma Bell, **"Business Research Methods"**, Oxford University Press.

E Resources:

1. https://www.wto.org/english/tratop_e/trips_e/trips_e.htm
2. https://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm7_e.htm
3. http://nptel.ac.in/courses/110999906/
4. http://nptel.ac.in/courses/109105112/

Course Outcomes:

After completion of the course, students will be able to

1. Comprehend the concepts of research methodology and its concepts.
2. Realize the concepts of literature review and developing a research proposal.
3. Understand the basic concepts of Intellectual property rights.
4. Understand the types of patents and their procedures.
5. Recognize the recent developments in IPR administration.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**	**3**			**3**	**3**
CO2	**3**	**3**			**3**	**3**
CO3	**3**	**3**			**3**	**3**
CO4	**3**	**3**			**3**	**3**
CO5	**3**	**3**			**3**	**3**

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: A2103	**POWER SYSTEMS COMPUTATION LAB-I**	**L**	**T**	**P**
Credits: 1.5		**-**	**-**	**3**

Course Objectives:

To acquire knowledge about the computational methods in load flow analysis and short circuit analysis.

List of Experiments:

1. Develop a program for Y_{BUS} formation.
2. Develop a Program for Load Flow Analysis of given Power system network using G-S method.
3. Develop a Program for Load Flow Analysis of given Power system network using N-R method.
4. Develop a Program for Load Flow Analysis of given Power system network using Fast Decoupled Load Flow method.
5. Develop a program for Single Line to Ground fault (L-G) in a power system.
6. Develop a program for Line to Line fault (L-L) in a power system.
7. Develop a program for Double Line to Ground fault (L-L-G) in a power system.
8. Transient Stability Analysis for Single Machine connected to Infinite Bus by Point by Point Method.
9. Develop a Program for Transient response of RLC Circuit for an input (i) pulse (ii) step and (iii) Sinusoidal signals.
10. Develop a Program for Analysis of Three Phase Circuit representing the generator transmission line and load. Plot three phase currents and neutral current.

Course Outcomes

At the end of the course, students will be able to

1. Develop a program for Y_{BUS} formation
2. Develop a program for Load Flow Analysis using G-S method, N-R method and FDLF method.
3. Develop a program for Short Circuit Analysis for various faults in power systems.
4. Develop a Program for Transient response of RLC Circuit for various input signals.
5. Develop a Program for analysis of three phase circuit for balanced and unbalanced loads.

CO-PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2		3	3	1	
CO2	3		2	3	3	
CO3	2		3	1	3	
CO4	3		2	3	1	
CO5	2		3	3	3	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: A2104	**ADVANCED POWER SYSTEMS LAB**	**L**	**T**	**P**
Credits: 1.5		**-**	**-**	**3**

Course Objectives:

To acquire knowledge about the computational methods in load flow analysis and short circuit analysis.

Course Objectives: Apply the concepts of power electronic converters for various applications of DC and AC machines. Design the power converter to meet a specific load requirement.

List of Experiments:

1. Speed Measurement and closed loop control using PMDC motor.
2. Speed control of thyristor based 1HP DC motor with closed loop control.
3. Speed control of three Phase input, thyristor based 3 HP DC motor with closed loop control.
4. Speed control of cycloconverter based AC Induction motor.
5. Performance of single phase fully controlled converter with inductive load.

The following experiments to be done in simulation

1. Simulation of Switching an Inductive Circuit Using a Breaker.
2. Simulation of detailed model of three phase programmable source, measurement of V-I and sequence analyzer.
3. Simulation of Single Phase Series Compensated Network.
4. Simulation of DC/DC and DC/AC PWM Converter.
5. Simulation of Space Vector PWM Converter.

Course Outcomes

At the end of the course, students will be able to

1. Analyze the performance of PMDC and DC motors with closed loop control.
2. Investigate the performance of squirrel cage and wound rotor Induction motor.
3. Design Single Phase Series Compensated Network and Switching an Inductive Circuit Using a Breaker
4. Design PWM Converter.
5. Design Space vector PWM converter.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**		**3**	**3**	**3**	

CO2	**3**		**2**	**2**	**3**	
CO3	**2**		**3**	**3**	**2**	
CO4	**3**		**2**	**2**	**3**	
CO5	**2**		**3**	**3**	**3**	

2020-21 Onwards (MR-20)	**MALLA REDDY ENGINEERING COLLEGE (Autonomous)**	**M.Tech. I Semester**		
Code: A0A04	**ENGLISH FOR RESEARCH PAPER WRITING**	**L**	**T**	**P**
Credits: Nil		**2**	**-**	**-**

Prerequisites: Nil

Course Objectives: The objective of the course is to provide the knowledge on structuring paragraphs, paraphrasing and preparation of research documents related to abstract, literature review, methods and results.

Module I: 6 Periods

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

Module II: 7 Periods

Clarifying Who Did What, Highlighting Your Findings, Hedging and criticising, paraphrasing and plagiarism, sections of a paper, abstracts. Introduction.

Module III: 6 Periods

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.

Module IV: 6 Periods

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Module V: 7 Periods

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

References:

1. Goldbort R (2006)," **Writing for Science**," Yale University Press.
2. Day R (2006)," **How to Write and Publish a Scientific Paper**", Cambridge University Press.
3. Highman N (1998), "**Handbook of Writing for the Mathematical Sciences**", SIAM. Highman's book .
4. Adrian Wallwork , "**English for Writing Research Papers"**, Springer New York Dordrecht Heidelberg London, 2011.

Course Outcomes

At the end of the course, students will be able to

1. Structure the sentences and paragraphs.
2. Elaborate the various sections of research papers.
3. Explore the check list in research documents.
4. Apply the key skills to coin the title, abstract, introduction and literature review.
5. Inspect the skills required for preparing experimental results and discussions.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		**2**			**2**	**1**
CO2		**2**			**2**	**1**
CO3		**2**			**2**	**1**
CO4		**2**			**2**	**1**
CO5		**2**			**2**	**1**

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: A2105	**DIGITAL PROTECTION OF POWER SYSTEM**	**L**	**T**	**P**
Credits: 3		**3**	**-**	**-**

Prerequisites: Switch Gear and Protection

Course Objectives:

To distinguish all kinds of circuit breakers and relays for protection of Generators, Transformers and feeder bus bars from over voltages and other hazards. To generalize neutral grounding for overall protection. To illustrate the phenomenon of over voltages and its classification.

MODULE I: Static Relays and Comparators 10 Periods

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.

MODULE II: Phase Comparators and Static over Current Relays 9 Periods

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

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

MODULE III: Static Differential and Distance Relays 10 Periods

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

B: Static Distance Relays: Static impedance – Reactance – MHO and angle impedance relay - Sampling comparator – Realization of reactance and MHO relay using sampling comparator.

MODULE IV: Multi Input Comparators and Power Swings 10 Periods

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.

MODULE V: Microprocessor based Protective Relays 9 Periods

(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 BOOKS

1. Badri Ram and D.N.Vishwakarma, **"Power System Protection and Switch Gear"**, Tata McGraw Hill Publications, New Delhi, 1995.
2. T.S.MadhavaRao, **"Static Relays"**, Tata McGraw Hill Publications, New Delhi, 2nd Edition, 1989.

REFERENCES

1. Bhavesh Bhalja, R.P. Maheshwari and Nilesh G. Chothani, **"Protection and Switchgear"**, Oxford University Press, 2012.
2. C.Christopoulos and A. Wright, **"Electrical Power System Protection"**, Springer International Publisher, 2nd Edition, 1999.

E-RESOURCES

1. http://www.mytech-info.com/2016/07/types-of-comparator.html
2. http://www.springer.com/energy/systems%2C+storage+and+harvesting/journal/41601
3. http://nptel.ac.in/courses/108101039/26

Course Outcomes

At the end of the course, students will be able to

1. Comprehend the construction and operation of static relays and amplitude comparators.
2. Understand the construction and operation of Phase Comparators and Static over current relays.
3. Apply the differential & static relays for protection schemes.
4. Illustrate the protection system by using Multi-Input comparators, effects of power swings and protection against the power swings.
5. Design microprocessor based relays to protect the system against different faults.

CO-PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2		3	2	2	
CO2	3		2	2	3	
CO3	2		3	2	2	
CO4	3		2	2	3	
CO5	2		3	2	2	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: A2106	**POWER SYSTEM DYNAMICS**	**L**	**T**	**P**
Credits: 3		**3**	**-**	**-**

Prerequisites: Nil

Course Objectives:

To impart the basics of dynamic characteristics of power system equipment. Analyze the Dynamic performance of power systems, System stability and controls.

MODULE I: BASIC CONCEPTS 10 Periods

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.

MODULE II: MODELING OF SYNCHRONOUS MACHINE 9 Periods

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

MODULE III: EXCITATION SYSTEM 10 Periods

A: 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.

B: Rotor equations - Synchronous machine model with field circuit - one equivalent damper winding on q axis (model 1.1) - calculation of Initial conditions.

MODULE IV: ANALYSIS OF SINGLE MACHINE SYSTEM 10 Periods

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.

MODULE V: APPLICATION OF POWER SYSTEM STABILIZERS 9 Periods

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 BOOKS

1. K R Padiyar, **"Power System Dynamics : Stability and Control",** B.S. Publications, 2006.
2. R. Ramanujam, **"Power System Dynamics : Analysis and Simulation"**, PHI Publications,

2009.

REFERENCES

1. P.M. Anderson and A.A. Fouad, **"Power system control and stability",** IEEE Press, 2002.
2. Prabha Kundur, **" Power System Stability And Control**", McGraw Hill Education Publisher, 1st Edition, 2006.
3. El-Shimy Mohamed, **"Dynamic Security of Interconnected Electric Power Systems - Volume 1"**, LAP Lambert Academic Publishing, 2015.

E-RESOURCES

1. ewh.ieee.org/soc/pes/psdpc/
2. http://magazine.ieee-pes.org/
3. nptel.ac.in/courses/108101004/

Course Outcomes

At the end of the course, students will be able to

1. Analyse the steady state and transient stability.
2. Model power system components and synchronous machine
3. Model the excitation system of the synchronous machine.
4. Interpret results of system stability studies
5. Analyze various components of power system stabilizers.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**2**	**2**	**3**	
CO2	**2**		**3**	**2**	**2**	
CO3	**3**		**2**	**3**	**2**	
CO4	**2**		**3**	**2**	**2**	
CO5	**3**		**2**	**3**	**3**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: A2107	**POWER SYSTEM OPERATION AND DEREGULATION**	**L**	**T**	**P**
Credits: 3		**3**	**-**	**-**

Prerequisites: Nil

Course Objectives:

The course introduces the concept of OPF with security constraints. To describe modeling of load frequency control of a power system. To get awareness on reactive power control of a power system.

MODULE I: State Estimation in Power Systems 10 Periods

A: Introduction- Power system state estimation- Maximum likelihood Weighted Least squares estimation-Matrix formulation- State estimation of AC network- State estimation by orthogonal decomposition.

B: Detection and identification of Bad measurements- Estimation of quantities not being measured- Network Observability and pseudo measurements

MODULE II: Power System Security 9 Periods

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

MODULE III: Contingency Analysis 10 Periods

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.

MODULE IV: Power System Deregulation 10 Periods

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.

MODULE V: Available Transfer Capability 9 Periods

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. A.J.Wood and B.F.Woollenberg, **" Power Generation Operation and Control",** Wiley-Interscience publication, 2nd Edition, 1996.
2. P.Venkatesh, B.V.Manikandan, S.Charles Raja and A.Srinivasan**, "Electrical Power Systems: Analysis, Security, Deregulation"**, PHI Learning Pvt. Ltd., 2012.

REFERENCES

1. P.S.R. Murty, **"Electrical Power Systems",** Butterworth-Heinemann Publishers, 2017.
2. Subir Ray**, "Electrical Power Systems: Concept, Theory and Practice",** PHI Learning Pvt. Ltd., 2014.
3. Hussain Shareef, **"Modern Power Tracing Methods for Deregulated Power Systems",** LAP Lambert Academic Publishing, 2011.

E-RESOURCES

1. https://neos-guide.org/content/optimal-power-flow
2. https://albertaviews.ca/electricity-deregulation/
3. http://nptel.ac.in/courses/108101005/
4. https://www.inc.com/magazine/20001101/20897.html

Course Outcomes

At the end of the course, students will be able to

1. Estimate the optimal scheduling of power plants.
2. Analyze the Power system security -Contingency analysis.
3. Analyse state estimation of Power system by using different measurements
4. Investigate the importance of restructuring and deregulation in Indian Power sector.
5. Compute Available Transfer Capability (ATC) and the cost of transmission.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**2**	**2**	**3**	
CO2	**2**		**3**	**2**	**2**	
CO3	**3**		**2**	**3**	**3**	
CO4	**2**		**2**	**2**	**2**	
CO5	**3**		**2**	**2**	**2**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: A2119	**RESTRUCTURED POWER SYSTEMS**	**L**	**T**	**P**
Credits: 3	(Professional Elective - III)	**3**	**-**	**-**

Prerequisites: Nil

Course Objectives: To Introduce the restructuring of power industry and market models. To impart knowledge on fundamental concepts of congestion management. To analyze the concepts of locational marginal pricing and financial transmission rights. To Illustrate about various power sectors in India.

MODULE I: Introduction to Restructuring of Power Industry 10 Periods

Introduction: Deregulation of power industry, Restructuring process, Issues involved in deregulation, Deregulation of various power systems – Fundamentals of Economics: Consumer behavior, Supplier behavior, Market equilibrium, Short and long run costs, Various costs of production – Market models: Market models based on Contractual arrangements, Comparison of various market models, Electricity vis – a – vis other commodities, Market architecture, Case study.

MODULE II: Transmission Congestion Management 10 Periods

Introduction: Definition of Congestion, reasons for transfer capability limitation, Importance of congestion management, Features of congestion management – Classification of congestion management methods – Calculation of ATC - Non – market methods – Market methods – Nodal pricing – Inter zonal and Intra zonal congestion management – Price area congestion management – Capacity alleviation method.

MODULE III: Locational Marginal Prices and Financial Transmission Rights 10 Periods

A: Mathematical preliminaries: - Locational marginal pricing– Lossless DCOPF model for LMP calculation – Loss compensated DCOPF model for LMP calculation – ACOPF model for LMP calculation – Financial Transmission rights – Risk hedging functionality - Simultaneous feasibility test and revenue adequency.

B: FTR issuance process: FTR auction, FTR allocation – Treatment of revenue shortfall – Secondary trading of FTRs – Flow gate rights – FTR and market power - FTR and merchant transmission investment.

MODULE IV: ANCILLARY SERVICE MANAGEMENT AND PRICING OF TRANSMISSION NETWORK **9 Periods**

Introduction of ancillary services – Types of Ancillary services – Classification of Ancillary services – Load generation balancing related services – Voltage control and reactive power support devices – Black start capability service - How to obtain ancillary service –Co-optimization of energy and reserve services - International comparison Transmission pricing – Principles – Classification – Rolled in transmission pricing methods – Marginal transmission pricing paradigm – Composite pricing paradigm – Merits and demerits of different paradigm.

MODULE V: Reforms in Indian Power Sector **9 Periods**

Introduction – Framework of Indian power sector – Reform initiatives - Availability based tariff – Electricity act 2003 – Open access issues – Power exchange – Reforms in the near future.

TEXT BOOKS

1. Mohammad Shahidehpour, Muwaffaq Alomoush, Marcel Dekker, "**Restructured Electrical Power Systems: Operation, Trading and Volatility**" Pub., 2001
2. Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen," **Operation of Restructured Power Systems**", Kluwer Academic Pub., 2001.

REFERENCES

1. Sally Hunt," **Making Competition Work in Electricity**", , John Willey and Sons Inc. 2002
2. Steven Stoft," **Power System Economics: Designing Markets for Electricity**", John Wiley & Sons, 2002.

Course Outcomes:

After completion of the course, students will be able to:

1. Comprehend the process involved in restructuring of power industry.
2. Classify different types of congestion management methods.
3. Analyse different models of Locational Marginal Prices (LMP).
4. Recognize the types of ancillary services.
5. List the requirements to reform the Indian power sector.

CO-PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3				3	2
CO2	3				2	2
CO3	2				3	3
CO4	3				2	2
CO5	3				2	3

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: A2120	**EHV AC TRANSMISSION**	**L**	**T**	**P**
Credits: 3	(Professional Elective - III)	**3**	**-**	**-**

Prerequisites: Nil.

Course Objectives:

To identify the different aspects of Extra High Voltage A.C and D.C Transmission design and Analysis. To understand the importance of modern developments of E.H.V and U.H.V transmission systems. To demonstrate EHV ac transmission system components, protection and insulation level for over voltages.

MODULE I: Introduction to EHVAC **10 Periods**

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.

MODULE II: Electrostatic field and voltage gradients **9 Periods**

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.

MODULE III: Over Voltages in EHV lines **10 Periods**

A: Electrostatic induction in unenergized lines – measurement of field and voltage gradients for three phase single and double circuit lines – un energized lines.

B: 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.

MODULE IV: Corona in E.H.V. lines **10 Periods**

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.

MODULE V: Design of EHV lines **9 Periods**

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

TEXT BOOKS

1. R. D. Begamudre ,**"EHVAC Transmission Engineering"**, New Age International (p) Ltd. 3rd Edition.
2. K.R. Padiyar, **"HVDC Power Transmission Systems"**, New Age International (p) Ltd. 2nd revised Edition, 2012.

REFERENCES

1. S. Rao, **"EHVAC and HVDC Transmission Engg. Practice"**, Khanna publishers.
2. Arrillaga.J, **,** 2nd Edition (London) peter Peregrines, IEE, 1998.
3. Padiyar.K.R, **" FACTS Controllers in Power Transmission and Distribution"** , New Age International Publishers, 2007.
4. Hingorani H G and Gyugyi. L, **"Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems",** New York, IEEE Press, 2000.

E-RESOURCES

1. https://www.electrical4u.com/voltage-in-power-lines/
2. https://www.electrical4u.com/corona-effect-in-power-system/
3. http://nptel.ac.in/courses/108108033/

Course Outcomes

At the end of the course, students will be able to

1. List the necessity of EHV AC transmission, choice of voltage for transmission, line losses and power handling capability.
2. Analyze the electrostatic field of AC lines and voltage gradients.
3. Calculate the power frequency voltage control and over voltage in EHV lines.
4. Estimate the Corona loss and Measurements of RI and RIV in EHV lines
5. Emphasize the Statistical procedures for line designs, and characteristics of EHV cables.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**2**	**2**	**3**	
CO2	**2**		**2**	**3**	**2**	
CO3	**2**		**3**	**2**	**2**	
CO4	**2**		**2**	**3**	**2**	
CO5	**3**		**3**	**3**	**3**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: A2121	**INDUSTRIAL LOAD MODELLING AND CONTROL** (Professional Elective - III)	**L**	**T**	**P**
Credits: 3		**3**	**-**	**-**

Prerequisites: Nil

Course Objectives: To understand the energy demand scenario. To understand the modeling of load and its ease to study load demand industrially. To know Electricity pricing models. To Study Reactive power management in Industries.

MODULE I: Industrial Electric Energy Scenario 10 Periods

Electric Energy Scenario-Demand Side Management-Industrial Load Management - Load Curves - Load Shaping Objectives – Methodologies - Barriers - Classification of Industrial - Loads - Continuous and Batch processes -Load Modeling.

MODULE II: Electricity Pricing 10 Periods

Electricity pricing – Dynamic and spot pricing –Models - Direct load control- Interruptible load control - Bottom up approach- scheduling- Formulation of load – Models - Optimization and control algorithms - Case studies.

MODULE III: Reactive Power Management 10 Periods

A: Reactive power management in industries - controls-power quality impacts - application of filters Energy saving in industries

B: Selection of Schemes Optimal Operating Strategies - Peak load saving - Integrated Load management for Industries

MODULE IV: Optimal Operation of Loads 9 Periods

Cooling and heating loads - load profiling - Modeling- Cool storage - Types-Control strategies - Optimal operation - Problem formulation- Case studies.

MODULE V: Power Pooling 9 Periods

Captive power units – Operating and control strategies - Power Pooling- Operation models - Energy banking - Industrial Cogeneration.

TEXT BOOKS

1. I.J.Nagarath and D.P.Kothari, "**Modern Power System Engineering**., Tata McGraw Hill publishers, NewDelhi, 1995.

REFERENCES

1. C.O. Bjork " **Industrial Load Management - Theory, Practice and Simulations**", Elsevier, the Netherlands,1989.
2. C.W. Gellings and S.N. Talukdar,. "**Load management concepts"**. IEEE Press, New York, 1986, pp. 3-28.
3. Y. Manichaikul and F.C. Schweppe ," **Physically based Industrial load**", IEEE Trans. on PAS, April 1981.

Course Outcomes

At the end of the course, students will be able to

1. Recognize about load control techniques in industries and its application
2. Analyse different types of industrial processes and optimize the process using tools like LINDO and LINGO
3. Apply load management to reduce demand of electricity during peak time
4. Apply different energy saving opportunities in industries
5. Comprehend the concept of power pooling

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**		**3**	**3**	**3**	**2**
CO2	**3**		**2**	**2**	**2**	**2**
CO3	**2**		**3**	**2**	**2**	**2**
CO4	**3**		**2**	**2**	**3**	**2**
CO5	**2**		**3**	**3**	**3**	**2**

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: A2122	**AI TECHNIQUES IN POWER SYSTEMS**	**L**	**T**	**P**
Credits: 3	(Professional Elective - IV)	**3**	**-**	**-**

Prerequisites: Nil

Course Objectives:

To cater the knowledge of soft commanding methodologies, such as artificial neural networks, Fuzzy logic and genetic Algorithms. To expose the students to the concepts of feed forward neural networks and about feedback neural networks. To understand about genetic algorithm, genetic operations and genetic mutations.

MODULE I: Artificial Neural Networks 10 Periods

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

MODULE II: ANN Paradigms 9 Periods

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

MODULE III: Fuzzy Logic 10 Periods

A: Introduction – Fuzzy versus crisp – Fuzzy sets - Membership function – Basic Fuzzy set operations – Properties of Fuzzy sets

B: Fuzzy Cartesian Product –Operations on Fuzzy relations. Fuzzy logic – Fuzzy Quantifiers-Fuzzy Inference-Fuzzy Rule based system-Defuzzification methods.

MODULE IV: Genetic Algorithms 10 Periods

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.

MODULE V: Applications Of AI Techniques 9 Periods

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 BOOKS

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

REFERENCES

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

E-RESOURCES

1. https://aitopics.org/
2. ieeexplore.ieee.org/document/10029/
3. www.nptelvideos.in/2012/11/artificial-intelligence-prof-p-dasgupta.html

Course Outcomes

At the end of the course, students will be able to

1. Recognize artificial neuron models, architectures, learning process, and learning techniques of artificial neutron models.
2. Apply algorithms like back propagation algorithm, self organizing map, radial networks.
3. Apply the concept of fuzzy based system, analogy between fuzzy and crisp sets, basic fuzzy set operations, rule based systems, Defuzzification methods.
4. Apply the genetic modeling, fitness function reproduction operators.
5. Apply the Intelligence techniques to real Power Systems.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**			**3**	**3**	
CO2	**3**			**2**	**3**	
CO3	**2**			**3**	**2**	
CO4	**2**			**2**	**3**	
CO5	**3**			**3**	**2**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: A2123	MODERN CONTROL THEORY (Professional Elective - IV)	**L**	**T**	**P**
Credits: 3		**3**	**-**	**-**

Prerequisites: Control Systems

Course Objectives: To explain the concepts of basic and modern control system for the real time analysis and design of control systems. To explain and apply concepts of state variables analysis. To analyze non linear systems. To apply the comprehensive knowledge of optimal theory for Control Systems.

MODULE I: Mathematical Preliminaries 10 Periods

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.

MODULE II: State Variable Analysis 10 Periods

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.

MODULE III: Non Linear Systems 10 Periods

A: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

B: 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.

MODULE IV: Stability Analysis 9 Periods

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.

MODULE V: Optimal Control 9 Periods

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

TEXT BOOKS

1. M.Gopal , **"Modern control system theory",** New Age International , 1984
2. Nagrath and Gopal, **"Control System Engineering"**, New Age International,4th Edition, 2006.

REFERENCES

1. Kirck, **"Optimal control"** , Dover Publications
2. A. NagoorKani , **"Advanced Control Theory"**, RBA Publications, 1999.
3. Ogata.K ," **Modern Control Engineering"**, Prentice Hall, 1997.

E-RESOURCES

1. http://nptel.ac.in/courses/108101037/
2. https://www.electrical4u.com/state-space-analysis-of-control-system/

Course Outcomes

At the end of the course, students will be able to

1. Apply the mathematical analysis for state model and state diagrams.
2. Understand the concepts of state variables analysis.
3. Understand the concepts of Non Linear Systems.
4. Analyze the concept of stability of nonlinear systems.
5. Analyze the concept of Optimal control problems.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**		**3**	**2**	**2**	
CO2	**3**		**2**	**2**	**3**	
CO3	**2**		**3**	**2**	**2**	
CO4	**3**		**2**	**2**	**3**	
CO5	**2**		**3**	**2**	**2**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: A2124	**POWER SYSTEM RELIABILITY AND PLANNING**	**L**	**T**	**P**
Credits: 3	(Professional Elective-IV)	**3**	**-**	**-**

Prerequisites: Nil

Course Objectives:

To develop the generation system model and recursive relation for capacitive model Building. To evaluate the equivalent transitional rates, cumulative probability and cumulative Frequency.

MODULE I: Generating System Reliability Analysis – I **10 Periods**

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.

MODULE II: Generating System Reliability Analysis – II **9 Periods**

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.

MODULE III: Operating Reserve Evaluation **9 Periods**

A: Basic concepts - risk indices – PJM methods – security function approach – rapid start and hot reserve units – Modeling using STPM approach.

B: 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.

MODULE IV: Inter Connected System Reliability Analysis **10 Periods**

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.

MODULE V: Distribution System Reliability Analysis - II **10 Periods**

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. Allan, **"Reliability Evaluation of Power Systems"**, Plenum press, New York and London, 2nd Edition, 1996.
2. J. Endrenyi,**"Reliability Modeling in Electric Power Systems"**, John Wiley and Sons, 1st Edition, 1978.

REFERENCES

1. D. Elmakias, **"Computational Methods in Power system Reliability"**, Springer-Verlag.

E-RESOURCES

1. technav.ieee.org/tag/8149/power-system-reliability
2. ieeexplore.ieee.org/document/7042739/
3. nptel.ac.in/syllabus/108101039/

Course Outcomes

At the end of the course, students will be able to

1. Estimate the loss of load and energy indices for generation systems model
2. Illustrate merging generation and load models
3. Apply various indices for distribution systems and evaluation of Bulk Power System Reliability.
4. Apply various indices for distribution systems and evaluation of Bulk Power System Reliability.
5. Analyze the parallel configuration of distribution systems and operation of substations and switching stations.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**		**2**	**2**	**3**	
CO2	**2**		**3**	**2**	**2**	
CO3	**2**		**2**	**2**	**3**	
CO4	**2**		**3**	**2**	**3**	
CO5	**3**		**3**	**2**	**2**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: A2108	**POWER SYSTEMS COMPUTATION LAB -II**	**L**	**T**	**P**
Credits: 1.5		**-**	**-**	**3**

Course Objectives:

To acquire knowledge about the computational methods in economic load dispatch and unit commitment.

List of Experiments:

1. Develop a Program For Economic Load Dispatch with Neglecting Losses and Generator Limits.
2. Develop a Program For Economic Load Dispatch With Losses And No Generator Limits.
3. Formation of Z_{BUS} by Building Algorithm.
4. Develop a program for Optimal loading of generators.
5. Develop a program for line outage distribution factors.
6. Develop a program for Economic dispatch using lambda-iteration method in a power System.
7. Develop a program for Unit commitment by Brute Force Method in a power system.
8. Develop a program for Nominal representation of a transmission line.
9. Develop a program for dynamic response of a generator.
10. Develop a program for Ferranti effect in a power system.

Course Outcomes

At the end of the course, students will be able to

1. Analyze economic load dispatch and formation of Z_{BUS} By Building Algorithm
2. Analyze optimal loading of generators and line outage distribution factors.
3. Develop a program for unit commitment.
4. Analyze Ferranti Effect.
5. Analyze dynamic response of a generator.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**		**3**	**2**	**3**	
CO2	**3**		**2**	**2**	**2**	
CO3	**2**		**3**	**2**	**3**	
CO4	**3**		**2**	**2**	**2**	
CO5	**3**		**2**	**2**	**3**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: A2109	**POWER SYSTEM PROTECTION LAB**	**L**	**T**	**P**
Credits: 1.5		**-**	**-**	**3**

Course Objectives:

To enhance the knowledge of power system protection by studying the characteristics of various relays. To emphasis the performance of transmission line model and transformer.

List of Experiments:

1. Determination of Equivalent circuit of a 3-Winding Transformer.
2. Determination of Sequence Impedances of a Cylindrical Rotor Synchronous Machine.
3. Determination of Sequence Impedances of Three Phase Transformer
4. Characteristics of Over Current Relays
   i) IDMT Electromagnetic Relay (7051 A).
5. Characteristics of Percentage biased Differential Relay.
   i) Electromagnetic Relay (7054 A).
6. Characteristics of Microprocessor based Over Voltage Relay (7053 B).
7. Characteristics of Under Voltage (UV) Microprocessor based Relay (7052 B).
8. Characteristics of Static Negative sequence Relays (7055B).
9. Performance and Testing of Transformer Protection System.
10. Performance and Testing of Transmission Line Model.

Course Outcomes

At the end of the course, students will be able to

1. Determine the equivalent circuit of three winding transformer.
2. Determine the sequence impedances of synchronous machine and three phase transformer.
3. Determine the characteristics of various relays.
4. Emphasis the performance of transmission line model
5. Emphasis the performance of transformer.

CO-PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3		3	2	3	
CO2	2		2	2	2	
CO3	3		3	2	3	
CO4	2		2	2	2	
CO5	3		3	2	2	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: A0A05	**VALUE EDUCATION**	**L**	**T**	**P**
Credits: Nil		**2**	**-**	

Prerequisites: Nil

Course Objectives: The course deals about value of education and self- development, Imbibe good values in students and know about the importance of character.

MODULE I: **6 Periods**

Values and self-development -Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

MODULE II: **7 Periods**

Importance of cultivation of values, Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness, Honesty, Humanity. Power of faith, National Unity, Patriotism.Love for nature, Discipline.

MODULE III: **6 Periods**

A:Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality,

B: Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour.

MODULE IV: **7 Periods**

Universal brotherhood and religious tolerance, True friendship Happiness Vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature.

MODULE V: **6 Periods**

Character and Competence -Holy books vs Blind faith, Self-management and Good health Science of reincarnation, Equality, Nonviolence ,Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively.

References:

1. Chakroborty, S.K. "**Values and Ethics for organizations Theory and practice**", Oxford

University Press, New Delhi

Course Outcomes:

After completion of the course, students will be able to:

1. Understand self-development and moral values
2. Explore the importance of character and cultivation of values
3. Apply the personality development methods
4. Analyze the association and cooperation principles
5. Elaborate the principles of religions and good health science

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Programme Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1					**2**	**2**
CO2					**2**	**2**
CO3					**2**	**2**
CO4					**2**	**2**
CO5					**2**	**2**

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. III Semester		
Code: A2125	**POWER SYSTEM TRANSIENTS**	**L**	**T**	**P**
Credits: 3	(Professional Elective-V)	**3**	**-**	**-**

Prerequisites: Nil

Course Objectives: The course introduces the fundamentals of lighting overvoltage, switching over voltages and travelling waves.

MODULE I: LIGHTNING OVERVOLTAGES 10 Periods

Mechanism and parameters of lightning flash, protective shadow, striking distance, electrogeometric model for lightning strike, Grounding for protection against lightning – Steady-state and dynamic tower-footing resistance, substation grounding Grid, Direct lightning strokes to overhead lines, without and with shield Wires.

MODULE II: SWITCHING AND TEMPORARY OVERVOLTAGES 9 Periods

Switching transients – concept – phenomenon – system performance under switching surges, Temporary overvoltages – load rejection – line faults – ferroresonance, VFTO.

MODULE III: TRAVELLING WAVES ON TRANSMISSION LINE 10 Periods

A: Circuits and distributed constants, wave equation, reflection and refraction – behavior of travelling waves at the line terminations.

B: Lattice Diagrams – attenuation and distortion – multi-conductor system and multivelocity waves.

MODULE IV: INSULATION CO-ORDINATION 9 Periods

Classification of overvoltages and insulations for insulation co-ordination – Characteristics of protective devices, applications, location of arresters – insulation coordination in AIS and GIS.

MODULE V: COMPUTATION OF POWER SYSTEM TRANSIENTS 10 Periods

Modelling of power apparatus for transient studies – principles of digital computation – transmission lines, cables, transformer and rotating machines – Electromagnetic Transient program – case studies: line with short and open end, line terminated with R, L, C, transformer, typical power system case study: simulation of possible overvoltages in a high voltage substation.

TEXT BOOKS

1. Pritindra Chowdhari, "**Electromagnetic transients in Power System**", John Wiley and Sons Inc., Second Edition, 2009.

2. Allan Greenwood, "**Electrical Transients in Power System**", Wiley & Sons Inc. New York, 2012.

REFERENCES

1. Klaus Ragaller, "**Surges in High Voltage Networks**", Plenum Press, New York, 1980.
2. Rakosh Das Begamudre, "**Extra High Voltage AC Transmission Engineering**", (Second edition) Newage International (P) Ltd., New Delhi, 2006.
3. Naidu M S and Kamaraju V, "**High Voltage Engineering**", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.

Course Outcomes

At the end of the course, students will be able to

1. Apply protection techniques against lightning overvoltage.
2. Analyse switching and temporary overvoltage
3. Analyse behaviour of travelling waves in the transmission llines
4. Choose protective devices according to insulation coordination
5. Analyse the power system under transient condition.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**2**	**2**	**3**	
CO2	**2**		**3**	**3**	**2**	
CO3	**2**		**3**	**2**	**2**	
CO4	**2**		**2**	**3**	**2**	
CO5	**3**		**2**	**2**	**2**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. III Semester		
Code: A2126	**FLEXIBLE AC TRANSMISSION SYSTEMS**	**L**	**T**	**P**
Credits: 3	(Professional Elective-V)	**3**	**-**	**-**

Prerequisites: Nil

Course Objectives: The course introduces the fundamentals of FACTS Controllers, Importance of controllable parameters and types of FACTS controllers & their benefits.

MODULE I: Facts Concepts **10 Periods**

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.

MODULE II: Voltage Source Converters **9 Periods**

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.

MODULE III: Static Shunt Compensation **10 Periods**

A: 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.

B: 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.

MODULE IV: Static Series Compensators **10 Periods**

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.

MODULE V: Unified Power Flow Controller **9 Periods**

SSR and its damping Unified Power Flow Controller, Circuit Arrangement, Operation and control of UPFC, Basic Principle of P and Q control, Independent real and reactive power flow control- Applications. Introduction to Interline Power Flow Controller.

TEXT BOOKS

1. N.G. Hingorani and L. Guygi, **"Understanding FACTS Devices",** IEEE Press Publications, 2000.
2. K.R. Padiyar., **" FACTS Controllers in Power Transmission and Distribution**", New Age International Publishers, 2007.

REFERENCES

1. Xiao-Ping Zhang, Christian Rehtanz and Bikash Pal, **"Flexible AC Transmission Systems: Modelling and Control (Power Systems)",** Springer publisher, 2nd Edition, 2012 **.**
2. Rajiv K. Varma R. Mohan Mathur, **"Thyristor-Based FACTS Controllers for Electrical Transmission Systems",** Wiley Publishers, 2011.
3. Nisha Tamta and Ashwini Arya, **"Modelling of Facts Controllers in Power System Networks",** LAP Lambert Academic Publishing, 2012.
4. T J E Miller, **"Static Reactive Power Compensation",** John Wiley and Sons, Newyork, 1982.

E-RESOURCES

1. http://www.electronicshub.org/flexible-ac-transmission-systemfacts/
2. http://www.powerqualityworld.com/2011/09/statcom-static-synchronous-compensator.html
3. https://www.youtube.com/watch?v=6u6twyQYFNM

Course Outcomes

At the end of the course, students will be able to

1. Analyze the importance of controllable parameters and basic concepts of FACTS controllers
2. Apply the concepts of Voltage source converters and Current Source Converters.
3. Apply the static shunt compensation by using different VAR generators.
4. Interpret the control circuits of Shunt Controllers like SVC & STATCOM for various functions.
5. Detect the Power and control circuits of Series Controllers GCSC, TSSC and TCSC.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**		**3**	**2**	**3**	
CO2	**3**		**2**	**2**	**2**	
CO3	**2**		**3**	**2**	**3**	
CO4	**3**		**2**	**2**	**2**	
CO5	**2**		**3**	**3**	**3**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. III Semester		
Code: A2127	**GAS INSULATED SYSTEMS**	**L**	**T**	**P**
Credits: 3	(Professional Elective - V)	**3**	**-**	**-**

Prerequisites: Nil

Course Objectives: To impart the GIS concepts and principles, to compare between Air Insulated Substation and GIS. To understand the design and constructional aspects of GIS.

MODULE I: Introduction to GIS and Properties of Sf_6 10 Periods

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.

MODULE II: Layout of GIS Stations 9 Periods

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

MODULE III: Design and Construction of GIS Station 10 Periods

A: Introduction - Rating of GIS components - Design Features - Estimation of different types of Electrical Stresses -Design Aspects of GIS components

B: 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.

MODULE IV: Fast Transient Phenomena In GIS 9 Periods

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.

MODULE V: Special Problems in GIS and GIS Diagnostics 10 Periods

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 BOOKS

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

REFERENCES

1. Hermann J. Koch, "**Gas Insulated Substations**", Wiley-IEEE Press, 2014.
2. S. A. Boggs, F. Y. Chu and N. Fujimoto, **"Gas-insulated substations: technology and practice"**, Pergamon Press, 1986.

E-RESOURCES

1. http://electrical-engineering-portal.com/gas-insulated-substations-gis
2. https://www.electricity-today.com/overhead-td/gas-insulated-switchgear-options-for-substations
3. https://www.youtube.com/watch?v=q025e5dW32c

Course Outcomes

At the end of the course, students will be able to

1. Analyze the properties of SF6 gas and its functioning
2. Analyze the features and layout of GIS systems
3. Observe constructional design features of GIS design
4. Analyze the Fast Transient Phenomena in Gas
5. Discriminate the Problems and design diagnostic methods of GIS

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**			**2**	**2**	
CO2	**2**			**2**	**2**	
CO3	**2**			**2**	**2**	
CO4	**2**			**2**	**2**	
CO5	**2**			**2**	**2**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. III Semester		
Code:	**Open Elective**	**L**	**T**	**P**
Credits: 3		**3**	**-**	**-**

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. III Semester		
Code: A2110	**TECHNICAL SEMINAR**	**L**	**T**	**P**
Credits: 2		**-**	**-**	**4**

Course Objectives: To promote deeper understanding the basic concepts, physical mechanism behind the processes, participate in scientific analysis and comprehensive of scientific writing of verbal presentation. This course is to introduce post graduate student to ideas, methods and techniques that can improve the content and presentation of scientific seminars.

Course Outcomes:

At the end of the course, students will be able to

1. Write technical documents to the standards
2. Give oral presentation on technical and general topics
3. Express ideas clearly with examples
4. Identify the research opportunities related to their area.
5. Communicate effectively.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Programme Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**1**					**1**
CO2					**2**	
CO3			**2**			
CO4	**2**					**1**
CO5			**1**		**2**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. III Semester		
Code: A2111	**PROJECT / DISSERTATION PHASE - I**	**L**	**T**	**P**
Credits: 8	(Major Project)	**-**	**-**	**16**

Course Objectives: To utilize basic knowledge and advance techniques to make product/process using experimentation and/or simulation and expose to others as document and oral presentation.

Course Outcomes:

At the end of the course, students will be able to

1. Summarize the work completed in the form of technical documents
2. Specify the techniques implemented or to be implemented
3. Explain the results obtained in Project Phase I
4. Summarize the ultimate finding of the project
5. Detailed presentation of work carried out.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Programme Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**1**	**2**	**2**	**3**	**3**	
CO2					**2**	**1**
CO3		**2**	**3**	**3**		
CO4	**2**					**1**
CO5			**2**		**2**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. IV Semester		
Code: A2112	**PROJECT / DISSERTATION PHASE - II**	**L**	**T**	**P**
Credits: 16	(Major Project)	**-**	**-**	**32**

Course Objectives: To utilize science and engineering to make product/process using innovative techniques, predict the results and prepare technical documents.

Course Outcomes:

At the end of the course, students will be able to

1. Identify project goals, constraints, deliverables, performance criteria, control needs and requirements.
2. Implement concepts, tools and techniques to do quality projects.
3. Adapt projects in response to issues that arise internally and externally.
4. Interact with team and stakeholders in a professional manner, respecting differences, to ensure a collaborative project environment.
5. Utilize technology tools for communication, collaboration, information management, and decision support.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Programme Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**1**	**2**	**2**	**3**	**3**	
CO2					**2**	**1**
CO3		**2**	**3**	**3**		
CO4	**2**					**1**
CO5			**2**		**2**	

OPEN ELECTIVES

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. III Semester		
Code: A3228	INDUSTRIAL SAFETY (Open Elective)	L	T	P
Credits: 3		3	-	-

Prerequisites: Industrial Management

Course objectives: The objective of this course is to understand and maintain health and safety from various hazards and understand the different types of maintenance in industry.

Module-I: Industrial safety **10 Periods**

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Module -II: Fundamentals of maintenance engineering: **9 Periods**

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Module -III: Wear and Corrosion and their prevention: **9 Periods**

A: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, Screw down grease cup, Pressure grease gun,. Splash lubrication, Gravity lubrication, Wick feed lubrication, Side feed lubrication and Ring lubrication.
B: Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Module-IV: Fault tracing: **10 Periods**

Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Module -V: Periodic and preventive maintenance: **10 Periods**

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Books:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.

References:

1. Pump-hydraulic Compressors, Audels, McGraw Hill Publication.
2. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

E-Resources

1. https://www.safeopedia.com/definition/1052/industrial-safety
2. https://en.wikipedia.org/wiki/Industrial_safety_system

Course Outcomes

After completion of the course, students will be able to:

1. Understand the basic concepts of industrial safety needs
2. Understand and identify various hazards in industry
3. Understand and avoid wear and tear during manufacturing process
4. Identify suitable fault finding activities
5. Use periodic and preventive maintenance in industry

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Programme Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1				**1**		
CO2	**1**		**3**			
CO3		**2**		**2**		
CO4					**1**	
CO5			**1**			

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. III Semester		
Code: A0B20	**ADVANCED OPTIMIZATION TECHNIQUES** (Open Elective)	**L**	**T**	**P**
Credits: 3		**3**	**-**	**-**

Pre-requisite: Nil

Course Objectives:

To understand extremely important topics under the broad umbrella of optimization, this is synonymous with efficiency which is the underlying prime rationale for all scientific and technological advances and progress.

Module - I: Linear Programming **[10 Periods]**

Introduction and formulation of models; convexity; graphical &simplex method; Big-M Method, Two phase method; degeneracy, non-existent and unbounded solutions; duality in L.P. Dual simplex method, sensitivity analysis for cost and requirement vector; Revised simplex method; Transportation and Assignment problems.

Module - II: Integer Linear Programming **[10 Periods]**

Gomory's cutting plane method; branch and bound algorithm; travelling salesman problem; knapsack problem; linear C-1 problem.

Module - III: Dynamic Programming , CPM & PERT **[9 Periods]**

A: Belman's Principle of optimality; recursive relations; Solution of L.P. Problem; simple examples.

B: CPM & PERT

Module -IV: Non-Linear Programming **[9 Periods]**

Classical optimization methods; equality and inequality constraints; Lagrange multipliers; Kuhn-tucker conditions; quadratic forms; quadratic programming and Beale's methods.

Module -V: Search Methods **[10 Period]**

One dimensional optimization; Fibonacci search; multi dimensional search methods; uni-variate search; gradient methods; steepest descent/ascent methods; conjugate gradient method; Fletcher-reeves method; penalty function approach.

TEXT BOOKS

1) J.K. Sharma "**Operations Research Theory & Applications**", 4th Edition, Mc.Millan Publications
2) S.S.Rao -"**Engineering Optimization theory and Practice**", 4th Edition, J Wiley & Sons, New jersey

REFERENCES

1. K.V.Mital -"**Optimization methods in operations research and system analysis**", 3rd Edition, Newage International (P) Ltd., publishers.
2. H.A Taha "**Operations Research: An Introduction**" Prentice Hall Edition, 2016 reprint
3. Raul Poler et.al "**Operations Research Problems Statement and solutions**" Springer, 2014 reprint.

E Resources:

1. http://www.mhhe.com/engcs/industrial/hillier/etext/PDF/chap03.pdf (LPP)
2. http://ocw.nctu.edu.tw/upload/classbfs121001503719748.pdf (Transportation Problems)
3. http://shodhganga.inflibnet.ac.in/bitstream/10603/19544/12/7_chapter%201.pdf (Replacement Models)
4. https://www.math.ucla.edu/~tom/GameTheory/mat.pdf (Game Theory)
5. http://www.ime.unicamp.br/~andreani/MS515/capitulo12.pdf (Inventory Models)

Course Outcomes

After completion of the course, students will be able to:

1. Find feasible solution to LPP by various methods.
2. Minimize the cost and time by using Travelling salesmen Problem.
3. Understand various methods Dynamic programming.
4. Understand the various concepts on Non-Linear programming.
5. Understand the various concepts of Search methods.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**1**			**3**		
CO2		**1**		**2**		
CO3	**2**			**3**		
CO4	**3**		**1**			
CO5				**3**	**2**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. III Semester		
Code: A1128	**WASTE TO ENERGY** (Open Elective)	**L**	**T**	**P**
Credits: 3		**3**	**-**	**-**

Prerequisites: Nil

Course Objective: The objective of this course is to introduce different Waste to Energy conversions and its innovative practices, explores the role of energy from waste in resource management and clean energy production.

MODULE I: Introduction **8 Periods**

Classification of waste as fuel - Agro based, Forest residue, Industrial waste - MSW - Conversion devices - Incinerators, gasifiers, digestors.

MODULE II: Biomass Pyrolysis **10 Periods**

Pyrolysis - Types, slow fast - Manufacture of charcoal - Methods - Yields and application - Manufacture of pyrolytic oils and gases, yields and applications.

MODULE III: Biomass Gasification **10 Periods**

A: Gasifiers - Fixed bed system - Downdraft and updraft gasifiers - Fluidized bed gasifiers - Design, construction and operation - Gasifier burner arrangement for thermal heating.

B: Gasifier engine arrangement and electrical power - Equilibrium and kinetic consideration in gasifier operation.

MODULE IV: Biomass Combustion **8 Periods**

Biomass stoves - Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

MODULE V: Biogas **12 Periods**

Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants - Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

REFERENCES

1. Desai, Ashok V., "**Non Conventional Energy**", Wiley Eastern Ltd., 1990.
2. Khandelwal, K. C. and Mahdi, S. S., "**Biogas Technology - A Practical Hand Book**" - Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Challal, D. S., "**Food, Feed and Fuel from Biomass**", IBH Publishing Co. Pvt. Ltd., 1991.
4. "**Biomass Conversion and Technology**", C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

E - RESOURCES

1. https://www.eia.gov/energyexplained/?page=biomass_waste_to_energy
2. https://www.r-e-a.net/renewable-technologies/energy-from-waste
3. http://www.volund.dk/Waste_to_Energy/How_it_works

Course Outcomes:

After completion of the course, students will be able to:

1. Understand the different types of wastes generated in an industry
2. Produce energy from various resources
3. Convert urban waste to useful energy
4. Assess the environmental impacts of various wastes.
5. Understand the benefits of waste-to-energy conversion.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**			**3**		
CO2			**2**		**1**	
CO3	**3**			**2**		
CO4			**1**	**1**		
CO5	**3**	**3**			**3**	