ACADEMIC REGULATIONS

M.Tech Programmes

Regulation: R16

Applicable for the students admitted from the Academic year 2016-17 onwards

ASCET
AUDISANKARA Originating the Bright Careers

AUDISANKARA
COLLEGE OF ENGINEERING & TECHNOLOGY
An Autonomous Institute Affiliated to JNTUA, Ananthapuram & Accredited by NAAC with 'A' Grade

NH5 Bypass Road, Gudur, SPSR Nellore (Dt.)

www.audisankara.ac.in

REGULATIONS FOR M. TECH TWO YEAR REGULAR COURSES

R 1.0 Eligibility for Admission:

The admissions for category A and B seats shall be as per the guidelines of APSCHE in consonance with government reservation policy.

a) Under Category A: 70% of the seats are filled based on GATE/PGCET ranks.

b) Under Category B: 30% seats are filled on merit basis as per guidelines of APSCHE.

R 2.0 Semester wise Course Beak-up:

Sem	Theory	Lab	Total Credits
1st	6	2+ Technical Seminar	24
2nd	6	2+ Term Paper + Comprehensive Vive	26
3rd	7	Internship + Project Work	4 + 0
4th	4	Project Work	20
Total	23	5+Internship+ Project Work	74

R 2.1 Course wise break-up for the total credits:

Total Theory Courses : 23 @ 3 credits each = 69
Total Laboratory Courses : 5 @ 2 credits each = 15
Technical Seminar : 1 @ 2 credits = 2
Term Paper : 1 @ 2 credits = 2
Internship : 1 @ 2 credits = 2
Compre. Vive-Voce : 1 @ 2 credits = 2
Project work : 1 @ 20 credits =20

R 3.0 Division of marks for Internal and External assessment:

Course	Marks of Continuous Assessment	Marks of External Assessment	Maximum Marks
Theory	40	60	100
Labs	25	50	75
Term Paper	25	50	75
Comprehensive Viva-Voce	--	75	75
Internship	25	50	75
Project work	Grade	Grade	

R 4.0 Evaluation Methodology:

R 4.1 Theory Course:

Each theory course will be evaluated for a total of 100 marks, consisting of 40 marks for Continuous assessment and 60 marks for semester end examination. Following is the scheme for continuous assessment:

Scheme for Continuous Assessment:

Assessment Component	Marks	Schedule	Final Marks
Assignment Test#1 (AT#1)	5	After and on Unit#1	80% of first best SE + 20% of second best SE (30M) + AT#1 (5M) + AT#2 (5M)
Sessional Exam#1 (SE#1)	30	At the end of Unit#1 & 2	
Assignment Test#2 (AT#2)	5	After and on Unit#3	
Sessional Exam#2 (SE#2)	30	At the end of Unit#3 & 4	

4..1 (a) Scheme for SE Marks:

Two Sessional examinations (SE) each for 30 marks with the duration of 90 minutes each will be conducted for every theory course in a semester. The SE marks shall be awarded giving a weightage of 80% in the SE in which the student scores more marks and 20% in the remaining SE.

4.1 (b) Scheme for Assignment Test Marks:

Assignment test#1 shall be conducted for 5M at the end of Unit#1 covering the syllabus of unit#1. Assignment test#2 shall be conducted for 5M at the end of Unit#3 covering the syllabus of unit#3. Questions for Assignment test shall address the topics covered/ extension of the covered topics/Case Studies.

R 4.2 Laboratory Course:

a) Each lab will be evaluated for a total of 75 marks consisting of 25 marks for continuous assessment and 50 marks for semester end lab examination. Out of 25 marks of internal assessment, continuous lab assessment will be done for 15 marks for the day to day performance and 10 marks for the final internal lab assessment. The semester end lab examination for 50 marks shall be conducted by two Examiners, one of them being laboratory class Teacher as internal examiner and an external examiner nominated by the Principal from the panel of experts recommended by HOD.

R 4.3 Technical Seminar

Technical Seminar shall be conducted in 1st semester. The distribution of internal marks for component of Technical seminar is given below:

Table 5: Distribution of Marks for component of Technical seminar

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

A Technical Seminar shall have two components, one chosen by the student from the course work as an extension and approved by the faculty supervisor. The other component is suggested by the supervisor and can be a reproduction of the concept in any standard research paper or an extension of concept from earlier course work. A hard copy of the information on seminar topic in the form of a report is to be submitted for evaluation along with presentation. The presentation of the seminar topics shall be made before a committee consisting of Head of the department, seminar supervisor and a senior faculty member. Each Technical Seminar shall be evaluated for 100 marks. Technical Seminar component-I for 50 marks and component-II for 50 marks making total 100 marks. (**Distribution of marks for 50:** 10 marks for report, 10 marks for subject content, 20 marks for presentation and 10 marks for queries).

R 5.3 Term Paper

The Term Paper is a self study report and shall be carried during 2nd semester along with other lab courses. Every student will take up this term paper individually and submit a report. The scope of the term paper could be an exhaustive literature review choosing any engineering concept with reference to a standard research papers or an extension of the concept of earlier course work in consultation with the term paper supervisor. The term paper reports submitted by the individual students during the second semester will be evaluated for a total of 75 marks consisting of 25 marks for internal assessment and 50 marks for semester end examination. Internal assessment shall be done by the term paper supervisor. Semester end examination for 50 marks shall be conducted by two examiners, one of them being term paper supervisor as internal examiner and an external Examiner nominated by the Principal from the panel of experts recommended by HOD.

R 5.4 Comprehensive Viva-Voce

All the students shall face a Comprehensive viva-voce covering the total courses of first and second semesters. The comprehensive viva-voce will be conducted along with 2nd semester lab examination for 75 marks by a committee consisting of Head of the Department, two senior faculty members nominated by the Head of the Department.

R 4.3 Internship

All the students shall undergo the summer internship during summer break after 2nd semester. The minimum internship period is eight weeks and the students have an option of choosing their own industry/area of interest, which may be related to their respective branch or any other service oriented task. A self study report for the internship shall be submitted and evaluated during the 3rd semester and will be evaluated for a total of 75 marks consisting of 25 marks for internal assessment and 50 marks for semester end examination. Internal assessment shall be done by the internship supervisor. Semester end examination for 50 marks shall be conducted by two examiners, one of them being internship supervisor as internal examiner and an external examiner nominated by the Principal from the panel of experts recommended by HOD.

R 4.6 Project Work

All the students shall take up a project work during 3rd and 4th semesters which carries a total of 20 credits. Every candidate shall be required to submit thesis or dissertation after completion of satisfactory work on a topic approved by the Project Review Committee.

a) A Project Review Committee (PRC) shall be constituted with the Dean (R&D), Head of the Department and one senior faculty member of the department apart from the Project Supervisor.
b) Registration of Project Work: A student is permitted to register for the project work in the beginning of the third semester after satisfying all the academic requirements.
c) A student has to submit the title, objective and plan of action of his project work in consultation with his project supervisor to the Project Review Committee (PRC) for its approval. After obtaining the approval of the Committee the student can initiate the Project work from the beginning of the third semester.
d) The project work initiated during the third semester shall be completed in duration of 10 months and its progress will be reviewed from time to time by the PRC.

e) Progress of the project work shall be reviewed in the 3rd semester tor two times for satisfactory performance of the student for zero credits. 20 credits shall be awarded based on the successful submission and approval of thesis at the end of the 4th semester.

f) On the completion of the project work the candidate shall submit the draft copy of thesis to the Head of the Department for the approval of PRC and shall make an oral presentation.

g) After the final approval by PRC, four copies of the Project Thesis certified by the supervisor shall be submitted to the Department.

h) Students are allowed to submit the project work/ thesis if s/he clears all the first and second semester courses.

i) The thesis shall be evaluated by one examiner selected by the Principal/Chief Controller of examinations from a panel of 5 examiners, who are eminent in the field and nominated by the concerned guide and Head of the department.

j) The following weightage are given for the continuous assessment as well as for the final evaluation of the project work:

i) Weightage for Supervisor evaluation	-	40 %
ii) Weightage for PRC evaluation	-	10%
iii) Weightage for External evaluation	-	50%

R5.0 Attendance Requirements:

a) It is desirable for a candidate to put on 100% attendance in all the subjects. However, a candidate shall be permitted to appear for the semester end examination provided s/he maintains a minimum of 75% overall attendance in the semester.

b) The shortage of attendance on medical grounds can be condoned to an extent of 10% provided a medical certificate is submitted to the Head of the Department when the candidate reports back to the classes immediately after the leave. Certificates submitted afterwards shall not be entertained. Condonation fee as fixed by the college for those who put on attendance between ≥ 65% and <75% shall be charged before the end examinations. Attendance may also be condoned as per the State Government rules for those who participate in sports, co-curricular and extra-curricular activities provided their attendance is in the minimum prescribed limits for the purpose and recommended by the concerned authority.

c) In case of the students having over all attendance less than 65% after condonation shall be declared detained and has to repeat semester again.

R 6.0 Promotion Policies:

a) A student shall be promoted to subsequent semester only if s/he fulfills the attendance requirement. In case a student fails to fulfill the attendance requirement, s/he has to repeat the semester in the next academic year.

b) A Student will be promoted from 2nd semester to 3rd semester if s/he fulfills the academic requirements and earning of minimum of 50% credits up to 2nd semester.

R 6.1 Scheme for the award of Grade

a) A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each theory course, if s/he secures

   i. Not less than 40% marks for each theory course in the semester end exam, and

   ii. A minimum of 40% marks for each theory course considering both internal and semester end examination.

   i. A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each Lab/ Technical Seminar/Term Paper/Comprehensive Viva/Internship/Project, if s/he secures not less than 50% marks for each Lab/ Term Paper/Mini Project/ Project course in the semester end exam,
   and

   ii. A minimum of 50% marks for each Lab/ Technical Seminar/Term Paper/Comprehensive Viva/Internship/Project course considering both internal and semester end examination.

R 6.2 Graduation requirements:

The following academic requirements shall be met for the award of the MCA. Degree.

a) Student shall register and acquire minimum attendance in all courses and secure 74 credits. However, the CGPA obtained for the best 71 credits shall be considered for the award of Grade/Class/Division.

b) A student of a regular program who fails to earn 91 credits within four consecutive academic years from the year of his/her admission with a minimum CGPA of 4.0 shall forfeit his/her degree and his/her admission stands cancelled.

R 6.3 Award of Degree:

a) Classification of degree will be as follows:

1. CGPA ≥ 7.5 : First Class with Distinction
2. CGPA ≥6.5 and < 7.5 : Degree with First Class
3. CGPA ≥5.5 and < 6.5 : Degree with Second Class
4. CGPA ≥4.0 and < 5.5 : Degree with Pass Class

b) Degree with Distinction will be awarded to those students who clear all the subjects in single attempt and secure a CGPA ≥ 8.0 during his/her regular course of study.

c) In case a student takes more than one attempt in clearing a course, the final marks secured shall be indicated by * mark in the marks memo.

All the candidates who register for the semester end examination will be issued memorandum of grades by the Institute. Apart from the semester wise marks memos, the institute will issue the provisional certificate subject to the fulfillment of all the academic requirements.

R7.0 Re-Admission Criteria:

A Candidate, who is detained in a year/semester due to lack of attendance/credits, 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.

R8.0 Conduct & Discipline:-

(a) Students shall conduct themselves within and outside the premises of the Institute in a descent and dignified manner befitting the students of Audisankara College of Engineering & Technology.

(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.

R9.0 Transitory Regulations:

A student, who is detained or discontinued in the year/semester, on readmission shall be required to do all the courses in the curriculum prescribed for such batch of students in which the student joins subsequently.

R9.1 A student who is following the JNTUA, Anantapur curriculum/R13 regulations, detained due to lack of credits/ attendance at the end of the any semester of any year, shall join the forthcoming autonomous/ R13 batch (es) (which ever applicable) after fulfilling the requirements. Such students will study all the courses prescribed for that batch, in which the student joins. The student has to clear all backlog subjects if any by appearing in the supplementary examinations of JNTUA/R13 for the award of degree. The class will be awarded based on the academic performance of a student. Such candidates will be considered on par with R13 stream and will be governed by the regulations applicable.

R9.2 A student who is following the JNTUA, Anantapur curriculum/R13, detained due to lack of credits/ attendance at the end of any semester, shall join the autonomous batch at the appropriate semester. Such candidates shall be required to pass in all the courses in the Programme prescribed by concerned BoS for such batch of students, to be eligible for the award of degree. However, exemption will be given in all those courses of the semester(s) of the batch, which the candidate joins now, which he had passed earlier. The student has to clear all his backlog subjects by appearing in the supplementary examinations, conducted by JNTUA, Anantapur and College (Autonomous Stream) for the Award of Degree. The class will be awarded based on the academic performance of a student in the JNTUA Pattern and academic regulations of JNTUA will be followed.

General:

a) s/he represents "she" and "he" both
b) Where the words 'he', 'him', 'his', occur, they imply 'she', 'her', 'hers' also.
c) The academic regulations should be read as a whole for the purpose of any interpretation.
d) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman, Academic Council will be final.

The college may change or amend the academic regulations or syllabi from time to time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the institute.

Course Structure for M.Tech (Power Electronics) Regular Programme

Applicable for students admitted from 2016-17 Academic Year

M.Tech 1st Semester – Power Electronics

S.No	Code	Course	L	P	C
1	16PE1101	Modern Control Theory	3	0	3
2	16PE1102	Principles of Machine Modeling Analysis	3	0	3
3	16PE1103	Analysis of Power Electronic Converters	3	0	3
4	16PE1104	Power Electronic Control of DC Drives	3	0	3
5	16PE1105	Advanced Power Electronics	3	0	3
6	**ELECTIVE-I**				
	16PE1106	Advanced Digital Signal Processing	3	0	3
	16PE1107	Advanced Power Semiconductor Devices and Protection			
	16PE1108	Advanced Microprocessors and Microcontrollers			
7	16PE2109	Power Convertors Lab	0	3	2
8	16PE2110	Simulation Lab-I	0	3	2
9	16PE2111	Technical Seminar	2	0	2
		TOTAL	**20**	**6**	**24**

M.Tech 2nd Semester – Power Electronics

S.No	Code	Course	L	P	C
1	16PE1201	Flexible AC Transmission Systems	3	0	3
2	16PE1202	Applications of AI Techniques	3	0	3
3	16PE1203	Power Electronic Control of AC Drives	3	0	3
4	16PE1204	HVDC Transmissions	3	0	3
5	16PE1205	Renewable Energy Systems	3	0	3
6	**ELECTIVE-II**				
	16PE1206	Programmable Logic Controllers	3	0	3
	16PE1207	Energy Auditing, Conversation and Management			
	16PE1208	Reactive Power Compensation and Management			
7	16PE1209	Renewable Energy Systems Lab	0	3	2
8	16PE2210	Simulation Lab-II	0	3	2
9	16PE2211	Term Paper	2	0	2
10	16PE2212	Comprehensive Viva-Voce	0	0	2
		TOTAL	**20**	**6**	**26**

M.Tech 3rd Semester – Power Electronics

S.No	Code	Course	L	P	C
1	16PE2301	Internship + Project Work	0	0	4
		TOTAL	**0**	**0**	**4**

M.Tech 4th Semester – Power Electronics

S.No	Code	Course	L	P	C
1	16PE2401	Project Work	0	0	20
		TOTAL	**0**	**0**	**20**

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M.Tech 1st Semester –PE

L	T	P	C
3	0	0	3

16PE1101 MODERN CONTROL THEORY

COURSE OUTCOMES:

At the end of the course students able to

1 Develop mathematical models of dynamic physical systems.
2 Design optimal controllers for physical systems including power electronic and power systems.
3 Determine the stability of linear and nonlinear control systems.
4 Linearize a given nonlinear system

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.
3 Kuo, Digital Control Engineering, Oxford University.1980.

REFERENCE BOOKS:

1 Stainslaw H. Zak "Systems and Control", Oxford Press, 2003.
2 I.J. Nagarath and M.Gopal "Control Systems Engineering", New Age International (P) Ltd.

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M.Tech 1st Semester –PE

L	T	P	C
3	0	0	3

16PE1102 PRINCIPLES OF MACHINE MODELING AND ANALYSIS

COURSE OUTCOMES:

At the end of the course students able to

1. Develop models for linear and nonlinear magnetic circuits
2. Determine the developed torque in an electrical machine using the concepts of field Energy and co-energy and determine the dynamic model of a DC machine
3. Determine the dynamic model of an induction machine based on the dq0 Transformation and determine instantaneous torque developed in an induction Machine- which leads to advanced control strategies such as vector control and direct torque control
4. Determine the torque developed in a salient pole synchronous machine using the Park's transformation and identify contribution of saliency torque- damping torque and excitation torque

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.

REFERENCE 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 (AUTONOMOUS)

M.Tech 1st Semester –PE

L	T	P	C
3	0	0	3

16PE1103 ANALYSIS OF POWER ELECTRONIC CONVERTERS

COURSE OUTCOMES:

At the end of the course students able to

1 Analyze the Power Electronic Application requirements.
2 Identify suitable power converter from the available configurations
3 Develop improved power converters for any stringent application requirements.
4 Improvise the existing control techniques to suit the application

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 3rdEdition, 2004
2 N.Mohan, Tore.M.Undeland, W.P.Robbins, Power Electronics –John Wiley, -2ndEdition. 1989

REFERENCE BOOKS:

1 P.S.Bimbhra “Power Electronics”, Khanna publishers-(2004),
2 M.D.Singh and K.B.Khanchandani, Power Electronics TMH-2002.

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M.Tech 1st Semester –PE

L	T	P	C
3	0	0	3

16PE1104 POWER ELECTRONIC CONTROL OF DC DRIVES

COURSE OUTCOMES:

At the end of the course students able to

1. Specify the appropriate power circuit configuration amongst the phase controlled rectifiers and choppers for the speed control of DC motor drives for four-quadrant operation.
2. Analyze closed loop operation of DC motor drives and simulation of DC motor 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 Freewheeling 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.

REFERENCE BOOKS:

1 Md.H.Rashid, Power Electronic Circuits, Devices and Applications –PHI, I Edn2004.
2 G. K. Dubey, Fundamentals of Electric Drives – Narosa Publications – 1995.

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M.Tech 1st Semester –PE

L	T	P	C
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16PE1105 ADVANCED POWER ELECTRONICS

COURSE OUTCOMES:

At the end of the course students able to

1. Select an appropriate power semiconductor device and design a power converter for the required application
2. Determine the power circuit configuration needed to fulfill the required power conversion with applicable constraints.
3. Design the control circuit and the power circuit for a given power converter
4. Determine the drive circuit requirements in terms of electrical isolation and the requirement of bipolar drive and ease of control

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.

REFERENCE BOOKS:

1 P.C Sen, Power Electronics, Tata McGraw-Hill Education, 1987.
2 Advanced Power Electronics, Euzelidodsantos, Edison R.dasilva, wiley-IEEE press, Nov 2014.

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16PE1106 ADVANCED DIGITAL SIGNAL PROCESSING

COURSE OUTCOMES:

At the end of the course students able to

1 Understand basic concepts in signals and systems.
2 Gain knowledge on the related mathematical tools in signal processing.
3 Design and analyze digital filters for power applications.

UNIT-I

Short 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- Transform: 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 Polyphone 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.

REFERENCE BOOKS:

1 M. Mondal and A.Asif, Continuous and Discrete Time Signals and Systems Cambridge, 2007.
2 Li Tan, Digital Signal Processing- Fundamentals and Applications Indian reprint, Elsevier, 2008.

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16PE1107 ADVANCED POWER SEMICONDUCTOR DEVICES AND PROTECTION

COURSE OUTCOMES:

At the end of the course students able to

1 Understand the characteristics of different power semiconductor devices such as BJT, IGBT.
2 Apply different protection methodologies for power electronics devices.

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 semi conductor 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.

REFERENCE BOOKS:

1 W.C. Lander, Power Electronics Circuits. McGraw-Hill international UK limited, 1993

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M.Tech 1st Semester –PE

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16PE1108 ADVANCED MICROPROCESSORS AND MICROCONTROLLERS

COURSE OUTCOMES:

At the end of the course students able to

1 Understand the generalized architecture of advanced microprocessors and advanced microcontrollers.
2 Develop algorithm/program of the advanced microcontrollers for a particular task.
3 Interface advanced microcontrollers with external peripherals.

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 boot loader – 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", McGraw Hill.Inc., 1995.
3 James L. Antonakos, "The Pentium Microprocessor", Pearson Education, 1997.
4 John .B.Peatman, "Design with PIC Microcontroller", Prentice Hall, 1997.

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16PE2109 POWER CONVERTERS LAB

COURSE OUTCOMES:

At the end of the course students able to

1 Critically compare various options available for the drive circuit requirements
2 Understand and apply the concept of controlling PMDC drives

LIST OF EXPERIMENTS

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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16PE2110 **SIMULATION LAB-I**

COURSE OUTCOMES:

At the end of the course students able to

1 Use modern software tools for power electronic simulation studies
2 Understand the operation of single phase rectifiers and ac voltage controllers circuits

LIST OF EXPERIMENTS

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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16PE2111 **TECHNICAL SEMINAR**

COURSE OUTCOMES:

At the end of the course students able to

1 Analyze and develop a thought process for presentation
2 Improve his language and communication skills
3 Be conversant with the latest developments in power systems

A Technical Seminar shall have two components, one chosen by the student from the course work as an extension and approved by the faculty supervisor. The other component is suggested by the supervisor and can be a reproduction of the concept in any standard research paper or an extension of concept from earlier course work. A hard copy of the information on seminar topic in the form of a report is to be submitted for evaluation along with presentation. The presentation of the seminar topics shall be made before a committee consisting of Head of the department, seminar supervisor and a senior faculty member. Each Technical Seminar shall be evaluated for 100 marks. Technical Seminar component-I for 50 marks and component-II for 50 marks making total 100 marks. (**Distribution of marks for 50:** 10 marks for report, 10 marks for subject content, 20 marks for presentation and 10 marks for queries).

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M.Tech 2nd Semester –PE

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16PE1201 FLEXIBLE AC TRANSMISSION SYSTEMS

COURSE OUTCOMES:

At the end of the course students able to

1 Understand the role of impedance control, phase angle control and voltage control in controlling real and reactive power in transmission systems
2 Identify configuration of FACTS controller required for a given application

UNIT-I

FACTS Concepts: Transmission interconnections power flow in an AC system, loading capability limits, Dynamic stability considerations, importance of controllable parameters basic types ofF ACTS 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, midpoint 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 BOOKS:

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

REFERENCE BOOKS:

1 "Understanding FACTS – Concepts and Technology of Flexible AC Transmission Systems" Narain G. Hingorani, Laszlo Gyugyi, Wiley India publications 2011

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16PE1202 APPLICATIONS OF AI TECHNIQUES

COURSE OUTCOMES:

At the end of the course students able to

1 Differentiate between Algorithmic based methods and knowledge based methods
2 Use the soft computing techniques for power system problems.
3 Use appropriate AI framework for solving power system problems.
4 Apply GA to power system optimization problems

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

Classical & Fuzzy Sets: Introduction to classical sets – properties, Operations and relations; Fuzzy sets, Membership, Uncertainity, Operations, Properties, fuzzy relations, cardinalities, membership functions.
Genetic algorithm and Particle swarm optimization.

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, economic load dispatch.
Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.

TEXT BOOKS:

1 Rajasekharan and Pai, Neural Networks, Fuzzy logic, Gnenetic algorithms: synthesis and applications – PHI Publication.2003
2 JacekM.Zurada, Introduction to Artificial Neural Systems Jaico Publishing House, 1997.

REFERENCE BOOKS:

1 N. Yadaiah and S. BapiRaju, Neural and Fuzzy Systems: Foundation, Architectures and Applications Pearson Education.2010.
2 BrokKosko, Neural Netwroks and Fuzzy Logic System PHI Publications
3 Timothy . J. Ross "Fuzzy logic for engineering applications",3rd edition , University of New Mexico, John Wiley & Sons Ltd, 2010.

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16PE1203 POWER ELECTRONIC CONTROL OF AC DRIVES

COURSE OUTCOMES:

At the end of the course students able to

1 Specify the appropriate power circuit configuration amongst the phase controlled rectifiers and choppers for the speed control of AC motor drives.
2 Analyze special machines drives(BLDC motors, reluctance motors)

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.

REFERENCE BOOKS:

1 B.K Bose, Power Electronics and AC drives Prentice Hall Publication -1ST Edition.2002.
2 Power Electronics Circuits, Devices and Application- M.H Rashid –PHI 1995.
3 GK Dubey, Fundamentals of Electric Drives Narora Publications -1995.
4 B.K.Bose, Power Electronics and Variable Frequency drives IEEE press-Standard publication-1st Edition-2002.

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16PE1204 **HVDC TRANSMISSIONS**

COURSE OUTCOMES:

At the end of the course students able to

1 Identify and analyze converter configurations used in HVDC and list the performance metrics
2 Compute the filter parameters for elimination of voltage and current harmonics in HVDC system
3 Learn protection of HVDC transmission system both voltage and current

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.

TEXT BOOKS:

1 E.W.Kimbark: Direct current Transmission, Wiely inter Science- New York.1971.
2 J.Arillaga: H.V.D.C. Transmission peter peregrilnus ltd., London UK 1983.

REFERENCE BOOKS:

1 K.R.Padiyar: High Voltage Direct current Transmission, Wiely Eastern Ltd.1990.
2 E.Uhlman: Power Transmission by Direct Current Springer Verlag, Berlin.1975.

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16PE1205 RENEWABLE ENERGY SYSTEMS

COURSE OUTCOMES:

At the end of the course students able to

1 Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline
2 Fluent application of engineering techniques, tools and resources

UNIT-I

Introduction: Energy Economics: Simple payback period, Internal (simple) rate of return, Net present value, 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

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

Photo Voltaic 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.

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.

REFERENCE BOOKS:

1 Renewable Energy Sources and Emerging Technologies, D.P. Kothari, K. C. Singal, RakeshRanjan, Kothari D.P., singal K. C., ranjan Rakesh.2011.

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16PE1206 PROGRAMMABLE LOGIC CONTROLLERS

COURSE OUTCOMES:

At the end of the course students able to

1 Apply basic knowledge in electronics, electrical circuit analysis, electrical machines, microprocessors, and programmable logic controllers.
2 demonstrate a working knowledge of drafting and computer usage, including the use of one or more computer software packages for technical problem solving
3 apply creativity through the use of project-based work to the design of circuits, systems, or processes

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

TEXT BOOKS:

1 John W.Webb and Ronald A. Reiss, Programmable logic controllers-Principle and applications, Fifth edition, PHI.2003.

REFERENCE BOOKS:

1 JR Hackworth and F.D Hackworth Jr, Programmable logic controllers- Programming Method and applications - Pearson, 2004.

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16PE1207 ENERGY AUDITING, CONSERVATION AND MANAGEMENT

COURSE OUTCOMES:

At the end of the course students able to

1 Impart basic knowledge about current energy scenario, energy management, auditing and conservation.
2 inculcate systematic knowledge and skill about assessing the energy efficiency, energy auditing and energy management.

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.

TEXT BOOKS:

1 W.R. Murphy & G. McKay Butter worth, Energy management, Heinemann publications.1982.
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.

REFERENCE BOOKS:

1 W.C.Turner, john Wiley and sons, Energy management hand book.2007.
2 Fuel efficiency- booklet12,Energy management and good lighting practice: -EEO.1993.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR (AUTONOMOUS)

M.Tech 2nd Semester –PE

L	T	P	C
3	0	0	3

16PE1208 REACTIVE POWER COMPENSATION AND MANAGEMENT

COURSE OUTCOMES:

At the end of the course students able to

1. Distinguish the importance of load compensation in symmetrical as well as un symmetrical loads
2. Observe various compensation methods in transmission lines
3. Construct model for reactive power coordination
4. Distinguish demand side reactive power management & user side reactive power management

UNIT-I

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

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.

TEXT BOOKS:

1 T.J.E.Miller, John Wiley and sons, Reactive power control in Electric power systems by, 1982 (Units I to IV).

REFERENCE BOOKS:

1 D.M.Tagare, Reactive power Management, Tata McGraw Hill, 2004. (Units V toVIII).

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(AUTONOMOUS)

M.Tech 2nd Semester –PE

L	T	P	C
0	0	3	2

16PE2209 RENEWABLE ENERGY SYSTEMS LAB

COURSE OUTCOMES:

At the end of the course students able to

1 Analyze the characteristics of a PV system, explain maximum power point tracking algorithm
2 Explain and identify different components of a wind power generation systems and analyze the output power characteristics
3 Apply engineering techniques, tools and resources.

LIST OF EXPERIMENTS

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 through SIMULINK/MATLAB.
13 Design of DC –AC Converter for different types of variable AC Loads trough SIMULINK/MATLAB

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
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M.Tech 2nd Semester –PE

L	T	P	C
0	0	3	2

16PE2210 SIMULATION LAB-II

COURSE OUTCOMES:

At the end of the course students able to

1 Understand the operation of rectifiers, ac voltage controllers and converter circuits

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.
3. Simulation of Three phase fully controlled converter with R and R-L load.
4. Simulation of Three phase AC Voltage controller with R and R-L Load.
5. Simulation of three phase inverter in 1200 conduction mode load connected both in star & delta
6. Simulation of three phase inverter in 1800 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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M.Tech 2nd Semester –PE

L	T	P	C
2	0	0	2

16PE2211 **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.Tech students. It helps to identify their Research area/topic and complete the groundwork and preliminary 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

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
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M.Tech 2nd Semester –PE

L	T	P	C
0	0	0	2

16PE2212 COMPREHENSIVE VIVA-VOCE

COURSE OUTCOMES:

At the end of the course students able to

1 Test the learning and understanding during the course of under graduate program.
2 Face interview both at the academic and the industrial sector.

All the students shall face a Comprehensive viva-voce covering the total courses of first and second semesters. The comprehensive viva-voce will be conducted along with 2nd semester lab examination for 75 marks by a committee consisting of Head of the Department, two senior faculty members nominated by the Head of the Department

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(AUTONOMOUS)

M.Tech 3rd Semester –PE

L	T	P	C
0	0	0	4

16PE2301 INTERNSHIP + PROJECT WORK

COURSE OUTCOMES:

At the end of the course students able to

1 develop awareness, understanding and capacity in the specific roles and responsibilities in an industry
2 develop and refinement of technical and professional skills

All the students shall undergo the summer internship during summer break after 2nd semester. The minimum internship period is eight weeks and the students have an option of choosing their own industry/area of interest, which may be related to their respective branch or any other service oriented task. A self study report for the internship shall be submitted and evaluated during the 3rd semester and will be evaluated for a total of 75 marks consisting of 25 marks for internal assessment and 50 marks for semester end examination. Internal assessment shall be done by the internship supervisor. Semester end examination for 50 marks shall be conducted by two examiners, one of them being internship supervisor as internal examiner and an external examiner nominated by the Principal from the panel of experts recommended by HOD

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(AUTONOMOUS)

M.Tech 4th Semester –PE

L	T	P	C
0	0	0	20

16PE2401 **PROJECT WORK**

COURSE OUTCOMES:

At the end of the course students able to

1 Identify a problem of current relevance to society
2 Formulate the problem and identify suitable modeling paradigm.
3 Analyze the problem and identify the solution methodology

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.