Rama University Uttar Pradesh, Kanpur

Faculty of Engineering & Technology

Study & Evaluation Scheme

Master of Technology

(Power Electronics & Power Systems)

[Applicable w.e.f. Academic Session 2016-17 till Revised]

FACULTY OF ENGINEERING & TECHNOLOGY

RAMA UNIVERSITY, UTTAR PRADESH, KANPUR

Website: www.ramauniversity.ac.in

Rama University Uttar Pradesh, Kanpur
Faculty of Engineering & Technology

Ref: RU/FET/EE/BOS/2016/001 **Dated: 25/04/2016**

Faculty of Engineering & Technology
Department of Electrical Engineering
Minutes of Meeting
Boards of Studies

A meeting of Boards of Studies of Electrical Engineering, FET was held on 23/04/2016 (Saturday) at 2:30 PM. in conference room of FET. The following members were present:

1. Mr. Ravi Prakash Vishvakarma - Chairperson
2. Mr. Abhishek Singh - Member
3. Ms. Almas - Member

The following members agreed to review the minutes in Delhi.

1. Prof. N. C. Sarkar - External Member
2. Mr. Pankaj Shrama - External Member

Agenda:

1. Action Taken Report (ATR) on the basis of feedback from Stack holder/External member

The department teams have been working on the curricula and syllabus and consider their feedback and suggestion of stack holder/External member. They suggested that the focus must be on fundamental and practical courses having emphasis on research and development.

Action taken: Courses like (i) Advanced Power System Analysis (ii) Advanced Power Electronics (iii) Advanced Electrical Machines (iv) Advance Machine Lab were included.

2. To review the Vision and Mission statements of the newly established of Electrical Engineering Department.

The Board of Studies reviewed the Vision and Mission statements prepared by the HoD, EE. The Board suggested minor revisions in the both the statements and recommends the final draft for adoption by the Academic Council.

Attached revised Vision and Mission statements in **Annexure: 1**.

3. **To review the Program Outcomes (PO), Program Specific Outcomes (PSO) and Program Educational Objectives (PEO) for M.Tech program.**

The Board reviewed the Program Outcomes (POs) for M.Tech. Program and revised them to fit into the Frame work laid down by the National Board of Accreditation.

The Program Specific Outcomes (PSO) and Program Educational Objectives (PEO) for M.Tech. Program were reviewed and recommended for approval by the Academic Council.

(Annexure: 2 & 3)

4. To consider and approved the curricula and syllabus.

S. No.	Item No.	Existing	Recommendation /Action Taken
1	To conceder and recommendation the evaluation scheme & syllabus for M.Tech students admitted in the session 2016-17.	....	The BOS consider the curricula and syllabus and discuss the credit of each subjects should be added in detailed syllabus of every subject. The BOS recommended the curricula and syllabus for approval by the Academic Council. **(Annexure: 4)**

The meeting concluded with a vote of thanks to the chair.
Date of the Next Meeting: to be decided and conveyed later

(Chairman)

Annexure:

1. Vision and Mission Statement for Department of Electrical Engineering
2. Program Outcomes (PO) for M.Tech Program
3. Program Specific Outcomes (PSO) & Program Educational Objectives (PEO) for M.Tech. Program
4. Evaluation Scheme & Syllabus

CC:
1. Dean
2. Registrar Office

Rama University Uttar Pradesh, Kanpur

Faculty of Engineering & Technology

Annexure: 1

Faculty of Engineering & Technology

Department of Electrical Engineering

Vision

To become a front-runner in bringing out globally competent electrical engineers, Innovators, researchers, and entrepreneurs and thereby contribute value to the knowledge-based economy and society.

Mission

- To provide state-of-the-art resources that contributes to achieve excellence in teaching-learning, research and development activities.
- To bridge the gap between industry and academia by framing curricula and syllabi based on industrial and societal needs.
- To enable students to develop skills to solve complex technological problems of current times and also provide a framework for promoting collaborative and multidisciplinary activities.
- To inculcate moral and ethical values among the faculty and students.

Annexure: 2 &3

Program Educational Objectives (PEO's):

PEO_1- To produce electrical power Electronic & Power Systems post graduates, who are employable in public and private industries/ Institutes/Organization, or pursue higher education.

PEO_2- To prepare graduates who have the ability to identify and address current and future problems in the domain of power systems, power electronics and electrical machines.

PEO_3- To inculcates research attitude and lifelong learning among graduates.

PEO_4- Students should be able to acquire knowledge for realizing it into gainful employment or entrepreneurship being useful to the societal needs.

Program specific outcomes (PSOs):

PSO $_1$- Students will be proficient in designing, developing and analyzing the power converters and their applications.

PSO $_2$- Students will be expertise in state-of-art simulation tools and real-time control platforms and exposure to multidisciplinary collaborative research works to emphasis their skills to attain key positions in research centers and industry or to emerge as entrepreneur.

PSO $_3$- Students will be able to assimilate in depth knowledge in power industry to obtain optimal solutions to complex problems.

PSO $_4$- Students are imbibed with ethical and social responsibilities in their professional endeavors.

Program Outcomes (PO's):

POs are defined for the program is aligned with the graduate attributes as follows:

PO-1: Acquire in-depth knowledge in the domain of power Electronic & Power systems or professional area with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge.

PO-2: Ability to critically analyze various power Electronic & Power systems components, models and their operation.

PO-3: Ability to apply fundamentals and concepts to analyze, formulate and solve complex problems of electrical power Electronic & Power systems and its components.

PO-4: Apply advanced concepts of electrical power engineering to analyze, design and develop electrical components, apparatus and systems and to put forward scientific findings at national and international levels.

PO-5: Ability to use advanced techniques, skills and modern scientific and engineering tools for professional practice.

PO-6: Preparedness to lead a multidisciplinary scientific research team and communicate effectively.

PO-7: Demonstrate and apply knowledge and understanding of engineering principles for project management.

PO-8: To motivate exploring ideas and to encourage for independent, reflective and lifelong learning.

PO-9: The in-depth education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.

PO-10: Ability to contribute to the community for sustainable development of society.

PO-11: Ability to learn from mistakes without depending on external feedback.

ORDINANCE, RULES, REGULATIONS

of

Master of Technology Programmes

RAMA UNIVERSITY UTTAR PRADESH
KANPUR

Mater of Technology Programmes

Title

This ordinance shall be called as "The Rama University Uttar Pradesh, Faculty of Engineering &Technology Ordinance Governing Two Years M.Tech. Degree Course"

APPLICABILITY:

This ordinance shall apply to all programmes leading to Master's Degrees in Technology.

1. DEFINITIONS:

1. Academic Programme/ Programmes shall mean a programme of courses and/or any other component leading to a Master's degree in Technology.

2. An Academic Year is a period of nearly 12 months devoted to completion of requirements specified in the Scheme of Teaching and the related examinations.

3. Board of Studies (BoS) shall mean the Board of Studies of the Institute concerned.

4. Course means a component of the academic programme, carrying a distinctive code number and specific credits assigned to it.

5. University shall mean **Rama University**

6. External Examiner shall mean an examiner who is not in the employment of the University.

7. Semester System – A programme wherein each academic year is apportioned into two parts known as semesters.

8. Student shall mean a person admitted and registered for a programme in the Institutes of the University.

2. CURRICULUM

M.Tech. courses shall be of any one of the following types:

(a) M.Tech. (Residential/Full-Time/Regular): It shall be a regular four-semester course in which students will be required to spend the entire study duration in the University campus or the Industry/ Institution/ R&D Organization where they shall be doing their dissertation/ project work.

(b) M.Tech. (Week-End): It shall be a regular four-semester course specially run by the University for working teachers, persons employed in Industry or Research and Development Organizations, who have a 5-day working week. The programme consists of three semesters of coursework in the University campus and one semester of dissertation/ project work in the University or in the Industry/ Institution/ R&D Organization. Number of contact hours in each subject will be the same as that of Residential M.Tech. Course. A candidate shall normally be required to submit a no objection certificate from his/her employer for this course.

(c) M.Tech. (Part Time): It shall be a six-semester part-time course meant for serving engineers/ teachers of the neighboring areas who can attend the classes during morning or evening hours only. A candidate shall normally be required to submit a no objection certificate from his/her employer for this course.

3. Duration of the Course

(PROGRAMMES CONTENT & DURATION)

(a) A Master's Degree programme shall comprise of a number of courses and/or other components as specified in the Teaching & Examination Scheme of the concerned programme duly approved by the Academic Council.

(b) The minimum period required for completion of a programme shall be the programme duration as specified in the Teaching & Examination Scheme for the concerned programme.

(c) The maximum permissible period for completing a programme for which the prescribed programme duration is n semesters, shall be (n+2) semesters. All the programme requirements shall have to be completed in (n+2) semesters. Under very special circumstances the duration of the total period may further be extended by a maximum of two (2) semesters with the approval of the Vice Chancellor. This excludes the period of expulsion or suspension by the University / medical leave.

(d) (i) A student may be allowed to "audit" a course(s) not included in the Teaching & Examination Scheme, or one of the elective course(s) in the Teaching & Examination Scheme, which the student is not opting for as a credit course.

(ii) The University may ask a student to audit one or more courses as pre-requisite courses so as to make up any deficiency at the entry level.

(iii) Such audited course(s) shall be shown in the final mark-sheet under a distinct head of "Audited Course(s)" provided the attendance requirement of the course is duly certified to have been met by the concerned teacher(s).

IV.However, a student shall neither be entitled to any credits for such course(s), nor these shall be considered for the purpose of declaration of results.

(e) Except for the first semester, registration for the next semester will be done during the first week of the next semester.

(f) From the second semester onwards, all students have to enroll on a specified day at the beginning of a semester. A student is eligible for enrolment if he has paid all the dues for the semester.

4. ELIGIBILITY FOR ADMISSION

B.Tech. or an equivalent degree in the relevant branch of Engineering with a minimum of 50% marks from a recognized University.

OR

MCA or M.Sc. degree in a related branch with 55% or higher aggregate marks from a recognized University

4.1 Medium of Instruction

The medium of instruction and examination shall be in English only.

4.2 Number of seats

Number of students to be admitted each year and the number of batches shall be decided and notified by the University from time to time; based upon the Rules, instructions and Notifications issued by The UGC and the Government of Uttar Pradesh.

5. Procedure for Admission

At the relevant time admission to the course shall be governed by The Acts, Statutes and Ordinances in force and issued by the University. Admission to the Course shall be made strictly on the basis of the merit of the Entrance Test.Provided that while making admission to the course reservation policy of the Government of Uttar Pradesh governing admission to higher educational Institutions issued from time to time shall be applied.

6. Fee's

A student shall pay the fee prescribed by the University from time to time

7.Attendance

All students are normally expected to have attendance of 100% in each subject (Lectures, Tutorials and Practical's). The attendance can be condoned upto 25% for genuine reasons. The Director of the concerned Institute/ Programme Coordinator may give further relaxation up to 10% on account of illness and other pre-approved occasions. Vice Chancellor may further condone attendance shortage up to 5% on genuine grounds. However, under no circumstances, a student with an attendance of less than 60% in a subject shall be allowed to appear in the semester-end examination of that subject. Provided that the late admitted students in the first semester of any course maintain at least 80% attendance (including medical and other reasons) from the date of their admission.

Director/Dean of the Institute / Programme Coordinator shall announce the names of all such students who are not eligible to appear in the subject(s) of semester-end examination, at least one week before the start of the semester-end examination and simultaneously intimate the same to the Controller of Examinations.

In case any student appears in the Examinations by default, who in fact has been detained by the Institute, his/ her result shall be treated as null and void.

8. Make-up Policy

Any student who misses any component of evaluation for genuine reasons must directly approach the instructor- in- charge/ instructor with a request for make-up examination stating the reasons, prior to the commencement of the examination. If the instructor-in-charge is satisfied with the request, he may arrange as soon as possible a make-up examination for the component of evaluation which the student had missed. If, on rare occasion, a student anticipates a genuine difficulty in meeting the date of the component of evaluation, he should take his instructor-in-charge/instructor into confidence prior to the event. The decision of the instructor-in-charge in all matters of make-up shall be final.

9.Curriculum:(basis of programmes)

9.1 The2 year curriculum has been divided into 4 semesters in full time programme and shall include lectures, tutorials, practicals, seminars and projects etc. in addition to industrial training and educational tour etc. as defined in the scheme and executive instructions issued by the University from time to time. And programme duration shall be basis on clause 2.(a,b,c)

9.2The curriculum will also include such other curricular, co-curricular and extra- curricular activities as may be prescribed by the University from time to time.

10.Change of Branch:

10.1Change of branch may be allowed against the vacant seats in the following two stages, provided criteria at following sub clauses is satisfied: branch shall be change basis on vice chancellor approval

10.2Further change of branch shall not be permitted.

11. Teaching

The objective of classroom education is to awaken the curiosity of the student, generate habits of rational thinking in him, gear his mind to face the unfamiliar and train him to stand on his own. Classroom instruction helps the student in the organization and correlation of facts, comprehension of ideas and the creative use of knowledge.

The teacher also has the additional responsibility to make the student search for knowledge on his own and induce him to use additional facilities like the library, laboratory and the environment, to optimize his learning process. Self-study by the student would therefore form an important factor in the planning of teaching and evaluation. The student is required to cooperate and respond to this challenge.

Every course whether single-section or multi-section is conducted by a member of the faculty called instructor-in-charge, with the assistance, wherever necessary, of the required number of instructors who will be partners with him in meeting the full academic perceptions and organizational needs of teaching the course and evaluating the students. Wherever the instructor-

in-charge is mentioned hereafter, it connotes the team of instructors, acting as one entity under his captainship.

The instructor-in-charge should make a comprehensive plan in respect of conducting the course even before the semester begins. In a multi-section course, all instructors must remain in continuous interaction in order to ensure a smooth operation of the course. While recognizing variations due to personal attitudes and styles, it is important that these are smoothened out so that the operation and grading in different sections in a course, indeed between courses across the faculty, are free from any seeming arbitrariness.

At the beginning of class work, the instructor, in-charge/instructor must announce to his class/ section through a Course Handout/Lesson Plan, the necessary information in respect of (i) the operations of the course (its pace, coverage and level of treatment, textbooks and other reading assignments, home tasks etc); (ii) various components of evaluation, such as tutorials, laboratory exercises, home assignment, several quizzes/tests/examinations (announced or unannounced, open book or closed book), regularity of attendance, etc. (iii) the frequency, duration, tentative schedule, relative weightage etc., of these various components; (iv) the broad policy which governs decisions about make-up; (v) mid-semester grading; (vi) grading procedure (overall basis, review of border line cases, effect of class average etc.) vii) Chamber consultation hours and (viii) other matters found desirable and relevant.

12. Examination:

12.1 The performance of a student in a semester shall be evaluated through continuous evaluation and end semester examination. The continuous evaluation shall be based on Mid Term Examination, assignments/tutorials, quizzes/viva-voce and attendance. The marks for continuous evaluation (Sessional marks) shall be awarded at the end of the semester. The end semester examination shall be comprised of written papers, practical's and viva-voce, inspection of certified course work in classes and laboratories, project work, design reports or by means of any combination of these methods.

12.2 The distribution of marks for Sessional, end semester theory papers, practicals and other examinations, seminar, project, industrial training shall be as prescribed.

12.3 The marks obtained in a subject shall consist of marks allotted in end semester theory paper, practical examination and sessional work.

12.4 The minimum pass marks in each theory subject (including sessional marks) shall be 50% with a minimum of 40% marks in each theory paper in the end semester examination. If there is no provision of sessional marks in any subject, the minimum pass marks in that subject shall be 50% in the end semester examination.

12.5 The minimum pass marks in a project/practical subject (including Sessional marks if any) shall be 50%.

12.6 A candidate, in order to pass, must secure 50% marks in the aggregate in a particular academic year inclusive of both semesters of the academic year subjected to conditions as bye laws

12 (b) Carryover System:

A candidate satisfying universityclause shall be required to exercise his/her choice upto a maximum of fourtheory papers inyear which he/she desires to appear in the examination to fulfill the requirements of clause. He/she shall inform the college about his/her choice within 15 days after the start of new session.

The highest marks secured in any subject in various attempts (end semester and carryover examinations) shall be considered.

12.(c)Ex-studentship:

A candidate opting for ex-studentship shall be required to appear in all the theory & practical subjects in the end semester examinations of both semesters of the same academic year. However, the marks pertaining to Sessional, Industrial Training, and Seminar shall remain the same as those secured earlier.

A candidate opting for ex-studentship shall be required to apply to the FET by paying only examination fee within 15 days from the start of new session.

12 (D) Re-admission:

- A Candidate may be allowed for re-admission provided he/she satisfies one of the following conditions:
- A candidate is declared fail.
- A candidate did not appear in a semester examination / or he/she was not granted permission to appear in the examination.
- A candidate has been detained by the department and subsequently has been permitted to take re-admission.
- A candidate as an ex-student passed the examination of the academic year or qualified for carryover system.

A candidate promoted with carry over subjects and he/she opted for re- admission.

13. Evaluation Feedback

Just as evaluation is done in continuous manner, feedback should also be available in a continuous manner. Thus, the answer scripts must be promptly evaluated, shown to the students for them to obtain any clarification on their performance and returned to the students whenever practical. The performance of the students in the examination should be discussed in the class giving as much details as possible like the highest, lowest and average performances. Solutions with marking schemes are displayed soon after a test.

14.Promotion:

The result of a candidate shall be declared on the basis of performance of both semesters of the same academic year. However, a final year student, who is not permitted in any one of the final year semester examinations due to shortage of attendance, will be permitted in that particular semester of the next academic session to study as a regular student and appear at that semester examination.

- Result of the final year shall be declared on the basis of working out Grand Total by adding marks of all the years of study in the following ways:

Award of Division: The division shall be awarded on the basis of final year result.

15.Grace Marks:

A candidate may be awarded grace marks up to a maximum of total 5 marks, in maximum onetheory subjects

The grace marks shall not be added to the aggregate marks.

16. Reports

At the end of the course, in certain situations, the instructor-in-charge may report certain events/facts in suitable words, in place of grades discussed earlier. These reports are not to be construed as grades. The various reports listed below are elaborated in the subsequent clauses.

- Incomplete (I)
- Grade Awaited (GA)
- Withdrawn (W)
- Registration Cancelled (RC), Required to Register (RR), Discontinued from the Program (DP)
- Not Cleared (NC)

Incomplete (I)

If the instructor-in-charge finds a student having not fulfilled some of the requirements of a course before the final deadline for transmitting the grade, and he is satisfied that he is able to transmit some grade or a report with or without this particular fulfillment, but at his discretion wishes to give the student an opportunity, he may, within the deadline, send a report 'I' (Incomplete) and also inform the student of the same. It shall be the responsibility of the student to contact the instructor-in-charge in time for replacement of the 'I' report within two weeks after the end of the semester (and within one week after the end of summer term, for a summer term course) which the instructor-in-charge will communicate whatever grade/report is possible

for the situation. Whenever such relaxation is made, the Dean/Director will specify at his discretion, with the consent of the instructor-in-charge, the date by which 'I' report has to be converted.

The requirement envisaged in the above clause must be completed within the time allowed. If the extra time given goes beyond the registration in the next semester/term, registration in the next semester/term, is not possible. The student in such a situation should seek permission to stay away as per the above clause

Grade Awaited (GA)

There are many situations where operational and practical difficulties may cause a delay in the communication of a grade. Certain situations which are visualized in this connection are: (i) where a case of unfair means is pending; (ii) where a case of indiscipline is pending, and (iii) where the courses are being conducted at an off campus centre for IP students, where precise co-ordination between the Institute and these centres may not work in a timely manner. In these circumstances the Dean may authorize the instructor-in-charge to report GA (Grades Awaited).

A student may also get a "GA" report if he has, due to a genuine reason not been able to appear for an examination on the scheduled date and his request for make-up has been granted. In such a case, the student should ensure by the end of the term that either:

- He takes the make-up examination and convert the "GA" report onto a letter grade or
- He makes an application to the Dean/Director, through Instructor in Charge to convert "GA" report into a "NC" report.

Whenever the report GA appears in the grade sheet, a student will not be allowed to register for the subsequent semester, until the student takes steps to convert "GA" report into a letter grade or "NC" report.

Withdrawn (W)

A student may seek withdrawal from the course(s) in a semester for any of the following reasons:

- The student is unable to register for the course(s) for a genuine reason.

- The student is unable to cope up with the normal load and withdraws from the course(s) to reduce his academic load for a particular semester.

The request for withdrawal should be made to the Dean of the faculty, within two weeks of the commencement of the semester in case of (i) above and within the stipulated duration as specified in the academic calendar in the case of (ii) In such cases the grade sheet/transcript of the student will indicate 'W' (Withdrawn against the course(s) from which the student has withdrawn his registration. The student will have to register for the course(s) when it is offered next and obtain a valid letter grade. If the course with 'W' report is a prerequisite course for another course, the registration to the course is possible only on obtaining a valid letter grade in the prerequisite course with 'W' report. If the withdrawal is made after the due date, the event will be reported as "RC" or "DP" as the case may be.

Registration Cancelled (RC) or Required to Register (RR) or Discontinued from the Programme (DP)

If a student's registration for a course has to be cancelled, this fact will be reported in the grade sheet as RC (Registration Cancelled). Registration would be cancelled and an RC is issued in the following cases:

- Cancellation is recommended as a part of disciplinary action for resorting to unfair means during examination or other unprofessional behavior.
- Cancellation is recommended due to less than the minimum required percentage of attendance.
- Cancellation is recommended if a provisionally admitted student fails to submit the proof of necessary documents required for registration and/or does not satisfy the minimum eligibility requirements for the admission within the prescribed time limit.
- Cancellation is recommended when a student persistently and/or deliberately does not pay his dues.

RC itself has many meanings and may be reported as the following:

- When it is clearly known that the student will be required to register again in the same course, the event will be reported as RRA (Required to Register Again).

- If RC amounts to discontinuation from the program it will be reported as DP (Discontinued from the Program)
- If the cancellation of registration is not reported either as RRA or as DP but is reported as RC, it does not necessarily mean that it is free from any constraint. The meaning of the constraint has to be construed from the context in which the RC is reported.

Not Cleared (NC)

If a student continued to remain registered in a course but gave the instructor inadequate opportunity to evaluate him by absenting himself from quizzes/tests/examinations/other components of evaluation, or by appearing in the same for the sake of appearance without applying himself to the task in hand or by submitting a blank script (answer book), these events would be reported as NC (Not Cleared).

Whenever a student gets a NC report in a course irrespective of whether he has a grade in the course or not earlier to this event, the following will govern further action. It is to be noted that a NC cannot be ignored, except under the situations described in (b) and (c) below:

- Whenever a student gets a NC report in a course which is in the compulsory package of his program, he is required to register again in the some course and get a valid grade therein.
- If a student has a NC report in a course taken as elective, he can either repeat the course to get a valid grade or ignore it to choose another course. However, a student must get valid grades in at least the prescribed number of electives in his program.
- Whenever a student's record has an NC in a course which remains unaccounted after a process of transfer has been completed it will not be possible for him to wipe out the NC report in such a course because this course is not a part of his program anymore; and he can graduate with this NC.
- If a student is reported NC in a project course, it will be administratively converted to RC by the Dean and future registration in project courses will be done only if the Dean is satisfied with the genuineness of the candidate's interest in the course.
- If a student is reported NC in Thesis or Seminar, he will be required to register in the same for one more semester. Operationally, this is to be achieved by requiring him to

register once again in as many units of Thesis or Seminar in which he had registered when he was awarded NC. If these two courses get separated due to NC in one of them, there is no need to register in the other.

17. Grade Sheet

A student's grades, reports, CGPA, etc., at the end of every semester/term will be recorded on a grade sheet, a copy of which will be issued to him. The grade sheet will be withheld when a student has not paid his dues or when there is a case of breach of discipline or unfair means pending against him.

While registration with approval of appropriate authority consistent with these regulations is a token of permission to pursue studies, the grade sheet is a complete record of the outcome of what was intended in the original/amended/ revised registration. The various grades and reports discussed above would be appropriately used to tally the grade sheet with original/ amended/revised registration. It would be evident that this tally between what was registered for and what was obtained in terms of grades and reports will apply to all courses except the course, which was originally registered for, but subsequently replaced by another course through substitution.

The tally is made on a course basis at the end of semester/term to determine which of the courses have been cleared. A course is deemed to have been cleared if the student obtains a grade in the course. However, mere clearing of the prescribed courses does not tantamount to fulfilling the requirements of graduation.

While all the grades secured and other pertinent information for semesters are given in a grade sheet, the chronologically organized information from the grade sheets of a student with the necessary explanation constitutes his transcript which is issued at the time he leaves the Institute or at an intermediate point on request.

18.Scrutiny and Revaluation:

18.1Scrutiny shall be allowed in three theory papers.

18.2Revaluation of theory/practical papers is not permitted.

19.Unfair means:

Cases of unfair means shall be dealt as per the rules of the University and The U.P. Public Examination (Prevention of Unfair means) Act if any in prevalence.

20.Award of Sessional Marks:

Sessional marks for theory subjects, practicals and project shall be awarded as will be prescribed and at present the break-up of sessional marks shall be as follows:

All courses ofM.Tech. shall be evaluated for 150 marks, of which 50 marks shall be for Internal Assessment and 100 for Comprehensive SemesterEnd Examination. Internal Assessment for 50 marks shall be as per the criteria given below:

Criteria	**Marks**
Class Test I	15
Class Test II	15
Assignments, class participation and discussion	10
Attendance	10
Total Internal Assessment	**50**

Marks for Practical Assessment shall be awarded as per the criteria given below:

Criteria	**Marks**
Attendance	5
File Record	5
Practical Perform/Execution	5
Viva-Voce	5
Total Practical Assessment	**20**

All students should have a minimum of 75% attendance in all subjects, in order to appear in term end examination / viva voce. The 75% criterion includes all leaves of absence – whether approved or not approved.

Students failing to obtain 75% attendance shall be required to repeat the course in the subsequent year, along with the next batch, to make up for the shortage of attendance.

Under extraordinary circumstances, a student with attendance below 75% shall be allowed to appear in the term end exams / viva voce. This will be at the discretion of the Vice Chancellor of the University. Circumstances when such leniency shall be shown include:

a. Death of a blood relative – father, mother, grandfather, grandmother, brother or sister.
b. Extreme cases of health adversity requiring hospitalization of the student.

In such cases, the student shall be required to give a written application to the Vice Chancellor of the University, along with appropriate proof. In case of death of blood relative, an application from the parent(s) shall be considered.

All faculty members shall maintain appropriate records and make them available to the University's Examination Centre at the end of the semester.

Credits

The M. Tech. Program has a total of 80 credits and students are required to complete all courses. On completion of all courses, the students shall earn 80 credits and would be eligible for award of the M.Tech. Degree.

Final Year Dissertation-I Work (M. Tech 3rd Semester)

During the 3rd semester, each student shall undertake a pre thesis work to be pursued by him/ her under the supervision of a guide/ supervisor. The guide/ supervisor shall be appointed by the Dean, Faculty of Engineering & Technology. Minimum four copies of Project Report along with one soft copy on a CD shall be submitted at least two weeks prior to the commencement of the Term End Examination of the 3rd Semester. The Dissertation-I Work shall carry 500 marks and shall be evaluated by a Board of Internal and External Examiners, appointed by the Dean. The Dissertation-I Work shall be evaluated in the following manner:

Criteria	Internal	External	Total
Pre-Thesis Report	100	150	250
Viva Voce	100	150	250

Total	200	300	**500**

Note: to move into fourth semester, the candidate will have to opt minimum E Grade in Dissertation-I.

Final Year Dissertation-II Work (M.Tech. 4th Semester)

During the fourth semester, each student shall undertake a Thesis work to be pursued by him/ her under the supervision of a guide/ supervisor. The guide/ supervisor shall be appointed by the Dean, Faculty of Engineering & Technology. Minimum four copies of Project Report along with one soft copy on CD shall be submitted at least two weeks prior to the commencement of the Term End Examination of the 4th Semester. The Dissertation-I Work shall carry 800 marks and shall be evaluated by a Board of Internal and External Examiners, appointed by the Dean/ VC. The Board shall be consisting of two Internal Faculty Members. The Dissertation-II work shall be evaluated in the following manner:

Criteria	**Internal**	**External**	**Total**
Thesis Report	100	200	300
Viva Voce	200	300	500
Total	300	500	**800**

Note: for getting degree, the candidate will have to opt. minimum E grade in Dissertation-II.

Guide Lines for Dissertation Work:

Student will follow any one of given below to complete M.Tech. Dissertation Work:

1. Candidate should present/ publish at least two papers in International Conferences.
2. Candidate should publish at least one paper in International Journals.
3. Candidate should publish at least one paper in National Journals & at least one paper present/ publish in International/ National Conferences.

Note: Dissertation Work Report should be documented in University Format & Norms.

21. Results:

- The result of a candidate shall be declared on the basis of performance of both semesters of the same academic year. However, a final year student, who is not permitted in any one of the final year semester examinations due to shortage of attendance, will be permitted in that particular semester of the next academic session to study as a regular student and appear at that semester examination.

- Result of the final year shall be declared on the basis of working out Grand Total by adding marks of all the years of study in the following ways:

Award of Division: The division shall be awarded on the basis of final year result

22. How to Calculate of Semester Grade Point Average:

- Computation of the Semester Grade Point Average (SGPA) and Cumulative Performance Index (CPI):

  The SGPA is an indicator of the overall academic performance of a student in all the courses he/she has registered during a given semester. It is computed as follows: If the grades awarded to a student are G_1, G_2 etc in courses with corresponding credits C_1, C_2 etc, the SGPA is given by:

$$SGPA = \frac{C_1 \times G_1 + C_2 \times G_2 + \cdots + C_n \times G_n}{C_1 + C_2 + \cdots + C_n}$$

- The CPI indicates the overall academic performance of a student in all the courses registered upto and including the latest completed semester/summer term. It is computed in the same manner as the SGPA, considering all the courses (say, n) and is given by:

$$CPI = \frac{\sum_{i=1}^{n} C_i \times G_i}{\sum_{i=1}^{n} C_i}$$

- Percentage conversion of CPI :

$$\boldsymbol{Percentage of\ Marks = CPI \times 10}$$

- Students should get a minimum grade E in each subject with 5CPI to clear the semester.
- CPI conversion

≥8 CPI	**IstDivision with Honours**
≥6 CPI	**IstDivision**
≥5 CPI	**IIndDivision**
<5 CPI	**Fail**

- In case a student gets a F grade in more than one subject, he / she has to repeat one or more of the subjects by registering for "Guided Study" in the semester the courses are offered. Registration for Guided Study shall be made on the payment of Rs. 500 per subject as well as registering for the examination with a payment of Rs. 1000 per subject.
- If the students get F grade in four subjects in an academic session then he/ she will repeat the year.

- M. Tech. Course should be completed within Four Years. If a student does not complete the M. Tech. program in stipulated time, he / she will have to appear freshly in the program.

23. CANCELLATION OF ADMISSION

The admission of a student at any stage of study shall be cancelled if:

(i) He / She are not found qualified as per the eligibility criteria prescribed by the University.

OR

(ii) He / She are involved in ragging.

OR

(iii) He / She are found involved in creating indiscipline in the Institute/Institute or in the University.

24. BOARD OF STUDIES

The constitution of the Board of Studies of each Institute shall be:

(a) The Director/ Dean of the Institute (Chairperson)

(b) Two Professors

(c) Two Associate Professors

(d) Two Assistant Professors

(e) Two External Expert Members

25. ACADEMIC PROGRAMME COMMITTEE

(a) There shall be an Academic Programme Committee in the Institute/ Department/ Constituent Institutions of the University.

(b) All the teachers of an Institute of Study shall constitute the Academic Programme Committee of which the Director of the Institute shall act as its Chairperson. This Committee shall coordinate the implementation of the courses for optimum utilization of resources and shall also

take care of the coordination of the Institute's programmes with the other programmes run by the different Institutes of the University.

(c) The Academic Programme Committees shall also perform other tasks as assigned to it by the Board of Studies of the concerned Institute of the University.

(d) The Academic Programme Committee shall meet as and when required but at least once every semester. The Chairperson of the Committee will convene the meetings

The Academic Council shall have the power to relax any provision provided in the ordinance in any specific matter/situation subject to the approval of Executive Council of the University & such decision(s) shall be reported to the Chancellor of the University.

Annexure: 4

Rama University Uttar Pradesh, Kanpur

Course Detail and Evaluation Scheme
(Effective from the Session 2016-17)
M.Tech. Power Electronics and Power Systems
Year-I SEMESTER-I

S No.	Course Code	Subject	Hours/Week			Hours	Credits	EVALUATION SCHEME					TOTAL
								SESSIONAL EVALUATION				EXAM ESE	
			L	T	P			CT	TA	AT	TOTAL		
Theory													
1	MEE-101	Power System Operation & Control	3	1	0	4	4	30	10	10	50	100	150
2	MEE-102	Advanced Power System Analysis	3	1	0	4	4	30	10	10	50	100	150
3	MEE-103	Advanced Power Electronics	3	1	0	4	4	30	10	10	50	100	150
4	MEE-104	Digital Control System	3	1	0	4	4	30	10	10	50	100	150
PRACTICAL /TRAINING/ PROJECT													
5	MEE-151	Power System Lab	0	0	4	4	2	-		-	20	30	50
6	MEE-152	Power Electronics Lab	0	0	4	4	2	-		-	20	30	50
Total			**12**	**4**	**8**	**24**	**20**	**120**	**40**	**40**	**240**	**460**	**700**

L=Lecture T=Tutorial P=Practical CT= Cumulative Test TA= Teacher's Assessment ESE=End Semester Exam.

Rama University Uttar Pradesh, Kanpur

Course Detail and Evaluation Scheme
(Effective from the Session 2016-17)
M.Tech. Power Electronics and Power Systems
Year-I SEMESTER-II

S No.	Course Code	Subject	Hours/Week			Hours	Credits	EVALUATION SCHEME					TOTAL
								SESSIONAL EVALUATION				EXAM ESE	
			L	T	P			CT	TA	AT	TOTAL		
Theory													
1	MEE-201	Power System Protection	3	1	0	4	4	30	10	10	50	100	150
2	MEE-202	Advanced Electrical Machines	3	1	0	4	4	30	10	10	50	100	150
3	MEE-203	HVDC Transmission	3	1	0	4	4	30	10	10	50	100	150
4	-	Departmental Elective-I	3	1	0	4	4	30	10	10	50	100	150
PRACTICAL /TRAINING/ PROJECT													
5	MEE-251	Electrical Machine Lab	0	0	4	4	2	-		-	20	30	50
6	MEE-252	Advance Machine Lab	0	0	4	4	2	-		-	20	30	50
Total			12	4	8	24	20	120		40	240	460	700

L=Lecture T=Tutorial P=Practical CT= Cumulative Test TA= Teacher's Assessment ESE= End Semester Exam

Rama University Uttar Pradesh, Kanpur

Course Detail and Evaluation Scheme
(Effective from the Session 2016-17)
M.Tech. Power Electronics and Power Systems
Year-II SEMESTER-III

S No.	Course Code	Subject	Hours/Week			Hours	Credits	EVALUATION SCHEME					TOTAL
								SESSIONAL EVALUATION				EXAM ESE	
			L	T	P			CT	TA	AT	TOTAL		
Theory													
1	-	Departmental Elective-II	3	1	0	4	4	30	10	10	50	100	150
2	-	Departmental Elective-III	3	1	0	4	4	30	10	10	50	100	150
PRACTICAL /TRAINING/ PROJECT													
3	MEE-351	Project/ Seminar	0	0	12	12	4	0	0	0	200	300	500
Total			**6**	**2**	**12**	**20**	**12**	**60**	**20**	**20**	**300**	**500**	**800**

L=Lecture T=Tutorial P=Practical CT= Cumulative Test TA= Teacher's Assessment ESE= End Semester Exam

Rama University Uttar Pradesh, Kanpur

Course Detail and Evaluation Scheme
(Effective from the Session 2016-17)
M.Tech. Power Electronics and Power Systems
Year-II SEMESTER-IV

S No.	Course Code	Subject	Hours/Week L	T	P	Hours	Credits	EVALUATION SCHEME: SESSIONAL EVALUATION CT	TA	AT	TOTAL	EXAM ESE	TOTAL
PRACTICAL /TRAINING/ PROJECT													
1	MEE-451	Dissertation	0	0	18	18	8	0		0	200	600	800
Total			**0**	**0**	**18**	**18**	**8**	**0**		**0**	**200**	**600**	**800**

L=Lecture T=Tutorial P=Practical CT= Cumulative Test TA= Teacher's Assessment ESE= End Semester Exam

Departmental Elective-I

1. EHVAC Transmission MEE-011
2. Applied Instrumentation MEE-012

Departmental Elective-II

1. Energy Management and Audit MEE-024
2. Microprocessor & their Application MEE-025
3. FACTS Devices MEE-026

Departmental Elective-III

1. Advanced Electrical Drives MEE-037
2. Non Conventional Energy Systems MEE-038
3. Energy Efficient Machines MEE-039

MEE-101: POWER SYSTEM OPERATIONS AND CONTROL

L	T	P	CR
3	1	0	4

Course Objectives:

The course is designed to meet with the objectives of:

1. To understand the electrical power plant operation and control.
2. To know the importance of compensation & compensating techniques in power system.

Detail Contents:

Unit-I: Economic operation: **8 Hours**

Load forecasting-Method of last square curve, fit-unit commitment-constraints in unit commitment solution methods-The economic dispatch problem of thermal units-Gradient method-Newton's method-Base point and participation factor method-Unit commitment versus economic dispatch.

Unit -II: Hydro-thermal co-ordination: **8 Hours**

Hydroelectric plant models-scheduling problems-short term hydrothermal scheduling problem gradient approach-Hydro units in series pumped storage hydro plants hydro scheduling using Dynamic programming and linear programming.

Unit -III: Automatic generation control (A.G.C.): **8 Hours**

Review of LFC and economic dispatch control (EDC) using the three modes of control viz. Flat frequency- tie-line control and tie-line bias control-AGC implementation-AGC features static and dynamic response of controlled two area system.

Unit -IV: MVAR control power system security: **8 Hours**

MVAR control–voltage monitoring-application of voltage regulator-synchronous condenser-transformer taps–static VAR compensators-Thyristor switched capacitors-Thyristor controlled reactors. Power system security: Factors affecting system security contingency analysis-linear sensitivity factors, constrained optimal power flow- interior point algorithm-bus incremental costs.

Unit -V: Inventory Control: **8 Hours**

Inventory, Cost, Deterministic Models, Introduction to supply chain management. Quality Control: Process control, Single, Double and Sequential Sampling, Introduction to TQM.

Course Learning Outcomes (CLO):

Students successfully completing this module will be able to:

1. Identify and explain the different methods of generation, distribution, control and compensation involved in the operation of power systems.
2. Design the mathematical models of the mechanical and electrical components.
3. Solve the problems related to the economic dispatch of power, plant scheduling, and unit commitment.

Test Books:-

Test Books:-

1. Allen J. Wood and Brace F Wollenberg, " Power Generation Operation and C ontrol", John Willey & Sons.
2. O.I. Elgerd, "Electric Energy S ystem Theory: - An Introduction", TMH.

Reference Books:-

1. L.K. Krichmayer, "Economic Operation of Power Systems", Jo hn Willey & Sons, N.Y.
2. E.L. Grant, "Principles of Engineering Economy", Ronald Press, N.Y.
3. Nagrath, I.J. and Kothari D.P, "Modern Power System Analysis", TMH, New Delhi

MEE-102: ADVANCED POWER SYSTEM ANALYSIS

L	T	P	CR
3	1	0	4

Course Objectives:

The course is designed to meet the objectives of:

1. In-depth understanding of specialist bodies & Application of engineering methods to complex engineering problem solving.
2. Fluent application of engineering techniques, tools and resources.

Detail Contents:

UNIT-I: **8 Hours**

Formation o f network matrices, singular and non-singular Transformation, Algorithms for formation of b u s admittance and bus impedance matrices, Sparsity Technique and optimal ordering

UNIT-II: **8 Hours**

Load flow studies using Y bus Gauses-Seidel, Newton Raphson, Fast Decoupled Power Flow, Z- Bus formulation for load flow solution, Comparison of various methods of load flow solution.

UNIT-III: **8 Hours**

Three Phase Networks, Three Phase Network Elements, Balanced Network, Transformation Matrices, Three Phase Unbalanced network Elements, Algorithm formation of Three Phase Bus Impedance Matrix, Modification of Three Phase Bus Impedance Matrix for changes in the Network.

UNIT-IV: **8 Hours**

Network faults and Contingency analysis: Fault computation using Z-Bus, Short Circuit Calculation for Three Phase Network using Z-bus, Contingency analysis for power system.

UNIT-V: **8 Hours**

State Estimation-method of least squares-statistics-errors-estimates-test for bad data-structure and formation of Hessian matrix-power system state estimation

Course Learning Outcomes (CLO):

Students successfully completing this module will be able to:

1. Relate the operation and control of synchronous generators to the fulfilling of various power system requirements.
2. Use a mathematical model that describes the electromechanical dynamics of a power system, to determine the transient stability limits under fault conditions.

3. Determine the static and dynamic frequency response of a power system under load and generation step change.

Text Books:

1. Glonn N. Stagg and Aimed H. El-abiad, "Computer Method in Power S ystem Analysis", McGraw Hill, International addition.
2. George L. Kusic, "Computer Aided Power S ystem Analysis", Prentice Hall.
3. J. Arrillage, C.P. Amold and S. J. Harker, "Computer Modeling of Electrical Power Systems", John. Willey and Sons.

Reference Books:

1. O.I. Elgard, "Electric Energy S ystems An Introduction", Tata McGraw Hill.
2. M. A. Pai, "Computer Techniques in Power Systems Analysis", Tata McGraw Hill.
3. P.M. Anderson, "Analysis of Faulted Power System", IEEE Press Book

MEE-103: ADVANCED POWER ELECTRONICS

L	T	P	CR
3	1	0	4

Course Objectives:

The course is designed to meet the objectives of:

1. To provide the students a deep insight in to the working of different switching devices & their characteristics.
2. To analyze different converters and control with their applications.

Detail Contents: **8 Hours**

UNIT-I: Power semiconductor diodes

Diode V-I Characteristics, Reverse Recover y Characteristics, Power Diodes Types, Forward and Reverse Recovery Time, Series & Parallel Connected Diodes.

UNIT-II: Thyristor **8 Hours**

V-I Characteristics, Turn ON & Turn OFF Characteristics, Thyristor Type, di/dt and dv/dt protection, Series and Parallel Operation of Thyristor, Thyristor circuit, UJT and PUJT Thyristor connection Techniques.

Power transistors

Bipolar Junction Transistors, Their steady State & Switching Characteristics, Power MOSFET'S and their steady State & Switching Characteristics, Gate derive SIT's & IGBTS's, Series & Parallel Operation, di/dt and dv/dt limitations.

UNIT-III: Controlled rectifiers **6 Hours**

Single Phase & Three Phase Full Converter with R-L load, Single phase & three phase dual converters, Power factor improvement technique.

UNIT-IV: A.C. voltage controllers **7 Hours**

Principle of phase control, Single Phase and Three Phase Full Controllers, Cycloconvertor, A.C.Voltage Controllers with PWM Control, Effects of source & Load Inductances

UNIT-V: D.C. choppers **8 Hours**

Chopper Classification, Thyristor Chopper Circuits, Effect of Service and Load Chopper Circuit Design

PWM

Inverters, Principle of Operation, Performance Parameters, Single Phase Bridge Inverters and their Voltage Control, Harmonic Reduction, Inverter Circuit Design.

Course Learning Outcomes (CLO):

Students successfully completing this module will be able to:

1. Articulate the basics of power electronic devices
2. Student should be able to understand the operation of inverter from different perspective.
3. Design of power electronic converters in power control applications

4. Ability to express characteristics of SCR, BJT, MOSFET and IGBT.

Text Books:

1. M.H.Rashid, "Power Electronics, Circuits Devices and Applications", PHI.
2. P.C.Sen, "Power Electronics", TMH.
3. P.S.Bhimbara, "Power Electronics", Khanna Publishers.

Reference Books:

1. Cyril, W.Lander, "Power Electronics", MHI.
2. M.D.Singh & K.B.Khanchandani, " Power Electronics", TMH

MEE-104: DIGITAL CONTROL SYSTEM

L	T	P	CR
3	1	0	4

Course Objectives:

The course is designed to meet the objectives of:

1. The ability to understand the characteristics of various types of nonlinearities present in physical systems.
2. The ability to carry out the stability analysis of non-linear control systems.
3. The ability to design compensators for digital control system to achieve desired specifications.
4. The ability to analyze the effect sampling on stability, controllability and observability.

Detail Contents: **8 Hours**

UNIT-I: Signal Processing in Digital Control

Digital control, Configuration of the basic Digital control scheme, Principles of signal conversion, Basic Discrete-Time signals, Time-Domain Models for Discrete- Time Systems, Transfer function Model, Stability in the Z-Plane & Jury stability criterion, Sampling as impulse modulation, Sampled spectra & Aliasing, Principles of Discretization, The Routh stability Criterion on the r-Plane.

UNIT-II: Models of Digital Control Devices & Systems **8 Hours**

Z-Domain, Description of Sampled continuous-Time Plants, Z-Domain Description of Systems with Dead Time, Implementation of Digital Controllers, Digital temperature Control System, Digital Position Control System, Stepping motors & their control.

UNIT-III: Design of Digital Control Algorithms **8 Hours**

Z-Plane specifications of control system design, Digital Compensator Design using frequency response plots, Digital Compensator design using root locus plots, Z-Plane Synthesis.

UNIT-IV: Control System analysis using State Variable methods **8 Hours**

State Variable representation, Conversion of state Variable models to Transfer functions, Conversion of Transfer functions to Canonical state Variable models, Solution of state equations, Concepts of Controllability & Observability, Equivalence between transfer function & State Variable Representation, Multivariable systems.

UNIT-V: State Variable analysis of Digital Control Systems **8 Hours**

State descriptions of Digitals Processors, State description of Sampled continuous- Time Plants, State description of Systems with dead Time, Controllability & Observability, Multivariable Systems.

Course Learning Outcomes (CLO):

Students successfully completing this module will be able to:

1. To impart the knowledge of AC rotating machine & 3 phases alternator and synchronous motor.

2. To impart the knowledge of 3 phases induction motor and special machine.

Text Books:

1. Raven, F.H., "Automatic Control Engg.", McGraw Hill Book Company.
2. Shinners, S.M., "Modern Control System Theory & Design", John Wiley & Sons.
3. KUO, B.C., "Automatic Control System", Prentice Hall.

Reference Books:

1. Ogata, K., "Modern Control Engineering", Prentice Hall.
2. Nagrath, I.J., & M. Gopal, "Control S ystems Engg.", John Wiley & Sons.

MEE-151: POWER SYSTEM LAB

L	T	P	CR
0	0	4	2

Note: - At least 10 experiments should be performed out of which 3 should be simulation based. (A)Hardware Based:

List of experiments:

1. To determine direct axis reactance (xd) and quadrature axis reactance (xq) of a salient pole alternator.
2. To determine negative and zero sequence reactances of an alternator.
3. To determine sub transient direct axis reactance (xd) and sub transient quadrature axis reactance (xq) of an alternator
4. To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation
5. To study the IDMT over current relay and determine the time current characteristics
6. To determine location of fault in a cable using cable fault locator
7. To study ferranty effect and voltage distribution in H.V. long transmission line using transmission line model.
8. To study operation of oil testing set.

Simulation Based Experiments (using MATLAB or any other software)

9. To determine transmission line performance.
10. To perform symmetrical fault analysis in a power system
11. To perform unsymmetrical fault analysis in a power system

Course Learning Outcomes (CLO):

Students successfully completing this module will be able to:

1. Analyze the performance of transmission lines and relays.
2. Calculate the different parameters of alternator.
3. Find out fault location of transmission line.
4. Verify the different parameters of alternator & transmission line using MATLAB.

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MEE-152: POWER ELECTRONICS LAB

L	T	P	CR
0	0	4	2

List of experiments:

1. SCR Characteristics.
2. Speed Control of AC motor using TRIAC.
3. Panel for speed control of 3-phase induction motor through AC drive (vector controlled).
4. MOSFET based chopper motor controller.
5. Simulation of 3-phase semi converter using MATLAB.
6. Simulation of 3-phase fully controlled converter using MATLAB.
7. Simulation of 1-phase dual converter using MATLAB.
8. Simulation of 1-phase semi converter for R, RL, RLE load using MATLAB.
9. Simulation of 3-phase semi converter for R, RL, RLE load using MATLAB.
10. Simulation of 3-phase full bridge inverter at (a) 180 degree mode operation (b) 120 degree mode operation.

Course Learning Outcomes (CLO):

Students successfully completing this module will be able to:

1. Design the control circuit and the power circuit for speed control of ac motor.
2. Critically compare various outcomes of different type of converter using MATLAB.
3. Familiar with simulation using MATLAB.

MEE-201: POWER SYSTEM PROTECTION

L	T	P	CR
3	1	0	4

Course Objectives:

The course is designed to meet the objectives of:

1. To isolate a faulty section of electrical power system from rest of the live system.
2. To learn basic concept of Protection system in power system and coordination of protection relays.
3. To learn the functional requirements of protection relay

Detail Contents:

UNIT-I: Fundamentals of Relaying: **7 Hours**

Types of relays, their classifications and theory, Phase and amplitude comparators. Static Comparators, Computer Applications to protective relaying.

UNIT-II: Protection of Lines: **8 Hours**

Transmission Line Protection, Carrier Current Protection. Applications of microwave Channels for protective relaying, Selection of suitable static relaying, scheme for transmission line protection. Performance specifications of distance relay effect of fault resistance and effects of power swings on operation of relays.

UNIT-III: Protection of Electrical Devices: **8 Hours**

Generators and Transformers Protection, CT's and PTs burden and accuracy and their connections. Protection of rotor winding, miscellaneous protection schemes for generators and transformers.

UNIT-IV: Differential Relays: **8 Hours**

Operating Characteristics, Restraining Characteristics, Analysis of Electromagnetic and differential Static relays schemes. Bus zone Protection: Types of bus bar faults, Protection requirements, protection schemes and modern trend in bus-bar protection.

UNIT-V: Circuit Breakers: **8 Hours**

Physical stress in circuit breakers, Vacuum circuit breakers, SF6, Circuit breakers, direct current C.B's, Short circuit testing of circuit breakers. Comparison of different types of circuit breakers.

Course Learning Outcomes (CLO):

At the end of this course, the learner will be able to

1. Understand Fundamentals of apparatus and system protection.
2. Understand that system protection is primarily achieved by under frequency, over frequency and rate of change of frequency relays.

Text Books:

1. T.S. Madhava Rao, "Power System Protections (Static Relays)", Tata McGrwaw-hill.

2. A.R. van C Warrington, "Protective Relays", Chapman and Hall London.
3. S.K. Basu and S. Chaudhary, "Power System Protection", Raju Primlan Oxford and IBH.

Reference Books:

1. Ravindra Nath M. Chander, "Power System Protection and Switch Gear", John Wiley Eastern.

MEE-202: ADVANCED ELECTRICAL MACHINES

L	T	P	CR
3	1	0	4

Course Objectives:

The course is design to meet with the objectives

1. To get detailed knowledge of design of Transformers, DC machines, Induction motors and synchronous machines.
2. To get detailed knowledge of construction and operating principles of Electro Mechanical AC Machines.
3. To make student understand equivalent circuit parameters and performance parameters of both synchronous and asynchronous AC Machines.

Detail Contents: **8 Hours**

UNIT-I:

Mathematical: Basic Synchronous machine parameters, Voltage, Flux linkage and inductance relations, Park's transformation-its physical concept, equations of performance. Balanced Steady State Analysis: Phasor equations and Phasor diagrams, Power-angle characteristics, cylindrical rotor and Salient pole machines,

UNIT-II: **8 Hours**

Transient Analysis: Three phase short circuits, Armature and field transients, Transient torque, sudden reactive loading and Unloading. Transient Analysis-a qualitative approach, Reactances and Time-Constants from equivalent circuits, Measurement of reactances, Transient Power-angle characteristics.

UNIT-III: **8 Hours**

Synchronous-machine Dynamics: The basic electromechanical equation, Linearized Analysis, Large Angular/oscillation, Non-linear analysis.

UNIT-IV: **8 Hours**

Multi-Circuit Transformers: General theory, Equivalent circuits, Three winding transformer as a multi-circuit transformers, Determination of parameters. Excitation phenomena in Transformers: Harmonics in Single-phase transformers, Harmonics in three-phase transformers, Disadvantages of harmonics, Suppression of harmonics.

UNIT-V: **8 Hours**

Transformer Transients: Inrush current phenomena, Qualitative approach, Analytical approach, Inrush current in 3-phase transformers. Unbalanced Operation of three-

phase Transformers, Single-Phasing in 3-phase transformers, Effect of using tertiary winding.

Course Learning Outcomes (CLO):

At the end of this course, the learner will be able to

1. Understand how to analyze the working of any electrical machine using mathematical model under loaded and unloaded conditions.
2. The skill to analyze the response & troubleshoot of any electrical machine.

Text Books:

1. "Generalized Theory of Electrical Machines" by Dr. P.S. Bimbhra (Khanna Publishers.)
2. "Generalized Theory of Electrical Machines" by B. Edikins.

Reference Books:

1. "Synchronous Machines" by Concordia.
2. Adkins B., "The General Theory of Electrical Machines", John Wiley Sons, 1957.

MEE-203: HVDC TRANSMISSION

	L	T	P	CR
Course Objectives:	3	1	0	4

The course is design to meet with the objectives

1. To introduce students with the concept of HVDC Transmission system, converters and their control system.
2. To expose the students to the harmonics and faults occur in the system and their prevention.

Detail Contents:

UNIT-I: Introduction: **8 Hours**

Introduction to AC and DC Transmission-application of DC Transmission-description of DC transmission-DC system components and their functions-modern trends in DC Transmission.

UNIT-II: HVDC Converter: **7 Hours**

Pulse Number-Converter configuration-analysis of Graetz circuit-converter bridge characteristics- characteristics of 12 pulse converter.

UNIT-III: HVDC Controllers: **8 Hours**

General principle of DC link control-converter control characteristics-system control hierarchy- firing angle control-current and extinction angle control-DC link power control-high level controllers.

UNIT-IV: Filters: **7 Hours**

Introduction to harmonics-generation of harmonics-design of AC filters-DC filters-carrier frequency and RI noise

UNIT-V: Protection: **7 Hours**

Basics of protection-DC reactors-voltage and current oscillations-circuit breakers-over voltage protection-switching surges-lightning surges - lightning arrestors for DC systems.

Course Learning Outcomes (CLO):

At the end of this course, the learner will be able to

1. Develop the knowledge of HVDC transmission and converters and the applicability and advantage of HVDC transmission over conventional AC transmission.
2. Formulate and solve mathematical problems related to rectifier and inverter control methods.
3. Analyze the different harmonics generated by the converters and their variation with the change in firing angles.

Text Books:

1. Kimbark E.X., "Direct Current Transmission", Vol. I, Wiley Interscience, NewYork.
2. Allan Greenwood, "Electrical Transients in Power Systems", John Wiley and Sons N.Y.
3. Adamson and Hingorani N.G., "High Voltage Direct Current PowerTransmission", Garraway ltd.,England.

Reference Books:

1. Padiyar K.R., "H V D C Transmission Systems", Wiley Eastern.

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DEPARTMENTAL ELECTIVE-I

MEE-011: EHVAC TRANSMISSION

L	T	P	CR
3	1	0	4

Course Objectives:

The course is design to meet with the objectives

1. Relate the performance and applications of VSI & CSI.
2. Know the importance of compensation methods in power system network.
3. Extend the knowledge of active & reactive power and voltage control with FACTS devices.

Detail Contents:

UNIT-I: **7 Hours**

Introduction to E.H.V. A.C. Transmission, tower configurations, Thermal ratings of lines and cables, Transformer technology.

UNIT-II: **6 Hours**

Circuit breakers, Voltage gradients of conductors, corona effects, power loss and audible noise.

UNIT-III: **6 Hours**

Radio interference, Electrostatic field of transmission lines, Lighting and lighting protection.

UNIT-IV: **7 Hours**

Insulation characteristics of long air gaps, Design of E.H.V. lines based upon steady state limits, Transient over-voltages.

UNIT-V: **6 Hours**

Voltage stability series and shunt compensation, Reactive power control apparatus.

Course Learning Outcomes (CLO):

At the end of this course, the learner will be able to

1. To Know the necessity, merits and demerits of EHVAC transmission and mechanical aspects
2. Evaluate the Inductance and capacitance of two conductor and multi conductor lines
3. Analyze the effect of corona, electrostatic field of EHVAC lines
4. Analyze the surface gradient on two conductor and bundle with more than 3 sub conductors.

Text Books:

1. R.D. Begamudre, "E.H.V.-A.C. Transmission", Wiley Eastern Ltd...
2. Transmission line Reference book 345 KV and above EPRI, Palo Alto, USA.

Reference Books:

1. "Electrical Transmission and Distribution" Reference book, Oxford book Company, Calcutta.

Rama University Uttar Pradesh, Kanpur
Faculty of Engineering & Technology

MEE-012: APPLIED INSTRUMENTATION

L	T	P	CR
3	1	0	4

Course Objectives:

The course is design to meet with the objectives

1. Students will have a sound knowledge base and skill sets to develop and expand professional careers in fields related to instrumentation technologies, process control, and industrial processes automation.
2. Students will meet industry expectations in managing ethical, societal, and environmental issues in the practice of Instrumentation Engineering Technology.

Detail Contents:

UNIT-I: **8 Hours**

Transducers, Classification of Transducers, including analog and digital transducers, Selection of Transducers Static and Dynamic response of transducer System.

UNIT-II: **8 Hours**

Measurement of length & thickness, linear Displacement, Angular Displacement, force, weight, torque, Moisture, Level, Flow, pH & Thermal Conductivit y, Measurement of Frequency Proportional, Geigermuller & Scintillation Counters.

UNIT-III: **8 Hours**

Telemetry: Basic Principles, Proximity & remote Action Telemetry systems, Multiplexing, Time Division and frequency division.

UNIT-IV: **8 Hours**

Various types of Display Device, Digital Voltmeters, Dual Slope DVMS, Digital encoders, Analog and Digital encoders, Analog and Digital Data Acquisition System, A/D Converter.

UNIT-V: **8 Hours**

Fibre Optic Technology for data transmission, Supervisory Control and Data Acquisition Systems (SCADA), Q-meter, Electrical noise in control signals, its remedial measures.

Course Learning Outcomes (CLO):

At the end of this course, the learner will be able to

1. Design and implement systems utilizing analog / digital control devices.
2. Understand the continuous and discrete systems.
3. Implementation of instrument and control systems utilizing appropriate software and hardware tools.

Text Books:

1. W.D. Coopper & A.D. Helfrick, "Electronic Instrumentation and Measurement Techniques", PHI.
2. B.C. Nakra and K.K. Choudhary, "Instrumentation Measurement Analysis", Tata McGraw-Hill.
3. "Instrument Transducers" by Hermann, K.P. Neubert.

Reference Books:

1. Electrical Transducers for Industrial Measurement" by pH Mansfield.
2. Instrumentation systems" by Mani Sharma, Rangan.
3. Principles & Methods of Telemetry" by Borden & & Thgnel Telemetry Method" by Foster

MEE-251: ELECTRICAL MACHINE LAB

L	T	P	CR
0	0	4	2

Note: Minimum eight experiments are to be performed from the following list:

List of experiments:

1. To obtain magnetization characteristics of a d.c. shunt generator
2. To obtain load characteristics of a d.c. shunt generator and compound generator (a) Cumulatively compounded (b) differentially compounded
3. To obtain efficiency of a dc shunt machine using Swinburn's test
4. To perform Hopkinson's test and determine losses and efficiency of DC machine
5. To obtain speed-torque characteristics of a dc shunt motor
6. To obtain speed control of dc shunt motor using (a) armature resistance control (b) field control
7. To obtain speed control of dc separately excited motor using Conventional Ward-Leonard/Static Ward –Leonard method.
8. To study polarity and ratio test of single phase and 3-phase transformers
9. To obtain equivalent circuit, efficiency and voltage regulation of a single phase transformer using C.C. and S.C. tests.
10. To obtain efficiency and voltage regulation of a single phase transformer by Sumpner's test.

Course Learning Outcomes (CLO):

At the end of this course, the learner will be able to

1. Discriminate and realize the various dc generator & machine.
2. Obtain the equivalent circuit parameters of dc generator, dc machine and transformer.
3. Convert phase of transformer & maximizes the output of transformer using different testing method.

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MEE-252: ADVANCED MACHINE LAB

L	T	P	CR
0	0	4	2

Note: The minimum 8 experiments are to be performed from the following, out of which there should be at least two software based experiments.

List of experiments:

1. To perform no load and blocked rotor tests on a three phase squirrel cage induction motor and determine equivalent circuit.
2. To perform load test on a three phase induction motor and draw: Torque -speed characteristics Power factor-line current characteristics.
3. To perform no load and blocked rotor tests on a single phase induction motor and determine equivalent circuit.
4. To study speed control of three phase induction motor by Keeping V/f ratio constant
5. To study speed control of three phase induction motor by varying supply voltage.
6. To perform open circuit and short circuit tests on a three phase alternator and determine
7. Voltage regulation at full load and at unity, 0.8 lagging and leading power factors by (i) EMF method (ii) MMF method.
8. To determine V-curves and inverted V-curves of a three phase synchronous motor.
9. To determine Xd and Xq of a three phase salient pole synchronous machine using the slip test and draw the power-angle curve.
10. To study synchronization of an alternator with the infinite bus by using: dark lamp method (ii) two bright and one dark lamp method.

Software based experiments (Develop Computer Program in 'C' language or use MATLAB or other commercial software)

11. To determine speed-torque characteristics of three phase slip ring induction motor and
12. Study the effect of including resistance, or capacitance in the rotor circuit.
13. To determine speed-torque characteristics of single phase induction motor and study the effect of voltage variation.
14. To determine speed-torque characteristics of a three phase induction motor by (i) keeping v/f ratio constant (ii) increasing frequency at the rated voltage.
15. Draw O.C. and S.C. characteristics of a three phase alternator from the experimental data and determine voltage regulation at full load, and unity, 0.8 lagging and leading power factors.

Course Learning Outcomes (CLO):

At the end of this course, the learner will be able to

1. Analyze different steady state speed control methods for Induction motors, and understand the closed loop block diagrams for different methods.
2. Properly select induction motor for industrial application.
3. Study different parameter of induction motor using MATLAB software.
4. Develop Computer Program in 'C' language for control of induction motor.

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Faculty of Engineering & Technology

DEPARTMENTAL ELECTIVE-II
MEE-024: ENERGY MANAGEMENT AND AUDIT

	L	T	P	CR
Course Objectives:				
The course is design to meet with the objectives	3	1	0	4

1. To understand Energy Audit procedure along with relevant technologies/ tools.
2. To understand Energy Conservation measures undertaken across different user segments using case studies.
3. To develop Energy Audit Report writing skills.

Detail Contents:

UNIT-I: Energy Scenario: **8 Hours**

Energy sources, security, conservation, strategy. Basics of energy and its various forms

Energy Management & Audit:

Energy costs, Bench marking, efficiency, audit instruments.

UNIT-II: Energy Action Planning: **8 Hours**

Role, motivation, training, information systems

Energy Monitor of Electrical System:

Power supply, Electricity billing, Electrical load management and maximum demand control, Power factor improvement and its benefit, Selection and location of capacitors, Performance assessment of PF capacitors, Distribution and transformer losses.

UNIT-III: Electric Motors: **8 Hours**

Types, characteristics, losses, efficiency, selection, energy efficient motors, Factors affecting motor performance, Rewinding and motor replacement issues. Energy saving opportunities with pumps, cooling towers, fans and blower.

UNIT-IV: Lighting System: **8 Hours**

Light source, choice of lighting, luminance requirements and energy conservation avenues.

Energy Efficient Technologies in Electrical System:

Maximum demand controllers, Automatic power factor controllers, Energy efficient motors, Soft starters with energy saver, Variable speed drives, Energy efficient transformers, Electronic ballast, Occupancy sensors, Energy efficient lighting controls.

Course Learning Outcomes (CLO):

At the end of this course, the learner will be able to

1. Energy Audit helps to map the flow of energy (in its various forms) across the value chain, highlighting areas for interventions.
2. This course is designed to sensitize students on the mechanism of energy audit and the technologies/ tools typically employed to undertake an audit exercise, supported by case studies & site visits.

Text Books:

1. Albert: Plant Engineers & Managers Guide to Energy Conservation.
2. Wayhe C. Tuner: Energy Management Handbook.
3. Anthony J. Pansini: Engineering Economic Analysis Guide Boo.

Reference Books:

1. D. Paul-Mehta: Handbook of Energy Engineering.

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MEE-025: MICROPROCESSORS AND THEIR APPLICATIONS

L	T	P	CR
3	1	0	4

Course Objectives:

The course is design to meet with the objectives

1. Understand the architecture and operation of typical microprocessors and microcontrollers.
2. To familiarize the students with the programming and interfacing of microprocessors and microcontrollers.
3. To provide strong foundation for designing real world applications using microprocessors and microcontrollers.

Detail Contents:

UNIT-I: Microprocessor **8 Hours**

Intel 8085- Introduction, register structure, memory Addressing, Addressing Modes, Instruction Set, Timing Methods, CPU Pins and Associated Signals, Instruction timing and execution, programming I/O, Interrupt System, DMA, SID & SOD lines, Instruction set, 8085, based system design, Intel 8086 - Introduction, Architecture, Addressing modes, instruction set memory management, assembler dependent instructions, Input/output, system design using 8086.

UNIT-II: Peripheral Interfacing **8 Hours**

Parallel versus serial transmission, synchronous and asynchronous serial data transmission, interfacing of hexadecimal keyboard and display unit, interfacing of cassette recorders and CRT. Parallel, serial interface standards

UNIT-III: Microprocessor Applications to Power Engineering Protective Relaying **7 Hours**

Over-current, impedance, MHO, reactance, bi-directional relays.

UNIT-IV: Measurements **8 Hours**

Frequency, power angle & power factor, Voltage and Current, KVA, KW, & KVAR, maximum demand, Resistance, Reactance, Temperature Controls.

Course Learning Outcomes (CLO):

At the end of this course, the learner will be able to

1. Assess and solve basic binary math operations using the microprocessor.
2. Apply knowledge and demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target microprocessor and microcontroller.
3. Analyze assembly language programs; select appropriate assemble into machine a cross assembler utility of a microprocessor and microcontroller.

Text Books:

1. Rafiquzzaman, M. Theory & Applications PHI Publications.
2. Gaonkar R. S. Microprocessor Architecture, Programming and Applications John Wiley.

Reference Books:

1. Ram B. Fundamentals of Microprocessors and Microcomputers, Dhanpat Rai & Sons.
2. Liu Yu Cheng and Gibson, G.A. PHI.

3. Leventhal, L.A. Introduction to Microprocessors: Software, Hardware, Programming

MEE-026: FACTS DEVICES

L	T	P	CR
3	1	0	4

Course Objectives:

The course is design to meet with the objectives

1. To familiarize power engineers about the Flexible AC Transmission devices and their applications in power systems with respect to active/reactive power control.
2. To impart the students with various FACTS devices which are used for proper operation of existing AC system more flexible in normal and abnormal conditions.
3. To enable students to design power electronics circuit that can control active and reactive power flow.

Detail Contents:

UNIT-I: Facts and Preliminaries: **8 Hours**

FACTS concept and general system considerations-Power flow in AC system-Definitions on FACTS-Basic types of FACTS controllers. Converters for Static Compensation-Three-phase converters and standard modulation strategies (Programmed Harmonic Elimination and SPWM)- GTO Inverters-Multi-Pulse Converters and Interface Magnetics-Transformer Connection for 12, 24 and 48 pulse operation-Multi-Level Inverters of Diode Clamped type and Flying Capacitor type and suitable modulation strategies (includes SVM) –Multi-Level inverters of Cascade type and their modulation-Current Control of Inverters.

UNIT-II: Static Shunt and Series Compensators: **8 Hours**

Static Shunt Compensators-SVC and STATCOM-operation and control of TSC, TCR, STATCOM-Compensator Control-Comparison between SVC and STATCOM-STATCOM for transient and dynamic stability enhancement, Static Series Compensation-GCSC, TSSC, TCSC and SSSC-operation and control-external system control for series compensators-SSR and its damping-static voltage and phase angle regulators-TCVR and TCPAR-operation and control.

UNIT-III: UPFC and IPFC: **8 Hours**

The Unified Power Flow Controller-operation, comparison with other FACTS devices-control of P and Q-dynamic performance-Special Purpose FACTS Controllers-Interline Power Flow Controller-operation and control.

UNIT-IV: Power Quality and Introduction to Custom Power Devices: **8 Hours**

Power Quality issues related to distribution systems-custom power devices-Distribution STATCOM-Dynamic Voltage restorer-Unified Power Quality Conditioner-Application of D- STATCOM, DVR and UPQC for improving power quality in distribution systems.

Course Learning Outcomes (CLO):

At the end of this course, the learner will be able

1. Understand the operations of different FACTS devices.
2. Select the controllers for different Contingencies.
3. Analyze the different FACTS devices in different stability conditions
4. Select an appropriate FACTS device for a particular application.

Text Books:

1. K.R. Padiyar, "FACTS Controller in Power Transmission and Distribution", New Age International.
2. N.G. Hingorani & L. Gyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", IEEE Press.

Reference Books:

1. Ned Mohan et.al, "Power Electronics", John Wiley & Sons.

DEPARTMENTAL ELECTIVE-III
MEE-037: ADVANCED ELECTRICAL DRIVES

L	T	P	CR
3	1	0	4

Course Objectives:

The course is design to meet with the objectives

1. To impart knowledge about fundamentals of Electric drives and control, operational strategies of dc and ac motor drives as per different quadrant operations and to discuss.
2. To provide students with a strong back ground in different types of electrical drives.
3. To train the students to have the solid foundation in mathematical and technical concepts required to engineering problems.

Detail Contents:

UNIT-I: Modeling: **8 Hours**

Dynamic modeling of induction machines – 3-phase to 2-phase transformation power equivalence – generalized model in arbitrary reference frame – electromagnetic torque - derivation of stator reference frame model, rotor reference frame model, synchronously rotating reference frame model - equations in flux linkages - dynamic d-q model of synchronous machines.

UNIT-II: Vector Control: **8 Hours**

Vector controlled induction motor drive - principle of vector or field oriented control - direct rotor flux oriented vector control - estimation of rotor flux and torque - implementation with current source and voltage source inverters - stator flux oriented vector control - indirect rotor flux oriented vector control scheme – implementation – tuning – dynamic simulation - parameter sensitivity and compensation of vector control induction motors – selection of flux level - flux weakening operation - speed controller design - simulation of vector control of induction motor using MATLAB/SIMLINK.

UNIT-III: Static Drives and Torque Control: **8 Hours**

Doubly-fed machine speed control by rotor rheostat – static Kramer drive - Phasor diagram, equivalent-speed control - power factor improvement - static scherbius drive - modes of operation - direct torque control of induction motor - principle – control strategy - space vector modulation - reduction of torque and flux ripple comparison of DTC and FOC - simulation of DTC of induction motor using MATLAB/SIMULINK.

UNIT-IV: Permanent Magnet synchronous and Brushless dc Motor Drives: **8 Hours**

Types of permanent magnet synchronous machines - vector control of PM synchronous machines model of PMSM - vector control - control strategies - constant torque angle control, unity power factor control, constant mutual flux - linkages control, optimum torque per ampere control, flux weakening operation, direct flux weakening algorithm, speed controlled PMSM drive – sensor less PMSM drives - PM brushless DC motor – modeling - drive scheme – switched reluctance motor drives.

Course Learning Outcomes (CLO):

At the end of this course, the learner will be able to

1. Describe the structure of Electric Drive systems and their role in various applications.
2. Understand basic requirements placed by mechanical systems on electric drives.
3. Review phasors and three-phase electric circuits.

Text Books:

1. R Krishnan, "Electric Motor Drives", PHI.
2. D W Novotny and T A Lipo, "Vector Control and Dynamics of AC Drives", Oxford University Press
3. B K Bose, "Modern Power Electronics and AC Drives",PHI.
4. Leonhard, "Control of Electric Drives", Springer.
5. Kazmierkowski, Krishnan, Bleiberg, "Control in Power Electronics –Selected Problems", Academic Press.

Reference Books:

1. John Chiasson, "Modelling and High Performance Control of Electric Machines",Wiley–IEEE Press.
2. I Boldea, S A Nasar, "Electric Drives", CRC Press.
3. K Rajashekara, "Sensorless Control of AC Motors", IEEE Press.
4. I Boldea, S A Nasar, "Vector control of AC Drives", CRC Pres

MEE-038: NON CONVENTIONAL ENERGY SYSTEMS

L	T	P	CR
3	1	0	4

Course Objectives:

The course is design to meet with the objectives

1. Understand the various forms of conventional energy resources.
2. Learn the present energy scenario and the need for energy conservation.
3. Explain the concept of various forms of renewable energy.
4. Outline division aspects and utilization of renewable energy sources for both domestics and industrial application

Detail Contents:

UNIT-I: **8 Hours**

Solar Energy-Introduction to solar energy: solar radiation, availability, measurement and estimation-Solar thermal conversion devices and storage-solar cells and photovoltaic conversion- PV systems-MPPT. Applications of PV Systems-solar energy collectors.

UNIT-II: **8 Hours**

Wind Energy-Introduction-Basic principles of wind energy conversion-wind data and energy estimation-site selection consideration-basic components of wind energy conversion system-Types of wind machines-basic components of wind electric conversion systems. Schemes for electric generations-generator control, load control.

UNIT-III: **8 Hours**

Chemical Energy Sources-Introduction-fuel cells-design and principles of operation of a fuel cell-classification of fuel cells. Types of fuel cells-conversion efficiency of fuel cells. Types of electrodes, work output and emf of fuel cell, Applications of fuel cells. Hydrogen energy: Introduction-hydrogen production-electrolysis, thermo chemical methods, Westinghouse Electro- chemical thermal sculpture cycle

UNIT-IV: **8 Hours**

Energy from oceans-Introduction, ocean thermal electric conversion (OTEC), methods of ocean thermal electric power generation, open cycle OTEC system, closed OTEC cycle. Energy from tides: Basic principles of tidal power, component of tidal power plants, operation methods of utilization of tidal energy, site requirements, storage, advantages and limitations of tidal power generation. wave energy conversion devices. Geothermal energy-Introduction, estimation of geothermal power, nature of geothermal fields, geothermal sources,

Course Learning Outcomes (CLO):

At the end of this course, the learner will be able to

1. Describe the environmental aspects of non-conventional energy & conventional energy systems, their prospects and limitations.
2. Know the need of renewable energy resources, historical and latest developments.
3. Describe the use of solar energy and their various components.
4. Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications.

Text Books:

1. SP Sukatme, "Solar Energy-Principles of thermal collection and storage", Tata McGraw Hill.
2. GD Rai, "Non Conventional Energy Sources".
3. J.A. Duffie and W.A. Beckman, "Solar Engineering of Thermal Processes", John Wiley, New York.

Reference Books:

1. D.Y. Goswami, F. Kreith and J.F. Kreider, "Principles of Solar Engineering", Taylor and Francis, Philadelphia.
2. D.D. Hall and R.P. Grover, "Bio-Mass Regenerable Energy", John Wiley, Newyork.

MEE-039: ENERGY EFFICIENT MACHINES

L	T	P	CR
3	1	0	4

Course Objectives:

The course is design to meet with the objectives

1. To prepare the students for successful career in the energy industry.
2. To produce graduates strong in energy resources, technologies and management.
3. Fundamentals, and capable in addressing the present and potential future energy problems.
4. Issues and concerns, and who can apply their specialized knowledge for the sustainable energy management.

Detail Contents:

UNIT-I: **8 Hours**

Introduction: Need for energy efficient machines, energy cost and two part tariff, energy conservation in industries and farms a necessit y, introduction to energy management and energy audit system. Review of induction motor characteristics.

UNIT-II: **8 Hours**

Energy Efficient motors: Standard motor efficiency, why more efficient motors, an energy efficient motor, Loss segregation method, Comparison, motor efficiency labeling, energy efficient motor standards.

UNIT-III: **8 Hours**

The power factor: The p.f. in sinusoidal systems, p.f. improvement, the p.f. with non-linear loads, Harmonics and the p.f., p.f. motor controllers.

UNIT-IV: **8 Hours**

Application of Electric motors: Varying duty applications, Voltage variation, Voltage Unbalance, over motoring, Poly-phase induction motors Supplied b y adjustable frequency power Supplies.

UNIT-V: **8 Hours**

Induction motors and adjustable drive systems: Energy Conservation, adjusted speed systems, Application of adjustable speed systems to fans, pumps and constant torque loads.

Course Learning Outcomes (CLO):

At the end of this course, the learner will be able to

1. Understood the conventional and non-conventional energy technologies Acquired the expertise and skills needed for the energy monitoring, auditing.
2. Acquired skills in the scientific and technological communications, and in the preparation, planning and implementation of energy projects.

Text Books:

1. John C. Andreas, "Energy efficient electric motors", Marcel Dekker Inc.

2. Albert Thuman, "Introduction to Efficient Electric System Design", the Fairmount Press Prentice-Hall.

Reference Books:

1. S.C. Tripathi, "Electric Energy Utilization and Conservation", Tata McGrwa-Hill.

MEE-351: PROJECT/SEMINAR

L	T	P	CR
0	0	12	4

Students will be allotted to the faculty members. On the advice of the faculty – students will select a topic of interest which is not covered in the regular class work and which enhances the students' knowledge in modern power electronics & power systems. Student will explore the recent publications and prepare a presentation and share it all the students. Faculty will monitor the presentations along with the other faculty members.

Course Learning Outcomes (CLO):

Students successfully completing this module will be able to:

1. Understand advanced topics in power electronics & power systems.
2. Improve language and communication skills.

SEMESTER: IV
MEE-451: DISSERTATION-II

L	T	P	CR
0	0	18	8

The project/dissertation shall be finalized by the students based on the III semester project/dissertation work report and shall be completed and submitted at least one month before date of which shall be notified in the academic calendar.
The assessment of performance of students should be made at least twice in IV semester. In this semester student shall present the final project live as also using overheads project or power point presentation on LCD to the internal committee as also the external examiner.
The evaluation committee shall consist of faculty members constituted by the Institution which would comprise of at-least three members comprising of the HOD, project/ dissertation guide and a nominee of the Dean. The students guide would be a special invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately in a sealed envelope to the HOD.

Course Learning Outcomes (CLO):
Students successfully completing this module will be able to:

3. Recognize and formulate a problem to analyze, synthesize, evaluate, simulate and create a power electronic converter and/or a drive system.
4. Carryout modeling and simulation studies pertaining to the system and prepare a presentation.
5. Build the hardware to demonstrate the principle of working.
6. Correlate the analytical, simulation and experimental results.
7. Deduce conclusions and draw inferences worthy of publication.

Convener
Signature: .....

Rama University Uttar Pradesh, Kanpur
Faculty of Engineering & Technology

Ref: RU/FET/EE/BOS/2017/001 **Dated:** 29/04/2017

Faculty of Engineering & Technology

Department of Electrical Engineering

Minutes of Meeting

Boards of Studies

A meeting of Boards of Studies of Electrical Engineering, FET was held on 29/04/2017 (Saturday) at 2:30 PM. in conference room of FET. The following members were present:

1. Mr. Ravi Prakash Vishvakarma - Chairperson
2. Mr. Abhishek Singh - Member
3. Ms. Almas - Member

The following members agreed to review the minutes in Delhi.

1. Prof. N. C. Sarkar - External Member
2. Mr. Pankaj Shrama - External Member

Agenda:

1. Action Taken Report (ATR) on Minutes of Previous Meeting.

The BOS committee confirmed the minutes of the BOS meeting held on 23/04/2016.

2. To consider the proposal of pre submission seminar of M.tech candidates to improve the quality of work done during their dissertation.

The member agreed that a pre-submission seminar for M.Tech dissertation by post graduate candidate must be delivered in order to monitor the quality of research work done by them in the presence of M.Tech dissertation screening committee (DCS). In case DCS find that the work not up to mark than the candidate may be asked to enhance the work or repeat the dissertation session. DCS shall be constituted out of faculty member on rotational basis.

3. To consider the moderation of Question paper setting programs.

The board considers the moderation committee for screening the question paper set by the faculty member for the theory exams of the department. The committee will insure that the standard of question paper is not compromised as well as syllabus is not tapered. A committee of Mr. abhishek Mishra, Ms. Almas & Mr. Raghvendra Singh (External member) was constituted in this connection and recommended for approval by the Academic Council.

The meeting concluded with a vote of thanks to the chair.

Date of the Next Meeting: to be decided and conveyed later

(Chairman)

CC:
1. Dean
2. Registrar Office

Rama University Uttar Pradesh, Kanpur
Faculty of Engineering & Technology

Ref: RU/FET/EE/BOS/2018/001 **Dated:** 28/04/2018

Faculty of Engineering & Technology

Department of Electrical Engineering

Minutes of Meeting

Boards of Studies

A meeting of Boards of Studies of Electrical Engineering, FET was held on 28/04/2018 (Saturday) at 2:30 PM. in conference room of FET. The following members were present:

1. Mr. Abhishek Singh - Member
3. Ms. Almas - Member
3. Mr. Manish Mishra - Member

The following members agreed to review the minutes in Delhi.

1. Prof. N.C. Sarkar - External Member
2. Mr. Pankaj Sharma - External Member

Agenda:

1. Action Taken Report (ATR) on Minutes of Previous Meeting.

The BOS committee confirmed the minutes of the BOS meeting held on 29/04/2017.

2. To review Result analysis.

The Board reviewed the result analysis and found it to be acceptable but need more improvements.

2. To consider the revision of syllabi of PG program.

To consider the feedback of faculty members and Stack holder BOS decided that the syllabi should be revise. The updated syllabi will be considered thereof will be placed before the next BOS. A committee consisting of following member has been constituted for the compilation of the revised syllabus.

1. Ms. Almas
2. Mr. Manish Mishra
3. Mr. Prakash Dwivedi

3. Recommendation on New courses/Short term training

S. No.	Item No.	Feedback from Faculty/Student	Recommendation /Action Taken
1	To consider and approved the short term course on Electrical	Pump& motor Repair course is designed to bring students up to speed in their knowledge of field pump& motor repair, maintenance	The BOS consider and approved.

	pump and motor repairing	and servicing as quickly and efficiently as possible. This course is suitable both for novice technicians seeking the fundamentals of pump repair as well as experienced technicians seeking skills improvement or a refresher.	

The meeting concluded with a vote of thanks to the chair.

Date of the Next Meeting: to be decided and conveyed later

(Chairman)

CC:
1. Dean
2. Registrar Office