AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
Gudur, Nellore Dist - 524101, A.P (India)

ACADEMIC REGULATIONS FOR THE AWARD OF FULL TIME
M.Tech DEGREE PROGRAMME
(WITH EFFECT FROM THE ACADEMIC YEAR 2014-15)

The **Audisankara College of Engineering and Technology**, Gudur, Nellore District, Andhra Pradesh shall confer M.Tech Post Graduate degree to candidates who are admitted to the Master of Technology Programs and fulfill all the requirements for the award of the degree.

1. ELIGIBILITY FOR ADMISSIONS:

Admission to the Master of Technology programme shall be made subject to the eligibility, qualifications and specialization criteria prescribed by the JNTUA, Anantapur for each programme, from time to time.

As per the norms of A.P. State Council of Higher Education (APSCHE), Government of Andhra Pradesh, admissions are made to the first year of two years M.Tech P.G. Degree Programme as follows:-

- As per the norms of Government of Andhra Pradesh, Category-A (based on the rank obtained in GATE / PGECET score) seats will be filled by the Convener, PGECET.
- As per the norms of Government of Andhra Pradesh, Category-B seats will be filled by the management.

2. COURSE WORK:

- A Candidate after securing admission must pursue the M.Tech course of study for Four Semesters duration.
- Each semester shall be of 20 weeks duration including all examinations.
- A candidate admitted to a programme should complete it within a period equal to twice the prescribed duration of the programme from the date of admission.

3.0 ATTENDANCE REGULATIONS AND CONDONATION:-

(i) A student shall be eligible to appear for end semester examinations, if he acquires a minimum of 75% attendance in aggregate of all the subjects.

(ii) Condonation of shortage of attendance in aggregate up to 10% on medical grounds (65% above and below 75%) in each semester may be granted on the recommendation of the College Academic Committee. However, granting condonation is purely at the discretion of Principal of the college.

(iii) A Student will not be promoted to the next semester unless he satisfies the attendance requirement of the present semester as applicable. They may seek re-admission for that semester as and when offered next.

(iv) Shortage of Attendance below 65% in aggregate shall in no case be condoned.

(v) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that particular semester and their registration for examination shall stand cancelled.

(vi) A stipulated fee shall be payable towards condonation of shortage of attendance if granted.

(vii) Attendance may also be condoned for those students who participate in prestigious sports and co and extracurricular activities provided their attendance is in the minimum prescribed range for the purpose and recommended by the concerned authority.

4.0. EVALUATION:-

The performance of the candidate in each semester shall be evaluated subject-wise for a maximum of 100 marks for Theory and 100 marks for practical subjects, on the basis of Internal Evaluation and End Semester Examination. For the theory & practical subjects 60% of the marks will be for the External End Examination, while 40% of the marks for Internal Evaluation.

4.1 INTERNAL EVALUATION FOR THEORY SUBJECTS:

Each course is evaluated for **40** marks **(a+b)**

a) Two Midterm Examinations each for **30 marks** with a duration of two hours each will be conducted for every theory course in a semester. First Midterm Examination is conducted in the middle of the Semester (I & II units) and second Midterm Examination immediately after the completion of instruction (III & IV units) as per academic schedule. The Midterm Examination marks shall be awarded giving a weightage of 80% in the Midterm Examination in which the student scores more marks and 20% in the remaining Midterm Examination.

Midterm Examination Pattern for 30 Marks:

- Each Midterm Examination Question Paper comprises of four questions covering the two units.
- Answering any three questions.
- Questions 1 & 2 from one unit and Questions 3 & 4 from another unit. Each question is allotted 10 marks.

b) 10 marks are allocated for **Assignment Tests.**

- There will be four Assignment Tests per subject.
- One Assignment Test is conducted from each unit.
- Five Assignment questions are given in advance from each unit out of which two questions given by the concerned teacher has to be answered during Assignment Test.
- Average of Assignment Tests marks is considered.

NOTE: A student who is absent for any Midterm Examination / Assignment Test, for any reason whatsoever, shall be deemed to have scored zero marks in that Midterm Examination/ Assignment Test and no make-up test shall be conducted.

4.2 INTERNAL EVALUATION FOR PRACTICAL SUBJECTS:

For Laboratory courses there shall be continuous evaluation during the semester for 40 internal marks. The break-up of internal marks to be awarded is as given below:

Table 1: Break-up of Internal Marks

S.No.	Criterion	Marks
1	Conduct of experiments, Observation & Results in regular class work(Day-to-Day Performance)	25
2	Viva – voce and Internal Examination	15

In any semester a minimum of 90% of the prescribed number of experiments/exercises specified in the syllabus for laboratory course shall be conducted. They shall complete these experiments/exercises in all respects and submit report and get it certified by the concerned internal lab teacher and the Head of the Department to become eligible to appear for the final end examination in the Laboratory Course.

4.3 INTERNAL EVALUATION FOR SEMINAR-I & SEMINAR-II:

There shall be two Seminars conducted in each discipline, Seminar-I in the M.Tech I Semester and the Seminar-II in M.Tech IV semester. The distribution of internal marks for seminar is given below:

Table 2: Distribution of Marks

S.No.	Criterion	Marks
1	Seminar Report & Subject content	20
2	Seminar presentation & Viva – Voce Exam	30

For the seminar, the student shall collect the information on a specialized relevant topic and prepare a report, showing his understanding over the topic, and submit the same to the department, which shall be evaluated by the Department Committee consisting of Head of the department, Seminar Supervisor and a Senior Faculty Member. Each Seminar shall be evaluated for 50 marks (10 marks for report, 10 marks for subject content, 20 marks for presentation and 10 marks for queries).

4.4 TERM PAPER:

The Term Paper is a precursor to the project work done in the 2nd year M.Tech Programme. The paper may be of 8-10 (A4 size) in length and follows the standard IEEE/Technical Journal Format.

The Term Paper helps to supplement the second year Project Work of the M.Techstudents. It helps to identify their Reserch area/topic and complete the groundwork andpreliminary research required for it comfortably. It trains the students to make use of Research Tools and Material available both in print and digital formats.
Based on the topic, a hypothesis is to be made by the student, under the supervision of the guide. The student is then required to collect literature and support information for his / her term paper from Standard Reference Books, Journals, and Magazines - both printed and online. Each student should refer to a minimum of 6 reference sources related to the topic. The student also presents his/her paper with the help of Power Point slides / OHP.
The Term Paper contains: The Aim and Objective of the study, The need for Rationale behind the study, Identify the work already done in the field, Hypothesis and Discussion, Conclusion Appendix with support data (Illustrations, Tables, Graphs, etc.).
Page Limit: minimum of eight pages.
Date of evaluation: During the Lab Internal Exam.
Method of Evaluation**:** Total 50 marks
1. Day to day work - 10 marks
2. Term Paper Report - 20 marks
3. Seminar - 20 marks

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

4.6 In case the candidate does not secure the minimum academic requirement in any subject(as specified in 4.4) he has to reappear for the Semester Examination either supplementary or regular in that subject, or repeat the course when next offered or do any other specified subject as may be required.

5.0 SEMESTER END EXAMINATIONS:-

5.1 Theory Courses: 60 marks each

The Semester end examination in each theory subject shall be conducted for 3 hours duration at the end of the semester for 60 marks. The question paper for Semester pattern shall be designed as per the following:

Question paper contains

- A total of Eight questions.
- Answer one Question from each Unit
- The Eight questions are to be designed taking one question from each unit (Unit Wise Either or Type) of the four units.
- In each question, one, two or more bits can be set, totaling 15 Marks with appropriate distribution of marks.

A student has to secure not less than a minimum of 40% of marks (24 marks) exclusively at the end semester examinations in each of the theory subjects in which the candidate had appeared. However, the candidate shall have to secure a minimum of 50% of marks (50 marks) in both external and internal components put together to become eligible for passing in the subject.

5.2 Lab Courses (Practical / Workshop): 60 marks

Out of 60 marks **40** marks are allocated for experiment (procedure for conducting the experiment carries 10 marks & readings, calculation and result-30 marks) and **15** marks for viva-voce examination with **5** marks for the record.

Each Semester External Lab Examination shall be evaluated by an Internal Examiner along with an External Examiner. External Examiner is appointed by the Principal.
A candidate shall be declared to have passed in individual lab course if he secures a minimum of 50% aggregate marks (50 marks) (Internal & Semester External Examination marks put together), subject to a minimum of 40% marks (24 marks) in the semester external examination.

5.3 EVALUATION OF PROJECT WORK:-

Every candidate shall be required to submit thesis or dissertation after taking up a topic approved by the college/ concerned department.

- **Registration of Project work**: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the courses (theory and practical courses of I & II Semesters)
- An Internal Departmental Committee (I.D.C) consisting of HOD, Supervisor/ Guide and one Internal senior expert shall monitor the progress of the project work.
- The work on the project shall be initiated in the penultimate semester and continued in the final semester. The duration of the project is for two semesters. The candidate can submit Project thesis with the approval of I.D.C. after 36 weeks from the date of registration at the earliest and one calendar year from the date of registration for the project work. Extension of time within the total permissible limit for completing the programme is to be obtained from the Head of the Institution.

- The student must submit status report at least in three different phases during the project work period. These reports must be approved by the I.D.C before submission of the Project Report.
- A candidate shall be allowed to submit the thesis / dissertation only after passing in all the prescribed subjects (both theory and practical) and then take viva-voce examination of the project. The viva-voce examination may be conducted once in two months for all the candidates submitted during that period.
- Three copies of the Thesis / Dissertation certified in the prescribed form by the supervisor and HOD shall be submitted to the HOD.
- The semester end examination for project work done during III & IV Semesters, shall be conducted by a Project Review Committee (PRC). The evaluation of project work shall be conducted at the end of the IV Semester.
- The PRC comprises of an External examiner appointed by the Principal, Head of the Department and Project Guide/Supervisor to adjudicate the thesis / dissertation. The PRC shall jointly evaluate candidates work and award grades as given below

S.No	Description	Grade
1	Very Good	Grade A
2	Good	Grade B
3	Satisfactory	Grade C
4	Not satisfactory	Grade D

If the report of the viva-voce is not satisfactory (Grade D) the candidate will retake the viva-voce examination after three months. If he fails to get a satisfactory report at the second viva-voce examination he will not be eligible for the award of the degree unless the candidate is permitted to revise and resubmit the thesis.

6.0 RE-REGISTRATION FOR IMPROVEMENT OF INTERNAL EVALUATION MARKS:

Following are the conditions to avail the benefit of improvement of internal evaluation marks.

- The candidate should have completed the course work and obtained examinations results for I & II semesters.
- He should have passed all the subjects for which the internal evaluation marks secured are more than 50%.
- Out of the subjects the candidate has failed in the examination due to Internal evaluation marks secured being less than 50%, the candidate shall be given one more chance for each Theory subject and for a maximum of **three** Theory subjects for Improvement of Internal evaluation marks.
- The candidate has to re-register for the subjects so chosen and fulfill all the academic requirements.
- For each subject, the candidate has to pay a fee equivalent to one third of the semester tuition fee and the amount is to be remitted in the form of D.D. in favour of **'The Principal, Audisankara College of Engineering & Technology' payable at Gudur** along with the requisition through the Controller of the Examinations of the college.
- In the event of availing the Improvement of Internal evaluation marks, the internal evaluation marks as well as the End Examinations marks secured in the previous attempt(s) for the reregistered subjects stand cancelled.

7.0 SEMESTER – WISE DISTRIBUTION OF CREDITS:

Table 3: Semester –wise Credits distribution

SEMESTER	No. of Credits per semester Theory + Lab	Total credits
I Semester	24+06	30
II Semester	24+06	30
III & IV Semesters	0+18	18
TOTAL CREDITS	48+30	78

8.0 AWARD OF DEGREE AND CLASS:-

A candidate shall be eligible for the award of degree if he satisfies the minimum academic requirements in every subject, Seminar and secures 'satisfactory' or higher grade report on his thesis/dissertation and viva-voce. Based on overall percentage of marks obtained, the following class is awarded.

Table 4: Award of Division

Class Awarded	% of marks to be secured
First Class with Distinction	70% and above
First Class	Below 70% but not less than 60%
Second Class	Below 60% but not less than 50%

9.0 READMISSION CRITERIA:

A Candidate, who is detained in a semester due to lack of attendance, has to obtain written permission from the Principal for readmission into the same semester after duly fulfilling all the required norms stipulated by the college in addition to paying the required fee.

10. SUPPLEMENTARY EXAMINATIONS:

Apart from the regular End Examinations the institute may also schedule and conduct supplementary examinations for all subjects for the benefit of students with backlogs. Such students writing supplementary examinations as supplementary candidates may have to write more than one examination per day.

11.CONDUCT AND DISCIPLINE:-

(a) Students shall conduct themselves within and outside the premises of the Institute in a descent and dignified manner befitting the students of ACET.

(b) As per the order of the Honorable Supreme Court of India, ragging in any form is considered a criminal offence and is totally banned. Any form of ragging will be severely dealt with.

(c) The following acts of omission and / or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures with regard to ragging.
   (i) Lack of courtesy and decorum; indecent behavior anywhere within or outside the college campus.
   (ii) Damage of college property or distribution of alcoholic drinks or any kind of narcotics to fellow students / citizens.

(d) Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.

(e) Mutilation or unauthorized possession of library books.

(f) Noisy and unruly behavior, disturbing studies of fellow students.
(g) Hacking in computer systems (such as entering into other person's areas without prior permission, manipulation and / or damage of computer hardware and software or any other cyber crime etc.
(h) Usage of camera /cell phones in the campus.
(i) Plagiarism of any nature.
(j) Any other act of gross indiscipline as decided by the college academic council from time to time.
(k) Commensurate with the gravity of offense, the punishment may be reprimand, fine, expulsion from the institute/ hostel, debarring from examination, disallowing the use of certain facilities of the Institute, rustication for a specified period or even outright expulsion from the Institute, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.
(l) For an offence committed in (i) a hostel (ii) a department or in a class room and (iii) elsewhere, the chief Warden, the concern Head of the Department and the Principal respectively, shall have the authority to reprimand or impose fine.
(m) Cases of adoption of unfair means and/ or any malpractice in an examination shall be reported to the principal for taking appropriate corrective action.
(n) All cases of serious offence, possibly requiring punishment other than reprimand, shall be reported to the Academic council of the college.
(o) The Institute Level Standing Disciplinary Action Committee constituted by the academic council shall be the authority to investigate the details of the offence, and recommend disciplinary action based on the nature and extent of the offence committed.
(p) The Principal shall deal with any problem, which is not covered under these rules and regulations.
(q) **"Grievance and Redressal Committee" (General)** constituted by the Principal shall deal with all grievances pertaining to the academic / administrative / disciplinary matters.
(r) All the students must abide by the code and conduct rules prescribed by the college from time to time.

12.0 WITH – HOLDING OF RESULTS:

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

13.0 TRANSITORY REGULATIONS:

Candidates who have discontinued or have been detained for want of attendance or who have failed after having undergone the course in earlier regulations and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when such subjects are offered, subject to the conditions of 4.5 and 2.3 sections.

14.0MINIMUM INSTRUCTION DAYS:

The minimum instruction days for each semester shall be 90 clear instruction days excluding the days allotted for tests/examinations and preparation holidays declared if any.

15.0AMENDMENTS OF REGULATIONS-

The college may, from time to time, revise, amend or change the regulations, scheme of examinations and syllabi. However the academic regulations of any student will be same throughout the course of study in which the student has been admitted.

16.0 GENERAL:

- The academic regulations should be read as a whole for the purpose of any interpretation.
- Disciplinary action for Malpractice/improper conduct in examinations is appended.
- Where the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.
- In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Head of the Institute is final.

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RULES FOR DISCIPLINARY ACTION FOR MALPRACTICE / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	**Punishment**
	If the candidate	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Is found copying in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate will be cancelled.
3.	Comes in alcohol drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
4.	Smuggles the Answer book or a part there of additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of

		seat.
5.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
6.	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate will also be debarred and forfeit the seat.
7.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate will also be debarred and forfeit the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate will also be debarred for two consecutive semesters from class work and all end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the impostor is an outsider, he will be handed over to the police and a case registered against him.
8.	Refuses to obey the orders of the Chief Superintendent/Asst.Superintendent/ any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall causing any injury to him or to any of his relations	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are

	whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case registered against them.
9.	Is a student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clauses 6 to 8.	In case of students of the college expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
11.	Is detected copying on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	Indulging in any malpractice which is not covered in the above clauses 1 to 11 if detected shall be reported to the College Authorities for further action to award suitable punishment.	Appropriate action will be taken as recommended by the College Authorities.

Malpractices identified by squad or special invigilators

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

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Course Structure for M.Tech (PE) Regular Programme
Applicable for students admitted from Academic Year 2014-15

M. Tech I Year (I Semester) – Power Electronics

Sl. No	Course Code	Subject	Scheme of instruction(Periods / week)		Scheme of Examination			No. of Credits
			Theory	Lab	IM	EM	Total Marks	
1	13PE101	Modern Control Theory	4	-	40	60	100	4
2	13PE102	Principles of Machine Modeling Analysis	4	-	40	60	100	4
3	13PE103	Analysis of Power Electronic Converters	4	-	40	60	100	4
4	13PE104	Power Electronic Control of DC Drives	4	-	40	60	100	4
5	13PE105	Advanced Power Electronics	4	-	40	60	100	4
6	13PE106 13PE107 13PE108	**Elective-I** a. Advanced Digital Signal Processing b. AI Techniques in Electrical Engineering c. Advanced Microprocessors and Microcontrollers	4	-	40	60	100	4
7	13PE109	Power Converters Lab	-	3	40	60	100	2
8	13PE110	Simulation Lab – I	-	3	40	60	100	2
9	13PE111	Seminar-I	-	-	50	-	50	2
Contact Periods / Week			24	**6**	370	480	850	
			Total Periods/ Week		**30**	Total Credits		**30**

M. Tech I Year (II Semester) – Power Electronics

Sl. No	Course Code	Subject	Scheme of instruction(Periods / week)		Scheme of Examination			No. of Credits
			Theory	Lab	IM	EM	Total Marks	
1	13PE201	Flexible AC Transmission Systems	4	-	40	60	100	4
2	13PE202	HVDC Transmission	4	-	40	60	100	4
3	13PE203	Power Electronic Control of AC Drives	4	-	40	60	100	4
4	13PE204	Advanced Electric Drives	4	-	40	60	100	4
5	13PE205	Renewable Energy systems	4	-	40	60	100	4
6	3PE206 3PE207 3PE208	**Elective-II** a. Programmable Logic Controllers b. Energy Auditing, Conservation and Management c. Reactive power compensation & Management	4	-	40	60	100	4
7	13PE209	Renewable Energy Systems Lab	-	3	40	60	100	2
8	13PE210	Simulation Lab-II	-	3	40	60	100	2
9	13PE211	Term Paper	-	-	50	-	50	2
Contact Periods / Week			24	**6**	370	480	850	
			Total Periods/ Week		**30**	Total Credits		**30**

M. Tech II Year (III & IV Semesters) – Power Electronics

Sl. No	Course Code	Subject	Scheme of Examination			No. of Credits
			IM	EM	Total Marks	
1	13PE401	Seminar-II	50	-	50	2
2	13PE402	Project Work	-	A/B/C/D	-	16
Contact Periods / Week						
				Total Credits		**18**

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

M.Tech I Semester (PE)

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(13EP101) MODERN CONTROL THEORY

UNIT –I

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

State Variable Analysis: Linear Continuous time model for physical systems – Existence and Uniqueness of Solutions to Continuous – Time State Equations – Solutions – Linear Time Invariant Continuous – Time State Equations – State transition matrix and it's properties.

UNIT – II

Controllability and Observability: General concept of Controllability - General concept of Observability Controllability tests for Continuous – Time Invariant systems - Observability tests for Continuous - Time Invariant systems - Controllability and Observability of state model in Jordan Canonical form - Controllability and Observability Canonical forms of State model.

State Feedback Controllers and Observers: State Feedback Controller design through Pole Assignment – state observers: Full order and reduced order.

UNIT – III

Non Linear Systems: Introduction – Non Linear Systems – Types of Non – Linearities – Saturation – Dead – Zone – Backlash – Jump Phenomenon etc; - Singular Points – Introduction to Linearization of nonlinear systems, properties of Non Linear Systems – Describing function – describing function analysis of Nonlinear systems- Stability analysis of Non – Linear systems through describing functions Introduction to phase – plane analysis, Method of Isoclines for Constructing Trajectories, singular Points, phase – plane analysis of nonlinear control systems.

UNIT – IV

Stability Analysis: Stability in the sense of Lyapunov, Lyapunov's stability and Lyapunov's instability theorems – Stability Analysis of the Linear Continuous time invariant systems by Lyapunov's second method – Generation of Lyapunov's functions – Variable gradient method – Krasooviski's method.

Text Books:

1. M. Gopal, Modern Control System Theory, New Age International – 1984.
2. Ogata. K, Modern Control Engineering Prentice Hall – 1997.
4. Kuo, Digital Control Engineering, Oxford University.1980.

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M.Tech I Semester (PE)

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(13PE102) PRINCIPLES OF MACHINE MODELING AND ANALYSIS

UNIT- I

Basic Concepts of Modeling: Basic Two-pole Machine representation of commutator machines, 3-phase synchronous machine with and without damper bars and 3-phase induction machine, Kron‟s primitive Machine-voltage, current and Torque equations.

DC Machine Modeling: Mathematical model of separately excited D.C motor – Steady State analysis-Transient State analysis-Sudden application of Inertia Load-Transfer function of Separately excited D.C Motor- Mathematical model of D.C Series motor, Shunt motor-Linearization Techniques for small perturbations.

UNIT- II

Modeling of Three Phase Induction Machine-I: Transformation from Three phase to two phase and Vice Versa - Transformation from Rotating axes to stationary axes and vice versa –Park‟s Transformation and its physical concept –The Inductance matrix-Mathematical model of Induction machine –Steady State analysis.

Modeling of Three Phase Induction Machine-II: d-q model of induction machine in Stator reference Frame, Rotor reference Frame and Synchronously rotating reference Frame -Small signal equations of induction machine-d-q flux linkages model derivation- Signal flow graph of the induction machine-Per unit model –Dynamic simulation of induction machine.

UNIT- III

Modeling of Single Phase Induction Machine: Comparison between single phase and poly-phase induction motor - Cross field theory of single phase induction machine, steady state analysis – steady state torque.

Modeling of Synchronous Machine Synchronous Machine: Inductances-the phase Co-ordinate model-the Space phasor (d-q) model- Steady state operation-Mathematical model of PM Synchronous motor.

UNIT- IV

Modeling of Special Machines-I: Modeling of Permanent Magnet Brushless DC Motor – Operating principle-Mathematical modeling of PM Brushless DC motor-PMDC Motor Drive Scheme.

Modeling of Special Machines-II: Mathematical model of Switched Reluctance Motor-Operating principle-Construction and functional Aspects-Average torque and Energy Conversion Ratio-The Commutation windings-SRM modeling-The flux current position curve fitting.

Text Books:

1. P.S.Bimbra, Generalized Theory of Electrical Machines, Khanna publications-5th edition-1995.
2. P.C.Krause, Analysis of Electrical Machinery – McGraw Hill- 1980.

References Books:

1. 5. R.Krishnan, Electric Motor Drives - Modeling, Analysis& control Pearson Publications-1st edition – 2002.
2. C.V.jones, Butterworth, The Unified Theory of Electrical Machines - London, 1967.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
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M.Tech I Semester (PE)

L	T	P	[C]
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(13PE103) ANALYSIS OF POWER ELECTRONIC CONVERTERS

UNIT-I

Single Phase AC Voltage Controllers: Single Phase AC Voltage Controllers with resistive, resistive-inductive and resistive-inductive induced emf loads-ac voltage controllers with PWM control-Effects of source and load inductances-synchronous tap changers –Application- numerical problems.

Three Phase AC Voltage Controllers: Three Phase AC Voltage controllers-Analysis of Controllers with star and delta connected resistive, resistive –inductive loads-Effects of source and load inductances–Application-problems.

UNIT-II

Cycloconverters: Single phase to single phase cycloconverters –analysis of midpoint and bridge configurations three phase to three phase cycloconverters-analysis of Midpoint and bridge configurations-Limitations-Advantages-Applications-numerical problems.

Single phase converters: Single phase cycloconverters- Half controlled and fully controlled Converters – Evaluation of input power factor and harmonic factor-Continuous and Discontinuous load current-Single phase dual converters-Power factor improvements-Extinction angle control-symmetrical angle control-PWM single phase sinusoidal PWM-Single phase series converters–Application- Problems.

UNIT-III

Three Phase Converters: Three Phase Converters- Half controlled and fully controlled Converters – Evaluation of input power factor and harmonic factor-Continuous and Discontinuous load current-three phase dual converters-Power factor improvements-three phase PWM-twelve pulse converters–Application problems

D.C. to D.C Converters: Analysis of step-down and step up dc to dc converters with resistive and resistive –inductive loads-Switched mode regulators- Analysis of Buck regulators-Boost Regulators-Buck-Boost Regulators-Cuk Regulators- Condition for continuous inductor and capacitor voltage-Comparison of regulators-Multi output boost regulators –advantages –Application- problems.

UNIT –IV

Pulse Width Modulated Inverters (Single Phase Inverter): Principle of operation- Performance parameters- Single Phase bridge Inverters-Evaluation of output voltage and current with resistive, inductive and capacitive loads-Voltage control of single phase inverters – Single PWM-Multiple PWM-Sinusoidal PWM-modified PWM-phase displacement control-Advanced Modulation techniques for improved performance , Trapezoidal, staircase ,stepped, harmonic injection and delta modulation – Advantage-Applications-problems.

Pulse Width Modulated Inverters (Three Phase Inverter): Three Phase inverters-analysis of 180 degree condition of output voltage and current with resistive, inductive loads-analysis of 120 degree conduction-Voltage control of three phase inverters-sinusoidal PWM-third harmonic PWM-60

degree PWM –space vector modulation comparison of PWM techniques-Space vector modulation-Comparison of PWM techniques harmonic reduction –current source inverters-Variable dc link inverter –boost inverters- buck and boost inverter – inverter circuit design – Advantage-– Application- numerical problems.

Text Books:

1. Md.H.Rashid, Power Electronics Pearson Education 3rd Edition, 2004.
2. N.Mohan, Tore.M.Undeland, W.P.Robbins, Power Electronics –John Wiley, -2nd Edition. 1989.
3. P.S.Bimbhra "Power Electronics", Khanna publishers-(2004),
4. M.D.Singh and K.B.Khanchandani, Power Electronics TMH-2002.

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M.Tech I Semester (PE)

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(13PE104) POWER ELECTRONIC CONTROL OF DC DRIVES

UNIT-I

Controlled Bridge Rectifier (1-Φ) with DC Motor Load: Separately excited DC motors with rectified single phase supply- single phase semi converter and single phase full converter for continuous and discontinuous modes of operation – power and power factor.

Controlled Bridge Rectifier (3-Φ) with DC Motor Load - Three phase semi converter and three phase full converter for continuous and discontinuous modes of operation – power and power factor – Addition of Free wheeling diode – Three phase double converter.

UNIT-II

Three Phase Naturally Commutated Bridge Circuit as a Rectifier or as an Inverter: Three phase controlled bridge rectifier with passive load impedance, resistive load and ideal supply – Highly inductive load and ideal supply for load side and supply side quantities, shunt capacitor compensation, three phase controlled bridge rectifier inverter.

Phase Controlled DC Motor Drives - Three phase controlled converter, control circuit, control modeling of three phase converter – Steady state analysis of three phase converter control DC motor drive – Two quadrant, Three phase converter controlled DC motor drive – DC motor and load, converter.

Unit-III

Current and Speed Controlled DC Motor Drives: Current and Speed controllers - current and speed feedback ⎯ Design of controllers - Current and Speed controllers – Motor equations – Filter in the speed feedback loop speed controller – current reference generator – current controller and flow chart for simulation – Harmonics and associated problems – sixth harmonics torque.

Chopper controlled DC motor drives: Principle of operation of the chopper – Four quadrant chopper circuit – Chopper for inversion – Chopper with other power devices – model of the chopper –input to the chopper – Steady state analysis of chopper controlled DC motor drives – rating of the devices – Pulsating torque.

UNIT- IV

Closed Loop Operation of DC Motor Drives: Speed controlled drive system – current control loop – pulse width modulated current controller – hysteresis current controller – modeling of current controller – design of current.

Simulation of DC motor Drives: Dynamic simulations of the speed controlled DC motor drives – Speed feedback speed controller – command current generator – current controller.

Text Books:

1. Shepherd, Hulley, Liang, Power Electronics and motor control – II Edn, CU Press.1995.
2. R. Krishnan, Electric motor drives modeling, Analysis and control – I Edn, PHI.2001.
3. Md.H.Rashid, Power Electronic Circuits, Devices and Applications –PHI, I Edn 2004.
4. G. K. Dubey, Fundamentals of Electric Drives – Narosa Publications – 1995.

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M.Tech I Semester (PE)

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(13PE105) ADVANCED POWER ELECTRONICS

UNIT- I

Modern Power Semiconductor Devices: Modern power semiconductor devices- MOS Turn Off Thyristor (MTO) – Emitter Turn Off Thyristor (ETO) – Integrated Gate – Commutated thyristor (IGCTs) – MOS – Controlled thyristors (MCTs) – Static induction Thyristors (SITHs) – Power integrated circuits (PICs) –Symbol, structure and equivalent circuit- comparison of their features.

Resonant Pulse Inverters: Resonant pulse inverters – series resonant inverters- series resonant inverters with unidirectional switches – series resonant inverters with bidirectional switches- analysis of half bride resonant inverter- evaluation of currents and Voltages of a simple resonant inverter – analysis of half bridge and full bridge resonant inverter with bidirectional switches – Frequency response of series resonant inverter- for series loaded inverter – for parallel resonant inverters – Voltage control of resonant inverters-class E resonant inverter – class E resonant rectifier- evaluation of values of capacitor and inductor for class E inverter and Class E rectifier – numerical problems.

UNIT-II

Resonant Converters: Resonant converters- zero current switching resonant converters – L type ZCS resonant converter- M type ZCS resonant converter – zero voltage switching resonant converters – comparison between ZCS and ZVS resonant converters- Two quadrant ZVS resonant converters – resonant dc – link inverters- evaluation of L and C for zero current switching inverter –problems.

Multilevel Inverters: Multilevel concept- Classification of multilevel inverters – Diode clamped multilevel inverter-Principle of operation – main features- improved diode clamped inverter – principle of operation –Flying capacitors multilevel inverter – principle of operation – main features.

UNIT-III

Multilevel Inverters (Continued): Cascaded multilevel inverter – principle of operation – main features- multilevel inverter applications – reactive power compensation – back to back intertie system – adjustable drives –switching device currents – dc link capacitor voltage balancing –features of Multilevel inverters –comparisons of multilevel converters.

DC Power Supplies: DC power supplies – classification- switched mode dc power supplies – fly back Converter forward converter- push –pull converter –half bridge converter –Full bridge converter – Resonant DC power supplies- bidirectional power supplies- Application.

UNIT -IV:

AC Power Supplies: AC power supplies – classification – switched mode ac power supplies Resonant AC power supplies-bidirectional ac power supplies – multistage conversions- control circuits- applications.

Power conditioners and Uninterruptible Power Supplies: Introduction- power line disturbances – power conditioners- uninterruptible power supplies applications.

Text Books:

1. Mohammed H.Rashid- Power Electronics Pearson Education- Third Edition –first Indian reprint-2004.
2. Ned Mohan, Tore M.Undeland and William P.Robbind – Power Electronics John wiley & Sons – Second Edition.1989.

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(13PE106) ADVANCED DIGITAL SIGNAL PROCESSING
(ELECTIVE - I)

UNIT-I

Introduction: Analog to digital and Digital to Analog conversion, sampled and Hold circuit, Continuous time Fourier Transforms. Discrete-time signals and systems, Discrete-time Fourier transform- its properties and applications, Fast Fourier Transform (in time-domain and Frequency domain), IDFT and its properties.

UNIT-II

Z- Transforms: Definition and properties, Rational z-transforms, Region of convergence of a rational z- Transform, The inverse z- Transform, Z-Transform properties, Computation of the convolution sum of finite-length sequences, The transfer function Digital filter structures: Block Diagram representation, Equivalent structures, Basic FIR Digital Filter structures, Basic IIR Digital Filter structures, Realization of Basic structures using MATLAB, All pass filters, Computational complexity of Digital filter structures.

UNIT III:

IIR Digital filter design: Preliminary considerations, Bilinear transformation method of IIR Filter design, Design of low pass IIR Digital filters, Design of High pass, Band pass and band stop IIR digital filters, Spectral Transformations of IIR filter, IIR digital filter design using MATLAB, Computer aided design of IIR digital filters.

FIR digital filter design: Preliminary considerations, FIR filter design based on windowed Fourier series, Computer aided design of Equiripple Linear phase FIR filters, Design of Minimum phase FIR filters, FIR digital filter design using MATLAB, Design of computationally efficient FIR digital filters.

UNIT IV:

Analysis of Finite word length effects: The quantization process and errors, quantization of Fixed point numbers, Quantization of floating point numbers, Analysis of coefficient quantization effects, Analysis of arithmetic round off errors, Low sensitivity digital filters, Reduction of product round off errors using error feedback, Round off errors in FFT algorithms. The basic sample rate alteration devices, Multi rate structures for sampling rate conversion, Multistage design of decimator and interpolator, The Polyphase decomposition, Arbitrary-rate sampling rate converter, Nyquist Filters and some applications of digital signal processing.

Text Books:

1. S.K. Mitra, Digital Signal Processing Tata McGraw-Hill, Third Edition, 2006.
2. B.P. Lathi, Principle of Signal Processing and Linear Systems Oxford International Student Version, 2009.
3. M. Mondal and A. Asif, Continuous and Discrete Time Signals and Systems Cambridge, 2007.
4. Li Tan, Digital Signal Processing- Fundamentals and Applications Indian reprint, Elsevier, 2008.

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M.Tech I Semester (PE)

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4	0	0	[4]

(13PE107) AI TECHNIQUES IN ELECTRICAL ENGINEERING
(ELECTIVE - I)

UNIT-I

Introduction to Neural Networks: Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

Essentials of Artificial Neural Networks: Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN-Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application.

UNIT-II

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

Multilayer Feed Forward Neural Networks -Credit Assignment Problem, Generalized Delta Rule, Derivation of Back propagation (BP) Training, Summary of Back propagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

Associative Memories: Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory), Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem. Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network.

UNIT-III

Self-Organizing MAPS (SOM) and Adaptive Resonance Theory (ART): Introduction, Competitive Learning, Vector Quantization, Self-Organized Learning Networks, Kohonen Networks, Training Algorithms, Linear Vector Quantization, Stability- Plasticity Dilemma, Feed forward competition, Feedback Competition, Instar, Outstar, ART1, ART2, Applications.

Classical & Fuzzy Sets: Introduction to classical sets – properities, Operations and relations; Fuzzy sets, Membership, Uncertainity, Operations, Properities, fuzzy relations, cardinalities, membership functions.

UNIT-IV

Fuzzy Logic System Components: Fuzzification, Membership Value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

Applications - Neural Network Applications: Process identification, Fraction Approximation, Control and Process Monitoring, Fault diagnosis and Load forecasting.

Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.

Text Books:

1. Rajasekharan and Rai, Neural Networks, Fuzzy logic, Gnenetic algorithms: synthesis and applications - PHI Publication.2003.
2. Jacek M.Zurada, Introduction to Artificial Neural Systems Jaico Publishing House, 1997.
3. N. Yadaiah and S. Bapi Raju, Neural and Fuzzy Systems: Foundation, Architectures and Applications Pearson Education.2010.
4. Brok Kosko, Neural Netwroks and Fuzzy Logic System PHI Publications.

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M.Tech I Semester (PE)

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(13PE108) ADVANCED MICROPROCESSORS AND MICROCONTROLLERS (ELECTIVE - I)

Objectives:

- To expose the students to the fundamentals of microprocessor architecture.
- To introduce the advanced features in microprocessors and microcontrollers.
- To enable the students to understand various microcontroller architectures.

UNIT-I

High Performance CISC Architecture – PENTIUM: CPU Architecture- Bus Operations – Pipelining – Brach predication – floating point unit- Operating Modes –Paging – Multitasking – Exception and Interrupts – Instruction set – addressing modes – Programming the Pentium processor.

UNIT- II

High Performance RISC Architecture – ARM : Arcon RISC Machine – Architectural Inheritance – Core & Architectures – Registers – Pipeline – Interrupts – ARM organization – ARM processor family – Co-processors – ARM instruction set- Thumb Instruction set – Instruction cycle timings – The ARM Programmer's model – ARM Development tools – ARM Assembly Language Programming – C programming – Optimizing ARM Assembly Code – Optimized Primitives.

UNIT- III

ARM Application Development: Introduction to DSP on ARM –FIR filter – IIR filter – Discrete fourier transform – Exception handling – Interrupts – Interrupt handling schemes- Firmware and bootloader – Embedded Operating systems – Integrated Development Environment- STDIO Libraries – Peripheral Interface – Application of ARM Processor – Caches – Memory protection Units – Memory Management units – Future ARM Technologies.

UNIT- IV

Motorola 68HC11 Microcontrollers: Instruction set addressing modes – operating modes- Interrupt system- RTC-Serial Communication Interface – A/D Converter PWM and UART.

PIC Microcontroller: CPU Architecture – Instruction set – interrupts- Timers- I2C Interfacing –UART-A/D Converter –PWM and introduction to C-Compilers.

Text Books:

1. Andrew N.Sloss, Dominic Symes and Chris Wright "ARM System Developer's Guide: Designing and Optimizing System Software" , First edition, Morgan Kaufmann Publishers, 2004.

Reference Books:

1. Steve Furber, “ARM System –On –Chip architecture”, Addision Wesley, 2000.
2. Daniel Tabak, “Advanced Microprocessors”, Mc Graw Hill. Inc., 1995.
3. James L. Antonakos, “The Pentium Microprocessor”, Pearson Education, 1997.
4. Gene .H.Miller, “Micro Computer Engineering”, Pearson Education, 2003.
5. John .B.Peatman, “Design with PIC Microcontroller”, Prentice Hall, 1997.

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M.Tech I Semester (PE)	L	T	P	[C]
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(13PE109) POWER CONVERTERS LAB

1. Speed Measurement and closed loop control using PMDC motor
2. Thyristorised drive for PMDC Motor with speed measurement and closed loop control.
3. IGBT used single 4 quadrant chopper drive for PMDC motor with speed measurement and closed loop control.
4. Thyristorised drive for 1 HP DC motor with closed loop control.
5. 3 Phase input, thyristorised drive, 3 HP DC motor with closed loop.
6. 3 Phase input IGBT, 4 quadrant chopper drive for DC motor with closed loop control equipment.
7. Cycloconverter based AC Induction motor control equipment.
8. Speed control of 3 phase wound rotor Induction motor.
9. Single phase fully controlled converter with inductive load
10. Single phase half wave controlled converter with inductive load.

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M.Tech I Semester (PE)	L	T	P	[C]
	0	0	3	[2]

(13PE110) SIMULATION LAB-I

1. Solution of simultaneous algebraic equations of Electrical network.
2. Solution of simultaneous differential equations of a given network.
3. Formation of incidence matrices.
4. Formation of network matrices by singular or nonsingular transformations.
5. Simulation of 1-phase diode bridge rectifier.
6. Simulation of 1-phase controlled rectifier.
7. Simulation of Single Phase AC voltage Controller.
8. Transfer function analysis of given system using Simulink.
9. State space analysis of a control system using MATLAB.
10. Conversion of the given state system into a suitable diagonal form.

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M.Tech I Semester (PE)	L	T	P	[C]
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(13PE111) SEMINAR-I

Objectives: To get involved with the latest advancements and developments to enhance communication and presentation skills, exchange of ideas, greater connectivity to develop a research bent of mind.

For the seminar, the student shall collect the information on a specialized relevant topic and prepare a report, showing his understanding over the topic, and submit the same to the department, which shall be evaluated by the Department Committee consisting of Head of the department, Seminar Supervisor and a Senior Faculty Member. Each Seminar shall be evaluated for 50 marks (10 marks for report, 10 marks for subject content, 20 marks for presentation and 10 marks for queries).

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M.Tech II Semester (PE)

L	T	P	[C]
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(13PE201) FLEXIBLE AC TRANSMISSION SYSTEMS

UNIT- I

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

Voltage source converters: Single phase three phase full wave bridge Converters transformer connections for 12 pulse 24 and 48 pulse operation.

UNIT- II

Three level voltage source converter, pulse width modulation converter, basic concept of current source Converters, and comparison of current source converters with voltage source converters. Static shunt compensation: Objectives of shunt compensation, mid point voltage regulation voltage instability prevention, improvement of transient stability, Power oscillation damping.

UNIT- III

Methods of controllable Var generation, variable impedance type static Var generators switching converter type Var generators hybrid Var generators. SVC and STATCOM: The regulation and slope transfer function and dynamic performance, transient stability enhancement and power oscillation damping operating point control and summary of compensator control.

UNIT- IV

Static Series Compensators: concept of series capacitive compensation, improvement of transient stability, power oscillation damping. Functional requirements, GTO thyristor controlled series capacitors (GSC), thyristor switched series capacitor (TSSC).and thyristor controlled series capacitor (TCSC) control schemes for GSC TSSC and TCSC.

Text Book:

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

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M.Tech II Semester (PE)	L	T	P	[C]
	4	0	0	[4]

(13PE202) HVDC TRANSMISSION

Unit-I

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

Unit-II

Harmonics in HVDC systems, harmonicas elimination, AC & DC filter Control of HVDC converter and systems: constant current, constant extinction angle and constant ignition angle control. Individual phase control and equidistant firing angle control, DC power flow control.

Unit-III

Interaction between HVAC & DC systems –voltage interaction, harmonic instability problems and DC power modulation. Multi-terminal DC link and systems; series, parallel and series parallel systems, their operation and control.

Unit-IV

Transient over voltage in HVDC systems: Over voltages due to disturbance on DC side, over voltages due to DC and AC side line faults. Converter faults and protection in HVDC systems: Converter faults, over current protection- valve group and DC line protection. Over voltage protection of converters, surge arresters.

Reference Books:

1. E.W.Kimbark: Direct current Transmission, Wiely inter Science- New York.1971.
2. J.Arillaga: H.V.D.C.Tranmission peter peregrilnus ltd., London UK 1983.
3. K.R.Padiyar: High Voltage Direct current Transmission, Wiely Eastern Ltd.1990.
4. E.Uhlman: Power Transmission by Direct Current Springer Verlag, Berlin.1975.

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M.Tech II Semester (PE)

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(13PE203) POWER ELECTRONIC CONTROL OF AC DRIVES

UNIT-I

Introduction to AC Drives: Introduction to motor drives-torque production- Equivalent circuit analysis-Speed-Torque characteristics with variable voltage operation, variable frequency operation, constant v/f operation-Induction motor characteristics in constant torque and field weakening regions.

Control of Induction Motor Drives at Stator side: Scalar control-Voltage fed inverter control-Open loop volts/Hz Control-Speed control slip regulation- Speed control with torque and flux control-Current controlled voltage fed inverter drive-Current fed inverter control-Independent current and frequency control-Speed and flux control in current fed inverter drive-Volts/Hertz Control current fed-Inverter drive-Efficiency optimization control by flux program.

UNIT-II

Control of Induction Motor at Rotor Side: Slip power recovery drives-Static Kramer Drive-Phasor diagram-Torque expression-Speed control of Kramer Drive-Static Scheribus Drive- Modes of operation.

Vector Control of Induction Motor Drives: Principles of Vector Control-Vector Control Methods-Direct method of Vector control-Adaptive control principles-Self tuning regulator-Model referencing control.

UNIT-III

Control of Synchronous Motor Drives: Synchronous motor and its characteristics – control strategies – constant torque angle control- Unity power factor control-Constant mutual flux linkage control

Controllers: Flux weakening operation- Maximum speed-Direct flux weakening algorithm – Constant torque mode controller- Flux Weakening controller- Indirect flux weakening – Maximum permissible torque-Speed control scheme- Implementation strategy – Speed controller design.

UNIT-IV

Variable Reluctance Motor Drive: Variable reluctance motor drives- Torque Production in the variable reluctance motor- Drive characteristics and control principles- Current control variable reluctance servo drive.

Brushless DC motor Drives: Three phase full wave Brushless dc motor – Sinusoidal type of Brushless dc motor-Current controlled Brushless dc servo drives.

Text Books:

1. R.Krishnan, Electric Motor Drives modeling, analysis and control Pearson Publication, 1/e -2002.
2. B.K Bose- Modern Power Electronics and AC drives Pearson Publication -1ST Edition.2002.
3. MD Murphy & FG Turn Bull, Power Electronic Control of AC motors Pergman Press (For Chapters II, III, V) – 1st Edition.
4. B.K Bose, Power Electronics and AC drives Prentice Hall Publication -1ST Edition.2002.
5. Power Electronics Circuits, Devices and Application- M.H Rashid –PHI 1995.
6. GK Dubey, Fundamentals of Electric Drives Narora Publications -1995.
7. B.K.Bose, Power Electronics and Variable Frequency drives IEEE press-Standard publication-1st Edition-2002.

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M.Tech II Semester (PE)

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(13PE204) ADVANCED POWER SEMICONDUCTOR DEVICES & PROTECTION

UNIT-I

BJTS: Introduction- vertical power transistor structures-I-V characteristics-physics of BJT operation switching characteristics-break down voltages-second break down-on-state losses-safe operation areas design of drive circuits for BJTs-snubber circuits for BJTs and darlingtons. Power MOSFETs Introduction-basic structures-I-V characteristics-physics of device operation-switching characteristics-operation limitations and safe operating areas-design of gate drive circuits-snubber circuits.

UNIT-II

Gate Turn-Off Thyristors: Introduction-basic structures-I-V characteristics-physics of device operation-GTO switching characteristics-snubber circuits-over protection of GTOs.

Insulated Gate Bipolar Transistors: Introduction-basic structures-I-V characteristics-physics of device operation-Latch in IGBT switching Characteristics-Device limits and safe operating areas-drive and snubber circuits.

UNIT-III

Emerging Devices and Circuits: Introduction-Power junction field effect transistors-field controlled Thyristor-JFET based devices versus other power devices-MOS controlled Thyristors-high voltage integrated circuits-new semiconductor materials

Passive Components and Electromagnetic compatibility: Introduction-design of inductor-transformer design-selection of capacitors-resistors current measurements-heat sinking circuit lay out –Electromagnetic Interference (EMI)-Sources of EMI Electromagnetic Interference in Power Electronic Equipment.

UNIT IV

Noise: Noise sources in SMPS-Diode Storage Charge Noise-Noise generated due to switching-Common noises sources in SMPS-Noises Due to High frequency transformer-How the conducted noise is measured - minimizing EMI-EMI shielding-EMI standards.

Protection of Devices & Circuits: Cooling & Heat sinks – Thermal modeling of power switching devices- snubber circuits – Reverse recovery transients – Supply and load side transients – voltage protections – current protections.

Text Books:

1. Md.H.Rashid, Power Electronics Circuits, Devices and Applications PHI.2013.
2. Mohan and Undeland, Power Electronics –Converters, Applications and Design John Wiley&Sons.1995.
3. W.C. Lander, Power Electronics Circuits. McGraw-Hill international UK limited, 1993

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M.Tech II Semester (PE)

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(13PE205) RENEWABLE ENERGY SYSTEMS

UNIT-I

Introduction: Energy Economics; Simple pay back period, Internal (simple) arte of return, Net present valve, Internal rate of return (IRR), NPV and IRR with Fuel Escalation.

Solar resource: Solar spectrum, Altitude angle of sun at solar noon, solar position at any time of day, solar time, sun rise and sunset, solar radiation-direct beam, diffuse radiation, reflected radiation, and radiation measurements.

Semiconductor physics: Band gap energy, Solar spectrum, Band gap impact on Photo voltaic efficiency, P-n junction diode.

UNIT – II

Photo Voltaics: Generic photo voltaic cell- Simple equivalent circuits, accurate equivalent circuit, Cells to modules to arrays, I-V curve under STC, Impacts of temperature & insolation on I-V curves, Shading impacts on I-V curves, Crystalline silicon technologies, thin film photovoltaics.

Photovoltaic systems: Introduction to major Photovoltaic systems types, current-voltage curves for loads, Maximum power point trackers Grid connected systems- Interfacing with utility, DC and AC rated power, Peaks hours approach to estimate PV performance, Grid connected system sizing Stand alone PV systems- Load estimation, Batteries- storage capacity, Sizing, Coulomb efficiency instead of energy, Blocking diodes, Sizing of PV array, Stand alone system design PV powered water pumping- Hydraulic system curves, Hydraulic curves, Hydraulic system curve and pump curve, A simple directly coupled PV-pump design approach- numerical

UNIT – III

Wind and Tidal Power: Wind power-Wind power- Historical development, types of wind turbines, power in wind, Temperature and altitude correction, Impact of tower height, Maximum rotor efficiency, wind turbine generators, Average power in the wind, wind turbine- Aerodynamics.

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

UNIT – IV

Fuel Cells & Wave Energy: Fuel Cells – Historical Development, Basic Operation of Fuel cells, Fuel cell Thermodynamics: Enthalpy, Entropy and theoretical efficiency of Fuel Cells, Gibbs free energy and Fuel cell efficiency, Electrical output of an ideal cell electrical characteristics.

Wave energy conversion: Wave power calculation, Properties of waves and power content, vertex motion of Waves, device applications. Types of ocean thermal energy conversion systems Application of OTEC systems examples.

Text Books:

1. Renewable and Efficient Electric Power systems: Gilbert M. Masters, John Wiley & Sons, Inc., Publication.2013.
2. Renewable Energy Sources and Emerging Technologies, D.P. Kothari, K. C. Singal, Rakesh Ranjan, Kothari D.P., singal K. C., ranjan Rakesh.2011.

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M.Tech II Semester (PE)

L	T	P	[C]
4	0	0	[4]

(13PE206) PROGRAMMABLE LOGIC CONTROLLERS
(Elective-II)

UNIT- I

PLC Basics: PLC system, I/O modules and interfacing, CPU processor, programming equipment, programming formats, construction of PLC ladder diagrams, devices connected to I/O modules. PLC programming: Input instructions, Outputs, operational procedures, programming examples using contacts and coils, drill press operation.

UNIT- II

Digital logic gates, programming in the Boolean algebra system, conversion examples. Ladder diagrams for process control: Ladder diagrams and sequence listings, ladder diagram constructions and flow charts for spray process system. PLC registers: characteristics of registers module addressing, holding registers, Input registers, Output registers.

UNIT- III

PLC Functions: Timer functions and industrial applications, counters, counter function industrial applications, arithmetic functions, number comparison.

Data Handling Functions: SKIP, master control relay, jump, move, FIFO, FAL, ONS, CLR and SWEEP functions and their applications.

UNIT-IV

Bit pattern and changing a bit shift register, sequence functions and applications, controlling of two axis and three axis robots with PLC, matrix functions. Analog PLC operation : Analog modules and systems, analog signal processing, multi bit data processing, analog output application examples, PID principles, position indicator with PID control, PID modules, PID tuning, PID functions.

Reference Books:

1. John W.Webb and Ronald A.Reiss, Programmable logic controllers-Principle and applications fifth Edition, PHI.2003.
2. JR Hackworth and F.D Hackworth Jr. - Programmable logic controllers- Programming Method and Applications Pearson, 2004.

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M.Tech II Semester (PE)

L	T	P	[C]
4	0	0	[4]

(13PE207) ENERGY AUDITING, CONSERVATION AND MANAGEMENT
(Elective-II)

UNIT- I

Basic Principles of Energy Audit: Energy audit- definitions, concept , types of audit, energy index, cost index ,pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit.

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

UNIT- II

Energy Efficient Motors: Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics - variable speed, variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit.

Power Factor Improvement: Lighting Power factor – methods of improvement, location of capacitors, p.f with non linear loads, effect of harmonics on p.f. , p.f motor controllers - Good lighting system design and practice , lighting control ,lighting energy audit.

UNIT- III

Energy Instruments: Energy Instruments watt meter, data loggers, thermocouples, pyrometers, lux meters, tongue testers, application of PLC's

Economic Aspects and Analysis: Economics Analysis-Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis - Energy efficient motors.

UNIT-IV

Computation of Economic Aspects: Calculation of simple payback method , net present worth method - Power factor correction, lighting - Applications of life cycle costing analysis, return on investment.

Reference Books:

1) W.R. Murphy & G. McKay Butter worth, Energy management, Heinemann publications.1992.
2) Paul o' Callaghan, Energy management, Mc-Graw Hill Book company-1st edition, 1998.
3) John C. Andreas &Marcel Dekker Energy efficient electric motors, Inc Ltd-2/e, 1995.
4) W.C.Turner, john Wiley and sons, Energy management hand book.2007.
5) Fuel efficiency- booklet12, Energy management and good lighting practice: -EEO.

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M.Tech II Semester (PE)

L	T	P	[C]
4	0	0	[4]

(13PE208) REACTIVE POWER COMPENSATION AND MANAGEMENT
(Elective-II)

UNIT- I

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

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

UNIT- II

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

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

UNIT-III

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

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

UNIT-IV

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

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

Reference Books:

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

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M.Tech II Semester (PE)

L	T	P	[C]
4	0	0	[4]

(13PE212) DIGITAL CONTROL SYSTEMS
(Elective-II)

UNIT- I

Introduction: Advantages of Digital control systems - Practical aspects of the choice of sampling rate and multirate sampling - Basic discrete time signals - Quantization – Sampling theorem - Data conversion and Quantization - Sampling process - Mathematical modeling - Data reconstruction and filtering of sampled signals – zero - order hold. z - transform and inverse z - transform, Relationship between s - plane and z - plane – Difference equation - Solution by recursion and z - transform - pulse transfer functions of the zero - order Hold and relationship between G(s) and G(z)– Bilinear transformation.

UNIT- II

Digital control systems - Pulse transfer function - z transform analysis of open loop, closed loop systems - Modified z Transform - transfer function - Stability of linear digital control systems - Stability tests. Root loci - Frequency domain analysis - Bode plots - Gain margin and phase margin - Design of Digital Control Systems based on Root Locus Technique.

UNIT- III

Cascade and feedback compensation by continuous data controllers - Digital controllers - Design using bilinear transformation - Realization of Digital PID controllers. State equations of discrete data systems, solution of discrete state equations, State transition Matrix: z -transform method. Relation between state equations and transfer functions.

UNIT- IV

Concepts on Controllability and Observability - Digital state observer: Design of the full order and reduced order state observer - Pole placement design by state feed back. Design of Dead beat Controller - some case studies - Stability analysis of discrete time systems based on Lyapunov approach.

Reference Books:

1. K. Ogata, Discrete Time Control Systems, PHI/Addison - Wesley Longman Pvt. Ltd., India, Delhi, 1995.
2. B.C Kuo, Digital Control Systems, 2nd Edition, Oxford Univ Press, Inc., 1992.
3. F. Franklin, J.D. Powell, and M.L. Workman, Digital control of Dynamic Systems, Addison - Wesley Longman, Inc., Menlo Park, CA , 1998.
4. Gopal, Digital Control and State Variable Methods, Tata McGraw Hill, India, 1997.
5. C. H. Houpis and G.B. Lamont, Digital Control Systems, McGraw Hill, 1985.
6. John S. Baey, Fundamentals of Linear State Space Systems, Mc. Graw – Hill, 1st edition.

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M.Tech II Semester (PE)

L	T	P	[C]
0	0	3	[2]

(13PE209) RENEWABLE ENERGY SYSTEMS LAB

1. The I-V and P-V characteristics of two modules in series and parallel.
2. Plot charging and discharging characteristics of battery.
3. Perform the experiment of manually finding the MPP by varying the resistive load across the PV panel.
4. Perform the experiment of finding the MPP by varying the duty cycle of DC-DC converter.
5. Observation of current for linear & nonlinear loads and voltage waveform at PCC.
6. Synchronization of grid tied inverter, observation of current waveform and calculations for distortion, displacement and power factor of grid tied inverter
7. Evaluation of the active, reactive power and net energy flow between grid tied inverter, artificial grid & load.
8. MPPT Algorithm for SOLAR PV Panel Testing.
9. P, V and F measurement of output of wind generator.
10. Impact of load and wind speed on power output and its quality.
11. Performance of Frequency drop characteristic of induction generator at different loading conditions.
12. Design of DC –DC Converter for different types of variable DC Loads trough SIMULINK/MATLAB.
13.Design of DC –AC Converter for different types of variable AC Loads trough SIMULINK/MATLAB.

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M.Tech II Semester (PE)	L	T	P	[C]
	0	0	3	[2]

(13PE210) SIMULATION LAB-II

List of Experiments

1. Simulation of firing schemes: Ramp, Cosine, PWM.

2. Simulation of Single phase fully controlled converter with R and R-L load using MATLAB/PSIM.

3. Simulation of Three phase fully controlled converter with R and R-L load using MATLAB/PSIM.

4. Simulation of Three phase AC Voltage controller with R and R-L Load using MATLAB/PSIM.

5. Simulation of three phase inverter in 120^0 conduction mode load connected both in star & delta

6. Simulation of three phase inverter in 180^0 conduction mode load connected both in star & delta

7. Simulation of step-down & step-up choppers

8. Simulation of buck & boost converter

9. Simulation of cuk converter

10. Simulation of Z-source inverter

11. Simulation of Single phase Cycloconverter

12. PWM pulse generation through MATLAB program

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	0	0	0	[2]

(13PE211) TERM PAPER

The Term Paper is a precursor to the project work done in the 2nd year M.Tech Programme. The paper may be of 8-10 (A4 size) in length and follows the standard IEEE/Technical Journal Format.

The Term Paper helps to supplement the second year Project Work of the M.Techstudents. It helps to identify their Reserch area/topic and complete the groundwork andpreliminary research required for it comfortably. It trains the students to make use of Research Tools and Material available both in print and digital formats.

Based on the topic, a hypothesis is to be made by the student, under the supervision of the guide. The student is then required to collect literature and support information for his / her term paper from Standard Reference Books, Journals, and Magazines - both printed and online. Each student should refer to a minimum of 6 reference sources related to the topic. The student also presents his/her paper with the help of Power Point slides / OHP.

The Term Paper contains: The Aim and Objective of the study, The need for Rationale behind the study, Identify the work already done in the field, Hypothesis and Discussion, Conclusion Appendix with support data (Illustrations, Tables, Graphs, etc.).

Page Limit: minimum of eight pages.

Date of evaluation: During the Lab Internal Exam.

Method of Evaluation**:** Total 50 marks

1. Day to day work - 10 marks
2. Term Paper Report - 20 marks
3. Seminar - 20 marks

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M.Tech III & IV Semesters (PE)	L	T	P	[C]
	0	0	0	[2]

(13PE401) SEMINAR-II

Objectives: To get involved with the latest advancements and developments to enhance communication and presentation skills, exchange of ideas, greater connectivity to develop a research bent of mind.

For the seminar, the student shall collect the information on a specialized relevant topic and prepare a report, showing his understanding over the topic, and submit the same to the department, which shall be evaluated by the Department Committee consisting of Head of the department, Seminar Supervisor and a Senior Faculty Member. Each Seminar shall be evaluated for 50 marks (10 marks for report, 10 marks for subject content, 20 marks for presentation and 10 marks for queries).

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M.Tech III & IV Semesters (PE)	L	T	P	[C]
	0	0	0	[16]

(13PE402) PROJECT WORK

Students are required to take up a project work, in which the student can choose any specific problem of Industry or Industry based project work. Alternatively it can be secondary source based or Field based project work. Before the commencement of the project work each student is required to submit a synopsis indicating the objectives, Methodology, Framework for analysis, Action plan with milestones in order to have clarity for the subsequent work. The project should have an internal faculty as guide. The student can initiate the project work in the penultimate semester of the course.