AR-19

COURSE STRUCTURE
AND
DETAILED SYLLABUS

For

M.Tech

POWER ELECTRONICS AND DRIVES

(DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING)

(Applicable for the batches admitted from 2019-2020)

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AUTONOMOUS)
Approved by AICTE, Accredited by NBA & NAAC,
Recognised under 2(f)12(b) of UGC
Permanently Affiliated to JNTUK, Kakinada
K.Kotturu, Tekkali, Srikakulam-532 201, Andhra Pradesh.

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT (AUTONOMOUS)
Approved by AICTE, Accredited by NBA & NAAC, Recognised under 2(f)12(b) of UGC
Permanently Affiliated to JNTUK, Kakinada.
K.Kotturu, Tekkali, Srikakulam-532201, Andhra Pradesh

Academic Regulations for M.Tech
(Effective for the students admitted into first year from academic year 2019-2020)

The M.Tech Degree of the Aditya Institute of Technology and Management (Autonomous), Tekkali shall be conferred on candidates who are admitted to the program and fulfill all the requirements for the award of the Degree.

1.0 ELIGIBILITY FOR ADMISSIONS:

Admission to the above program shall be made subject to the eligibility, qualifications and specialization prescribed by the University from time to time. Admissions shall be made on the basis of merit / rank obtained by the qualifying candidate in GATE / PGCET, subject to reservations prescribed by the Govt. of AP from time to time.

2.0 AWARD OF M. Tech DEGREE:

2.1 A student shall be declared eligible for award of the M.Tech degree, if he/she pursues a course of study and completes it successfully in not less than two academic years and not more than four academic years.

2.2 A student, who fails to fulfill all the academic requirements for the award of the degree within four academic years from the year of his/her admission, shall forfeit his/her seat in M.Tech course.

2.3 The minimum instruction for each semester 95 clear instruction days.

3.0 ATTENDANCE:

3.1 A candidate shall be deemed to have eligibility to write End Semester examinations if he/she has put in a minimum of 75% of attendance in aggregate of all the subjects.

3.2 Condonation of shortage of attendance up to 10% (65% and above, and below 75%) may be given by the College academic committee.

3.3 Condonation of shortage of attendance shall be granted only on genuine and valid reasons on representations by the candidate with supporting evidence.

3.4 Shortage of attendance below 65% shall in NO case be condoned.

3.5 A candidate shall not be promoted to the next semester unless he/she fulfills the attendance requirements of the present semester.

3.6 A stipulated fee shall be payable towards condonation of shortage of attendance.

4.0 COURSE OF STUDY:

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

1	VLSI System Design
2	Power Electronics and Drives
3	Computer Science and Engineering
4	Structural Engineering
5	Thermal Engineering

4.1 A standard academic format common for all PG programmes describing numbers of credits, weightage for lecture, laboratories work and projects have been fixed considering the scope of study. The position and sequence of study of core courses and elective courses are made to ensure sequential and integral learning. The focus on advance study in core courses through theory and laboratories work supported by study on relevant programme specific electives are incorporated. The selection of unique courses in the basket of elective is a special feature of curriculum ensuring flexibility and diversity. The emphasis on understanding advanced Concepts of PG course is ensured through elaborate practical work conducted through actual and virtual laboratory experiments. The concept of designing experiments and developing concept application is made part of learning process. The PG course is spread over two years in four semesters and inclusion of Mini project, Audit course, Open elective, Technical Seminar and Dissertation are the special features of this curriculum. The contents of course are unitised to facilitate its execution. The list of suggested reading is also made part of the curriculum.

4.2 The students are asked to learn IPR/ research methodology to understand the importance and process of creation of patents through research. The introduction of One Audit course covering subjects of developing desired attitude among the Learners is on the line of initiatives such as English for research paper writing, Disaster management, Sanskrit for Technical Knowledge, Value Education, Constitution of India, Pedagogy studies, Stress Management by yoga, Personality development through life enlightenment skills.

4.3 The introduction of Mini project ensures preparedness of students to undertake major projects/ dissertation. Students be encouraged to go to Industrial Training/Internship for at least 2-3 months during semester break. The courses included under open electives are of importance in the context of special skill development and they are on Business analytics, Industrial safety, Operation research and Cost management of engineering project, Composite materials and Waste to Energy. These courses shall make students capable to work in industrial environment. The dissertation/major project work of PG programme of one-year duration is given strong weightage in the curriculum. It is expected to undertake industrially relevant problem to develop an optimal solution through extensive research work. The students and faculty can design the research project in consultant with industry preferably in the region.

5.0 EVALUATION:

The performance of the candidate in each semester shall be evaluated subject-wise with a maximum of 100 marks for theory and 100 marks for laboratory, on the basis of continuous Internal Evaluation and Semester End Examination.

5.1 For Theory Courses, **40** marks shall be for internal evaluation and **60** marks for end semester examination. Out of **40** internal marks **30** marks are assigned for subjective exam, **5** marks for assignments and **5** marks for seminars. The internal evaluation for **30** marks shall be made based on the average of the marks secured in the two Mid Term-Examinations conducted, one in the middle of the Semester and the other immediately after the completion of instruction. Each midterm examination shall be conducted for duration of **120** minutes and question paper shall contain **4** questions. The student should answer all **4** questions.

5.2 For courses **Research Methodology & IPR** and **Open Elective,** the pattern of midterm and end examinations is similar to regular theory courses and the valuation is purely internal.

5.3 Audit course is one among the compulsory course and does not carry any Credits and end examination.

5.4 For laboratory courses, **40** marks shall be for internal evaluation and **60** marks for end semester examination. Out of **40** internal marks **20** marks are assigned based on day-to-day evaluation and **20** are assigned based on the internal test. The end examination shall be conducted by the teacher concerned and an external examiner.

5.5 For Mini Project, **40** marks shall be for internal evaluation and **60** marks for end semester examination. The end semester examination (Viva-Voce) shall be conducted by a committee. The committee consists of an External examiner, Head of the department and Supervisor of the mini project. The internal evaluation shall be made on the basis of seminar given by each student on the topic of his/her mini project, which was evaluated by Departmental committee. Out of **40** internal marks **10** marks allotted for literature survey, **15** marks for results and analysis and **15** marks for seminar. The Departmental Committee consists of Head of the Department, supervisor and one other senior faculty member from the Department.

5.6 For Technical Seminar there will be only internal evaluation for **100** marks. A candidate has to secure a minimum of **50%** to be declared successful. For evaluation the candidate has to collect literature on a topic, prepare the document, submit it to the Department in a report form and shall make an oral presentation before the Departmental Committee. The Departmental Committee consists of Head of the Department and two other senior faculty members from the department.

5.7 A candidate shall be deemed to have secured the academic requirement in a subject if he/she 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.

5.8 In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.7) he has to reappear for the supplementary examination in that subject.

6.0 EVALUATION OF DISSERTATION-1 / DISSERTATION-2 WORK:

Every candidate shall be required to submit thesis or dissertation after taking up a topic approved by the Dissertation Review Committee.

6.1 A DISSERTATION Review Committee (DRC) shall be constituted with Principal as chair Person, Head of the department, Supervisor and one senior faculty member of the concerned department

6.2 Registration of DISSERTATION: A candidate is permitted to register for the Dissertation after satisfying the attendance requirement of all the subjects (theory and practical subjects) in Second semester.

6.3 After satisfying 6.2, a candidate has to submit, in consultation with his supervisor, the title, objective and plan of action of his dissertation work to the Dissertation Review Committee for its approval. After obtaining the approval of the Committee the student can initiate the dissertation work after the second semester end examinations.

6.4 Every candidate shall work on dissertation approved by the DRC of the Department.

6.5 If a candidate wishes to change his supervisor or topic of the dissertation he can do so with approval of the DRC. However, the Dissertation Review Committee (DRC) shall examine whether the change of topic/supervisor leads to a major change of his initial plans of project proposal. If so, his date of registration for the dissertation work starts from the date of change of Supervisor or topic as the case may be.

6.6 A candidate shall submit status report in two stages at least with a gap of 3 months between them.

6.7 The work on the dissertation shall be initiated in the beginning of the III semester and the duration of the project is for two semesters. The candidate shall identify the problem, Literature survey, design/modeling part of the problem i.e. almost 35% of his dissertation work should complete in the III semester itself and it will be evaluated by DRC. If the candidate fails to get the satisfactory report, he has to re-register for the dissertation work.

6.8 A candidate shall be allowed to submit the dissertation report only after fulfilling the attendance requirements of all the semesters with approval of DRC and not earlier than 40 weeks from the date of registration of the dissertation work. For the approval of DRC the candidate shall submit the draft copy of dissertation to the Principal (through Head of the Department) and shall make an oral presentation before the DRC.

6.9 The Candidate may be permitted to submit the Dissertation Report, if only the student pass in all subjects and work is Published/Accepted to be published in a Journal / International conference of repute and relevance.

6.10 Three copies of the Dissertation Report certified by the Supervisor shall be submitted to the College.

6.11 The Dissertation shall be adjudicated by external examiner from outside the college.

6.12 The viva-voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner outside the college who adjudicated the Dissertation.

The Board shall jointly report candidates work as:

A. Excellent
B. Good
C. Satisfactory
D. Unsatisfactory

Head of the Department shall coordinate and make arrangements for the conduct of viva-voce examination. If the report of the viva-voce is unsatisfactory, the candidate will retake the viva-voce examination after three months. If he fails to get a satisfactory report at the second viva-voce examination, the candidate may be asked to submit a new Dissertation proposal to DRC starting with 6.4

7. Method of Awarding Letter Grades and Grade Points for a Course:

A letter grade and grade points will be awarded to a student in each course based on his/her performance as per the grading system given below.

Table: Grading System for M.Tech. Programme

Percentage	Grade Points	Letter Grade
95-100%	10	O
85-<95%	9	A+
75-<85%	8	A
65-<75%	7	B+
55-<65%	6	B
50-<55%	5	P
< 50%	0	F (Fail)

7.1 Calculation of Semester Grade Points Average (SGPA)* for semester

The performance of each student at the end of the each semester is indicated in terms of SGPA. The SGPA is calculated as below:

$$SGPA = \frac{\Sigma(CR \times GP)}{\Sigma CR}$$ (for all courses passed in semester)

Where CR = Credits of a Course
GP = Grade points awarded for a course

*SGPA is calculated for the candidates who passed all the courses in that semester.

Equivalent % of marks:

Equivalent % of marks in a semester is = (SGPA - 0.5) x 10 %

Over all Percentage of marks is = (CGPA* - 0.5) x 10 %

CGPA* - CGPA Obtained at the End of completion of fourth semester

7.2 Calculation of Cumulative Grade Points Average (CGPA*) and Award of Division for Entire Programme.

The CGPA is calculated as below:

$$\text{CGPA} = \frac{\Sigma(\text{CR} \times \text{GP})}{\Sigma\text{CR}} \quad \text{(for entire programme)}$$

Where CR = Credits of a course

GP = Grade points awarded for a course

*CGPA is calculated for the candidates who passed all the courses till that semester.

Table: Award of Divisions

CGPA	DIVISION
≥ 7.5	First Class with distinction
≥ 6.5 and < 7.5	First Class
≥ 5.5 and 6.5	Second Class
≥ 5.0 and <5.5	Pass Class
< 5.0	Fail

After a student has satisfied the requirements prescribed for the completion of the programme and is eligible for receiving the award of M.Tech. Degree, he shall be placed in one of the above divisions.

8.0 WITH-HOLDING OF RESULTS:

If the candidate has not paid any dues to the college or if any case of indiscipline is pending against him / her, the result of the candidate will be withheld and he/she will not be allowed into the next higher semester. The issue of the degree is liable to be with held in such cases.

9.0 TRASITORY REGULATIONS:

Candidate who have discontinued or have been detained for want of attendance or who have failed after having undergone the course are eligible for admission to the same or equivalent subjects as and when subjects are offered, subject to 5.8 and 2.0

10.0 GENERAL:

10.1 The academic regulations should be read as a whole for purpose of any Interpretation.

10.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

10.3 The Institute may change or amend the academic regulations and syllabus at any time and the changes and amendments made shall be applicable to all the students with effect from the date notified by the college.

10.4 Wherever the word he, him or his occur, it will also include she, her and hers.

*** * * * ***

Aditya Institute of Technology and Management, Tekkali
M.Tech. – Power Electronics and Drives
(AR19 Regulations)

COURSE STRUCTURE

Semester	Subject Code	Theory/Lab	L	T	P	C
I	19MPE1001	Power electronic control of DC drives	3	0	0	3
	19MPE1002	Modeling and Analysis of Electrical Machines	3	0	0	3
	XXXXXX	Program Elective – I	3	0	0	3
	XXXXXX	Program Elective – II	3	0	0	3
	19MCC1001	Research Methodology and IPR	2	0	0	2
	19MAC1001 19MAC1002 19MAC1003 19MAC1004	Audit Course: 1) English for Research Paper Writing 2) Disaster Management 3) Constitution of India 4) Personality Development through Life Enlightenment Skills	2	0	0	0
	19MPE1101	Electrical Drives Laboratory	0	0	4	2
	19MPE1102	Power electronics systems simulation lab	0	0	4	2
Total			**16**	**0**	**8**	**18**

Semester	Subject Code	Theory/Lab	L	T	P	C
II	19MPE1009	Power electronic control of AC drives	3	0	0	3
	19MPE1010	Switched mode power converters	3	0	0	3
	XXXXXX	Program Elective – III	3	0	0	3
	XXXXXX	Program Elective – IV	3	0	0	3
	XXXXXX	Program Elective – V	3	0	0	3
	19MOE1001 19MOE1002 19MOE1003 19MOE1004	Open Elective: 1) Industrial Safety 2) Operations Research 3) Composite Materials 4) Waste to Energy	3	0	0	3
	19MPE1103	Digital Signal Processing Lab	0	0	4	2
	19MPE1201	Minor Project	0	0	4	2
Total			**18**	**0**	**8**	**22**

Semester	Subject Code	Theory/Lab	L	T	P	C
III	19MPE2202	Technical Seminar	0	0	4	2
	19MPE2203	Dissertation Phase – I	0	0	20	10
Total			**0**	**0**	**24**	**12**

Semester	Subject Code	Theory/Lab	L	T	P	C
IV	19MPE2204	Dissertation Phase – II	0	0	32	16
Total			**0**	**0**	**32**	**16**

Program Elective – I

Code	Subject
19MPE1003	Analysis of Power electronic converters
19MPE1004	Modern control theory
19MPE1005	Power Quality

Program Elective – II

Code	Subject
19MPE1006	Programmable logic controllers
19MPE1007	Micro controllers and applications
19MPE1008	Design and conditioning of Machines

Program Elective – III

Code	Subject
19MPE1011	Analysis of dynamic systems
19MPE1012	Intelligent control
19MPE1013	Advanced digital signal processing and applications

Program Elective – IV

Code	Subject
19MPE1014	Energy auditing, conservation and management
19MPE1015	Non-conventional energy sources and applications
19MPE1016	Smart Grids

Program Elective – V

Code	Subject
19MPE1017	HVDC transmission
19MPE1018	FACTS and Custom Power Devices
19MPE1019	SCADA Systems and Applications

POWER ELECTRONIC CONTROL OF DC DRIVES

L	P	C	INT	EXT
3	0	3	40	60

19MPE1001

Course Objectives:

The main objective of the course is to:

- Provides basic understanding of main principles of DC drives, various modes of operation, control from converters and choppers, and also modeling of DC machines.

Course Outcomes:

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

CO1: Able to understand the concept of modeling and analysis of DC motors.
CO2: Able to design controllers for closed loop and open loop transfer function of DC motor drives.
CO3: Able to analyze the controlled converter and DC chopper circuits.
CO4: Able to Analyze the Dual Converter Control of DC motor
CO5: Able to Distinguish the difference between PWM controller and hysteresis controller

UNIT I:

Modeling of DC Machines: Theory of operation-Equivalent Circuit and Electromagnetic Torque- Electromechanical Modeling- State space modeling-Block diagram and Transfer functions.

UNIT II:

Single Phase Controlled DC Motor Drives: Principle of DC Motor Speed Control- Armature control-Field Control-armature and field controls. Single –phase semi converter and single-phase full converter fed Separately excited DC motor for continuous and discontinuous modes of operation- Problems.

UNIT III:

Three Phase Controlled DC Motor Drives: Three-phase semi converter and three- phase full converter Separately excited DC motor- for continuous and discontinuous modes of operation-Problems-Four Quadrant Operation using Dual Converters-Control modeling of three- phase converter-Two quadrant Three Phase Converter Controlled DC Motor Drive-Transfer Functions of the subsystems.

UNIT IV:

Design of Controllers: Current controller-First order Approximation of Inner Current Loop-speed controller- Simulation of one quadrant DC Motor Drive-The Motor equations-field in the speed feedback loop-Speed Controller- Current Reference Generator-Current Controller- Flow Chart for Simulation.

UNIT V:

Chopper controlled DC Motor drives-I: 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.

UNIT VI:

Chopper controlled DC Motor drives-II: 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 controller, analysis of Chopper controlled DC Motor drives.

TEXT BOOKS:

1. R.Krishnan, "Electric motor drives modeling, Analysis and control" 1st ed., Prentice Hall India
2. Shepherd, Hulley, Liang, "Power Electronics and motor control", 2nd ed., Cambridge University Press

REFERENCE BOOKS:

1. M.H. Rashid, "Power Electronic circuits, Devices and applications", 1st ed., PHI, 1995
2. G.K. Dubey, "Fundamentals of Electric Drives", Narsa Publications, 1995.
3. Power Electronics- Ned Mohan, Tore M.Undelan and William P.Robbins –John Wiley & Sons -2nd Edition.

MODELING AND ANALYSIS OF ELECTRICAL MACHINES

L	P	C	INT	EXT
3	0	3	40	60

19MPE1002

Course Objectives:

The main objective of the course is to:

- Understand the Principles of electromagnetic energy conversion.
- Understand the basic concepts of modeling.
- Understand how the Reference Frame Theory helpful for modeling of electrical machines.
- Understand how to analysis and model the different electrical machines i.e. D.C and A.C machines and special electrical machines.

Course Outcomes:

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

CO1: Able to understand Principles of electromagnetic energy conversion.

CO2: Determine the developed torque in Kron’s primitive Machine and determine the dynamic model of a DC machine.

CO3: Determine the dynamic model & Small signal model of three phase 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.

CO4: Analyze and model the Symmetrical and Unsymmetrical Two phase induction machine.

CO5: Analyze and model the three phase synchronous machine and special electrical machines.

UNIT I:

Principles of electromagnetic energy conversion: Magnetic circuits, permanent magnet, General expression of stored magnetic energy, co-energy– force and torque in single and doubly excited system.

UNIT II:

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

UNIT III:

Reference Frame Theory: Real time model of a two phase induction machine- Transformation to obtain constant matrices-Linear transformation-three phase to two phase transformation-Power equivalence.

UNIT IV:

Dynamic & Small Signal Modeling of Three phase Induction Machine:

Generalized model in arbitrary reference frame-Electromagnetic torque-Derivation of commonly used Induction machine models- Stator reference frame model-Rotor reference frame model-Synchronously rotating reference frame model-Equations in flux linkages-per unit model -Small signal equations of Induction machine.

UNIT V:

Symmetrical and Unsymmetrical Two phase Induction Machine:

Analysis of symmetrical 2 phase induction machine-voltage and torque equations for unsymmetrical 2 phase induction machine-voltage and torque equations in stationary reference frame variables for unsymmetrical 2 phase induction machine-analysis of steady state operation of unsymmetrical 2 phase induction machine.

UNIT VI:

Modeling of Synchronous Machine:

Voltage and torque equations in machine variables, voltage equations in arbitrary reference frame, voltage equations in rotor reference frame (park's equations), Torque equation in Substitute Variables.

Modeling of Special Machines: Modeling of PM Synchronous motor, Modeling of BLDC motor, Modeling of Switched Reluctance motor.

TEXT BOOKS:

1.Electric Motor Drives - Modeling, Analysis& control -R.Krishnan- Pearson Publications-1st edition - 2002

2.Analysis of Electrical Machinery and Drive systems – P.C.Krause, Oleg Wasynczuk, Scott D.Sudhoff – Second Edition-IEEE Press

3.Electric Machinery-Charles Kingsle,Jr., A.E. Fitzgerald, Stephen D.Umans-Tata Mcgraw Hill

REFERENCE BOOKS:

1. Generalized Theory of Electrical Machines – P.S.Bimbra-Khanna publications-5thEdition-1995
2. Brushless Permanent Magnet and Reluctance Motor Drives-Miller, T.J.E.- Clarendon Press
3. Dynamic simulation of Electric machinery using Matlab / Simulink –CheeMunOng- Prentice Hall.

ANALYSIS OF POWER ELECTRONICS CONVERTERS

Program Elective – I

L	P	C	INT	EXT
3	0	3	40	60

19MPE1003

Course Objectives:

The main objective of the course is to:

- Introduce basic concepts of AC voltage controllers, AC-DC converters, concepts on Power factor converters and inverters.

Course Outcomes:

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

CO1: Describe the operation of DC-DC, DC-AC, AC-DC and AC-AC power converters.

CO2: Explain the control characteristics of power semiconductor switching devices

CO3: Calculate the values of circuit parameters to limit output ripple voltages and currents of a converter with specified values

CO4: Evaluate the effects of various modulation techniques on the quality of input and output waveforms.

CO5: Analyze and evaluate the performance of a simple power circuit.

UNIT I:

AC voltage Controllers: Single Phase AC Voltage Controllers with RL and RLE loads-ac voltage controller’s with PWM control, Effects of source and load inductances, synchronous tap changers, Application, numerical problems.

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

UNIT II:

Single Phase Ac-Dc converters: Single phase Half controlled and Fully controlled Converters with RL load, Evaluation of input power factor and harmonic factor, Continuous and Discontinuous load current, Power factor improvements, Extinction angle control, symmetrical angle control, PWM single phase sinusoidal PWM, Single phase series converters, numerical problems.

UNIT III:

Three Phase AC-DC Converters: Three Phase AC-DC Converters, Half controlled and fully controlled Converters with RL load, 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, numerical problems.

UNIT IV:

Power Factor Correction Converters: Single-phase single stage boost power factor corrected rectifier, power circuit principle of operation, and steady state, analysis, three phase boost PFC converter.

UNIT V:

PWM Inverters: Principle of operation-Voltage control of single phase inverters, sinusoidal PWM, modified PWM, phase displacement Control, Trapezoidal, staircase, stepped, harmonic injection and delta modulation, numerical problems, Voltage Control of Three Phase Inverters Sinusoidal PWM 60◦ PWM. Third Harmonic PWM, Space Vector Modulation, Comparison of PWM Techniques-current source inverters,Variable dc link inverter, numerical problems.

UNITVI:

Multi level inverters: Introduction, Multilevel Concept, Types of Multilevel Inverters, Diode-Clamped Multilevel Inverter, Principle of Operation, Features of Diode-Clamped Inverter, Improved Diode-Clamped Inverter, Flying-Capacitors Multilevel Inverter, Principle of Operation, Features of Flying, Capacitors Inverter, Cascaded Multilevel Inverter, Principle of Operation, Features of Cascaded Inverter, Switching Device Currents, DC-Link Capacitor Voltage Balancing, Features of Multilevel Inverters, Comparisons of Multilevel Converters.

TEXT BOOKS:

1. Power Electronics- Md.H.Rashid –Pearson Education Third Edition-2008
2. Power Electronics- Ned Mohan, Tore M.Undelan and William P.Robbins –John Wiley & Sons -2nd Edition.

REFERENCE BOOKS:

1. Power Electronics – Lander – 2009.
2. Modern Power Electronics and AC Drives – B.K.Bose.
3. Power Converter Circuits – willian swpherd & Li zhang – Yes Dee Publishing Pvt.Ltd

MODERN CONTROL THEORY

Program Elective – I

L	P	C	INT	EXT
3	0	3	40	60

19MPE1004

Course Objectives:

The main objective of the course is to:

- Apply linear algebra concepts to find solutions of linear matrix equations.
- Apply concepts of linear vector space in engineering analysis
- Apply linear algebra concepts to solve and analyze the response of dynamic systems
- Apply concepts of E igen values and eigenvectors to design and analyze dynamic systems
- Apply the methods to find stability of dynamic systems.

Course Outcomes:

CO1: Ability to apply current knowledge and applications of algebra concepts to find solutions of linear matrix equations

CO2: Ability to design algebra concepts to solve and analyze the response of dynamic systems

CO3: Ability to understand the concepts of linear vector space in engineering analysis.

CO4: Ability to understand the non – Linear systems and analyze the Non- Linear systems through describing functions.

CO5: Ability to find the stability of Non-Linear systems.

UNIT I:

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

UNIT II:

State Variable Analysis: Linear Continuous time 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 III:

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.

UNIT IV:

Non Linear Systems-I: 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.

UNIT IV:

Non Linear Systems-II: 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 VI:

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 second method – Generation of Lyapunov functions – Variable gradient method – Krasooviski’s method.

TEXT BOOK:

1. Modern Control System Theory by M. Gopal – New Age International – 1984

REFERENCE BOOKS:

1. Modern Control Engineering by Ogata. K – Prentice Hall – 1997
2. Optimal control theory by Donald E. Kirk.

POWER QUALITY

Program Elective – I

L	P	C	INT	EXT
3	0	3	40	60

19MPE1005

Courser Objectives:

1. Introduction to custom power and study of factors governing power quality.
2. Study of Power factor compensation techniques with power electronic devices and active harmonic filtering.
3. Introduction to measuring & solving power quality problems and particular standards relating to them**.**

Course Outcomes:

1. Students will be adequately trained to work for improvement and betterment of power quality
2. Students will be skilled theoretically and practically for monitoring of power quality and
3. Students will be substantially prepared to take up prospective research assignment.

UNIT-I

Introduction to electrical power quality: Definition of Power Quality, Power Quality Issues, Electric Power Quality Standards.

Power frequency disturbances: Introduction- Common power frequency disturbances-Cures for low frequency disturbances-Voltage tolerance criteria.

UNIT-II

Interruptions and voltage sags: Interruptions(Long and Short): Terminology, causes and origin of interruptions, Limits for the interruption frequency and duration.

Voltage sag: Sources of sags-Estimating Voltage sag performance-Fundamental principles of protection-Solutions at the End-User level- Flickers.

UNIT-III

Electrical transients: Types and Causes of Transients, Atmospheric Causes, Switching Loads On or Off, Interruption of Fault Circuits, Capacitor Bank Switching, Motor Start Transient.

Long duration voltage variations: Principles of regulating the voltage-Devices for voltage regulation-Utility voltage regulator application-Capacitors for voltage regulations-End user capacitor application.

UNIT-IV

Harmonics: Definition of Harmonics, Causes of Voltage and Current Harmonics. Individual and Total Harmonic Distortion, Effect of Harmonics on Power System Devices, Guidelines for Harmonic Voltage and Current Limitation, Harmonic Current Mitigation

UNIT- V

Power factor improvement: Passive and Active Compensation Techniques. Active Power Factor Corrected Single Phase Front End converter, Control Methods for Single Phase APFC.
Three Phase APFC and its Control Techniques, PFC based on Bilateral Single Phase and Three Phase Converter.

UNIT- VI

Measuring devices for quality: Power Quality Measurement Devices, Harmonic Analyzers, Transient-Disturbance Analyzers, Oscilloscopes, Data Loggers and Chart Recorders, True RMS Meters, Power Quality Measurements.

TEXT BOOKS:

1. R.C. Dugan, M.F. McGranaghan and H.W. Beaty, Electric Power Systems Quality. New York: McGraw-Hill.1996.
2. C. Sankaran, Power Quality. CRC, 2002. 5. J. Arrillaga, D.A Bradely and P.S. Bodger, Power System Harmonics. New York: Wiley, 1985.

REFERENCE BOOKS:

1. G.T. Heydt, Electric Power Quality. 2nd ed. West Lafayette, IN: Stars in a Circle, 1994.
2. A Ghosh, G. Ledwich, Power Quality Enhancement Using Custom Power Devices. Kluwer Academic, 2002
3. G.T. Heydt, "Electric power quality", McGraw-Hill Professional, 2007
4. Math H. Bollen, "Understanding Power Quality Problems", IEEE Press, 2000.
5. Power Quality Problems and Mitigation Techniques 1st Edition by Bhim Singh.

PROGRAMMABLE LOGIC CONTROLLERS

Program Elective – II

L	P	C	INT	EXT
3	0	3	40	60

19MPE1006

Course Objectives:

The main objective of the course is to:

- Introduces basic concepts in PLC programming, operational procedure, different types of PLC registers, PLC functions, data handling functions, which are useful in practical PLC applications in Industries

Course Outcomes:

CO1: Able to learn the basic PLC system construction and programming.
CO2: Able to learn ladder diagrams for different process control.
CO3: Able to learn the Characteristics of PLC Registers.
CO4: Able to learn PLC Function and data handling Functions.
CO5: Able to learn data handling functions which are useful for the Robotics and PID applications

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 & sequence listings, ladder diagram construction and flowchart for spray process system.

UNIT III:

PLC Registers: Characteristics of Registers, module addressing, holding registers, Input Registers, Output Registers.

UNIT IV:

PLC Functions: Timer functions & Industrial applications, counters, counter function industrial applications, Arithmetic functions, Number comparison functions, number conversion functions.

UNIT V:

Data Handling functions: SKIP, Master control Relay, Jump, Move, FIFO, FAL, ONS, CLR & Sweep functions and their applications

UNIT VI:

Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two-axis & three axis Robots with PLC, Matrix functions. Analog PLC operation: Analog modules& 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 BOOK:

1. Programmable Logic Controllers- Principles and Applications by John W. Webb & Ronald A. Reiss, Fifth Edition, PHI

REFERENCE BOOK:

1. Programmable Logic Controllers- Programming Method and Applications JR.Hackworth & F.D Hackworth Jr. –Pearson, 2004.

MICROCONTROLLERS AND APPLICATIONS

Program Elective – II

L	P	C	INT	EXT
3	0	3	40	60

19MPE1007

Course Objectives:

The main objective of the course is to:

- To study the complete architecture of 8051 micro-controller.
- To study the addressing modes, interrupts and instruction set of 8051 MCU.
- To study the architecture of Atmel and PIC micro- controllers.
- To study the interfacing and industrial applications of micro-controllers.

Course Outcomes:

CO1: Understand the architecture of basic 8051 Micro-controller.

CO2: Understand and impart the knowledge about instructions, interrupts and addressing modes.

CO3: Understand the architecture of advanced Microcontrollers like PIC, ATMEL and Flash type PIC.

CO4: Develop skill in writing simple programs for 8051.

CO5: Develop skill in writing programs for interfacing peripherals with Micro- controllers.

UNIT I:

Microcontrollers: Introduction to Intel 8 bit & 16 bit Microcontrollers, MCS-51 Architecture, Registers in MCS-51, 8051 Pin Description, 8051 Connections, 8051 Parallel I/O Ports Memory Organization.

UNIT II:

MCS-51 Addressing Modes and Instructions: 8051 Addressing Modes, MCS-51 Instruction Set, 8051 Instructions and Simple Programs, Using Stack Pointer, 8051 Assembly Language Programming, Development Systems and Tools, Software Simulators of 8051.

MCS-51 Interrupts, Timer/Counters and Serial Communication:

Interrupts, Interrupts in MCS-51, Timers and Counters, Serial Communication, Atmel Microcontrollers (89CXX and 89C20XX), Architectural Overview of Atmel 89C51 and Atmel 89C2051, Pin Description of 89C51 and 89C2051, Using Flash Memory Devices Atmel 89CXX and 89C20XX.

UNIT III:

Applications of MCS-51 and Atmel 89C51 and 89C2051 Microcontrollers: Applications of MCS-51 and Atmel 89C51 and 89C2051 Microcontrollers- Square Wave Generation- Rectangular Waves- Pulse Generation- Pulse Width Modulation- Staircase Ramp Generation- Sine Wave Generation- Pulse Width Measurement- Frequency Counter.

UNIT IV:

PIC Microcontrollers: PIC Microcontrollers: Overview and Features, PIC 16C6X/7X, FSR(File Selection Register) [Indirect Data Memory Address Pointer], PIC Reset Actions, PIC Oscillator Connections, PIC Memory Organizations, PIC PIC 16C6X/7X Instructions, Addressing Modes, I/O Ports, Interrupts in PIC 16C61/71, PIC 16C61/71 Timers, PIC 16C71 Analog-to-Digital Converter (ADC).

UNIT V:

PIC 16F8XX Flash Microcontrollers: Introduction, Pin Diagram of 16F8XX, STATUS Register, OPTION_REG Register, Power Control Register (PCON), PIC 16F8XX Program Memory, PIC 16F8XX Data Memory, DATA EEPROM and Flash Program EEPROM, Interrupts in 16F877, I/O Ports, Timers

UNIT VI:

Interfacing and Microcontroller Applications: Light Emitting Diodes (LEDs), Push Buttons, Relays and Latch Connections, Keyboard Interfacing, Interfacing 7-Segment Displays, LCD Interfacing, ADC AND DAC Interfacing with 89C51 Microcontrollers - Measurement Applications, Automation and Control Applications

TEXT BOOK:

1. Microcontrollers-Theory and Applications by Ajay V Deshmukh, McGraw Hills

REFERENCE BOOK:

1. Microcontrollers by Kennith J ayala, Thomson publishers 3 Microprocessor and Microcontrollers by Prof C.R.Sarma

DESIGN AND CONDITIONING OF MACHINES

Program Elective –II

L	P	C	INT	EXT
3	0	3	40	60

19MPE1008

Course Objectives:

The main objective of the course is to:

- Introduce basic concepts of design of different machines like Transformers, AC and DC Rotating Electrical Machines and their condition monitoring which are useful in practical applications.

Course Outcomes:

CO1: Able to learn the design and monitoring details and the need for monitoring of the electrical equipment.

CO2: Able to learn the design and Monitoring of transformers.

CO3: Able to learn the design of DC Machines.

CO4: Able to learn the design of Induction and Synchronous Machines.

CO5: Able to learn the Monitoring of electrical Machines.

UNIT I:

Introduction to design: Design concepts, Factors, Manufacturing techniques, Review of basic principles.

Introduction to monitoring: Introduction to condition monitoring, condition monitoring and diagnostics engineering management, Techniques employed in the field of condition monitoring, importance of condition monitoring.

UNIT II:

Design of Transformers: Transformer windings, Output equation, coil design, Core and yoke design, Selection of number of tubes. Design of Insulation and Leakage Reactance for concentrated and distributed type of windings. Steps for detailed design of a transformer.

UNIT III:

Conditioning of Transformers: Mineral insulating oil-Functions of Transformer oil, causes of oil ageing, ageing rate accelerators, control of acceleration factors, development of a comprehensive testing program, Tests on transformer oil such as power factor, Moisture, Neutralization number, Interfacial tension, Relative density, colour, visual examination, BDV, dissolved gas analysis, furanic compounds, degree of polymerization and remaining life; and their interpretation as per standards.

Diagnostic tests:

Dissolved Gas analysis (D.G.A)-Duval Triangle method, Rogers Ratio method, Sweep Frequency response analysis (S.F.R.A), Furan analysis.

UNIT IV:

Design of DC Machines: Concept of generation of emf in rotating machines, Output equation, choice of loading intensities, Separation of main dimensions, Design of field system, Interpoles, commutator and brushes.

UNIT V:

Design of Rotating AC Machines: Design of induction machines Output equation, Stator Design, Stator Slots, Squirrel cage and blocked rotor design.

Design of Synchronous machines:

Constructional Features, Short circuit Ratio, Specific Loadings, main dimensions, Stator Design and Design of Salient pole Field coil-Length of air gap.

UNIT VI:

Monitoring of Rotating Electrical Machines:

Introduction, electric motor failures, simple preventive techniques, methods of motor monitoring such as current, temperature, starting strategies and soft starts, resistance, lubrication, cleaning, general inspection, advanced techniques for electric generator monitoring, vibration monitoring, stator current monitoring.

TEXT BOOKS:

1. Electrical Machine Design, Sawhney, Dhanpath Rai.
2. Handbook of Condition Monitoring by B. K. N. Rao, Elsevier Science Publisher, 1st Edition, 1996.

REFERENCE BOOKS:

1. R.E James and Q. Su Condition assessment of high voltage insulation in power system equipment, Publisher: IET.
2. P. J. Tavner, J. Penman and Howard Sedding, “Condition Monitroing of Rotating Electrical Machine”, Publisher: IET.

RESEARCH METHODOLOGY AND IPR

L	P	C	INT	EXT
2	0	2	40	60

19MCC1001

COURSE OUTCOMES:

On completion of this course, students should be able to

CO 1. Understand research problem formulation.

CO 2. Analyze research related information

CO 3. Follow research ethics

CO 4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

CO 5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

CO 6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Unit I:

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.

Unit II:

Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, an Illustration

Unit III:

Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed, analysis Plagiarism, and Research ethics.

Unit IV:

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Unit V:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under Patent Cooperation Treaty (PCT).

Unit VI:
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology, Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc, Traditional knowledge Case Studies, IPR and IITs.

Text Books

1. Research methodology by C.R. KOTHARI
2. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

Ref. Books

1. Research Methodology, Paneersevam, PHI
2. Research Methodology, Chawla and Sondhi, Vikas
3. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”
4. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007
5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.

ENGLISH FOR RESEARCH PAPER WRITING

Audit Course

L	P	C	INT	EXT
2	0	0	40	60

19MAC1001

Course Objectives

- To make students understand significance of improving writing skills and level of readability
- To assist students learn about what to write in each section of their papers
- To aid students realize importance of reviewing literature for a paper writing
- To help students acquire skills required for writing a Title, Abstract and Introduction
- To enable students obtain skills needed when writing methods, results, discussions and conclusions
- To get students ensure paper is written in the best possible manner

Course Outcomes

1. Students will be able to write paper with clarity and brevity
2. Students will be able to interpret their findings in their own way unaffected by external factors
3. Students will be able to get accurate results with an astute understanding of the subject
4. Students will be able to begin paper writing more aptly
5. Students will be able to write methods, results, discussions and conclusion in their paper more logically
6. Students will be able to use phrases competently to express their ideas

Unit – I

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

Unit – II

Clarifying Who Did What, Highlighting Findings, Hedging and Criticizing,Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

Unit – III

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

Unit – IV

Key skills needed when writing a Title, an Abstract, an Introduction and a Review of the Literature

Unit – V

Skills needed when writing Methods, Results, Discussions and Conclusion

Unit – VI

Useful phrases, how to ensure paper is as good as it could possibly be the first- time Submission

Text Books

1. Goldbort R (2006). *Writing for Science*. Yale University Press.
2. Day R (2006). *How to Write and Publish a Scientific Paper*. Cambridge University Press.
3. Highman N (1998). *Handbook of Writing for the Mathematical Sciences*, SIAM. Highman's book .

DISASTER MANAGEMENT

Audit Course

L	P	C	INT	EXT
2	0	0	40	60

19MAC1002

Course Objectives

Students will be able to:

- To understand basic concepts, definitions and Terminologies used in Disaster Management.
- To Understand Types and Categories of Disasters and its Impact.
- To promote Prevention and Preparedness for disaster
- To undertake Mitigation & Risk Reduction steps to prioritize Rescue and Relief operation, Rehabilitation & Reconstruction
- To understand the seismic zoning of India and various seismic vulnerable locations
- To know the statistical approach on land slides

Course Outcomes

At the end of the course the student will be able to:

1. Know the Disaster Concepts to Management.
2. Ability to Categorize Disasters & Preparedness plans for disaster response.
3. Ability to analyze seismic vulnerable location in various parts of India
4. Monitoring and evaluation plan for disaster response, setting up of early warning systems for risk reductions
5. Ability to analyze seismic vulnerable location in various parts of India
6. Analyze the statistical approach on land slides

Unit – I

Concept of Disaster Management. Types of Disasters. Disaster mitigating agencies and their organizational structure at different levels

Unit – II

Overview of Disaster situations in India: Vulnerability profile of India and vulnerability mapping including disaster – prone areas, communities, places.

Unit – III

Disaster preparedness – ways and means; skills and strategies; rescue, relief, reconstruction and rehabilitation.

Unit – IV

Case studies: Lessons and experiences from various important disasters in India.

Unit – V

Seismic vulnerability of urban areas.: Seismic response of R.C. frame buildings with soft first storey. Preparedness for natural disasters in urban areas. Sulbh technology for sanitation improvement in urban habitat. Landslide hazards zonation mapping and geo-environmental problems associated with the occurrence of landslides.

Unit – VI

Statistical approach to study landslides: Landslide casual factors in urban areas. Roads and landslide hazards in Himalayas. Lateral strength of masonry walls. A numerical model for post earthquake fire response of structures. Cyclone resistant house for coastal areas. Disaster resistant construction role of insurance sector. Response of buried steel pipelines carrying water subjected to earthquake ground motion. Preparedness and planning for an urban earthquake disaster. Urban settlements and natural hazards. Role of knowledge based expert systems in hazard scenario.

Text Books

1. Natural Hazards in the Urban Habitat” by Iyengar, C.B.R.I., Tata McGraw Hill.
2. Natural Disaster management”, Jon Ingleton(Ed), Tulor Rose
3. Disaster Management”, R.B. Singh (Ed), Rawat Publications,2006
4. Anthropology of Disaster management”, Sachindra Narayan, Gyan Publishing House,2000

CONSTITUTION OF INDIA

Audit Course

L	P	C	INT	EXT
2	0	0	40	60

19MAC1003

Course Objectives

Students will be able to:

- To help Students regulate their behavior in a social environment as Engineering Professionals.
- To make students aware of the impact of taking social, legal and Administrative decisions about their profession.
- To understand the political and constitutional parameters in work environment.
- To understand the need and strengths of our nation and adopt their knowledge for future career.

Course Outcomes:

By the end of this course the student will be able to:

1. Realize the rigidness of our Indian Politics and Administrative aspects.
2. A Student can understand our nation federalism.
3. Can assess different types of risks involved in misadministration.
4. Can create competitive advantage.
5. Summarizes the legal, Administrative, Political and Financial aspects for betterment of the National building.
6. To assess the growth of Indian opinion regarding modern Indian intellectuals' Constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism

Unit – I

Introduction: Historical perspective of the constitution of India - Salient features of The Indian Constitution –Features: Fundamental Rights (Article 12 to 35), Duties (51 A – 1976 emergency) and Directive principles (Article 36 to 51) of State Policy - Articles 14 to 18- Articles 19 - Article 21

Unit-II

Amendment Procedure of The Indian Constitution: 42nd amendment (Mini Constitution) - 44thamendment (1978 – Janatha Govt.)

Unit – III

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of ElectedRepresentative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: ZilaPachayat, Elected officials andtheir roles, CEO ZilaPachayat: Position and role, Block level: Organizational Hierarchy (Different departments),Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit – IV

Parliamentary form of Govt. In India: President of India - Emergency provisions - National Emergency – Article 352 President Rules – Article 356 - Financial Emergency – Article 360Prime Minister and Cabinet - Supreme Court of India (Indian Judiciary)

Unit – V

Indian Federalism: Union – State relations; - Legislative, Administrative and Financial relations. LokSabha, RajyaSabha, VidhanSabha & VidhanParishad - Composition; Speaker, Chairman, Privileges, Legislative procedure.

Unit – VI

Parliamentary Committees: Public Accounts Committee - Estimates Committee - Committee on Public Undertakings. - Election commission of India (Article -324) - Comptrollar and Auditor General (CAG) of India
(Article – 148 to 150) - Finance Commission (Article – 280) - NeethiAayog (Planning Commission) and - Political Parties.

Text Books:

1) D.D Basu – Indian Constitution.
2) Dr. D. Surannaidu – Indian PoliticalSystem.
3) MadhavKhosla – The IndianConstitution.

Reference Books:

1) The Constitution of India, 1950 (Bare Act), Government Publication.
2) M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Audit Course

L	P	C	INT	EXT
2	0	0	40	60

19MAC1004

Course Outcomes:

On completion of this course, students should be able

1. Realize that everyone is responsible for creating his/her own personality.
2. Gain knowledge of the importance of developing virtues like wisdom and courage and knowing what are good acts (do’s) and bad acts (don’ts).
3. Understand the key message of Bhagavad Gita which is experiencing spiritual oneness by practicing any or all of the karma, bhakti, dhyana or raja, and jnana yogas.
4. Know the vedantic perspective of lifewith regards to understanding human nature, art of living and technique of self-unfoldment.
5. Realize the goal and means to attain self-realization which is the only way to attain liberation.
6. Become aware that sub-conscious mind which is full of desires is the main obstacle for self-realization and spiritual practices help in eliminating these desires.

Unit – I

Personality Development: It is Personality that Matters – Laws of Personality Development – Different Layers of Personality – Pleasure is not the Goal – How to Change Our Character – Control Your Negative Emotions – Change Yourself First – Take Whole Responsibility of Yourself.

Unit – II

Holistic Personality Development: (from BhartruhariNeetiSatakam)

Wisdom (Verses 19, 20, 21, 22) – Pride & Heroism (Verses 29, 31, 32) – Virtues (Verses 26, 28, 63, 65) – Don’ts (Verses 52, 53, 59) – Do’s (Verses 71, 73, 75, 78)

Unit – III

BhagavadGita:

Chapter 2 – Verses 17, 56, 62, 68
Chapter 3 – Verses 13, 21, 27, 35, 36, 37, 42
Chapter 4 – Verses 18, 38, 39
Chapter 6 – Verses 5, 13, 17, 23, 35
Chapter 12 – Verses 13, 14, 15, 16, 17, 18
Chapter 18 – Verses 37, 38, 45, 46, 48, 63

Unit – IV

Vedantic Perspective of Life: Brief discussion of major topics in Understanding Human Nature – Art of Living – Technique of Self Unfoldment

Unit – V

Vivekachudamani: Self-realization is the means of liberation – Means to Self-realization – Qualifications of a Spiritual Aspirant – 4-fold Spiritual Discipline

Unit – VI

Mind and Its Mysteries: What is Mind? Mind and body, Mind and food – Mental faculties – Theory of perception, Memory, Imagination, Thought-Culture, Desires – Cultivation of Virtues, Control of Senses and Mind – Concentration, Meditation and Enlightenment.

Text Books

1. Personality Development, Swami Vivekananda, Advaita Ashrama Publication, ISBN 978817552246
2. Three Satakam of Bharatrhari (Niti, Srngara, Vairagya), P. Gopinath, Rashtriya Sanskrit SansthanPubllication.
3. Bhagavad Gita, Swami Swarupananda, Advaita Ashram Publication.
4. Vedanta – Science of Life, 3 Vols, Swami Chinmayananda, Chinmaya Mission Pub (Vol1 – Understanding Human Nature, Vol2 – Art of Living, Vol3 – Technique of Self-Unfoldment)
5. Message of Vivekachudamani, Swami Ranganadhananda, Advaita Ashrama Publication, ISBN 817553089
6. Mind, Its Mysteries and Control, Swami Sivananda, Divine Life Society Publication.

Reference Books:

1. https://archive.org/download/satakasofbhartri00bharuoft/satakasofbhartri00bharuoft.pdf
2. Bhagavad Gita – Sadhaka Sanjivani, Swami Ramsukhdas, Gita Press Publication (1080, 1081)
3. The Goal and The Way, Swami Satprakashananda, Ramakrishna Math Publication
4. Spiritual Quest, Swami Tapasyananda, Ramakrishna Math Publications, ISBN 8171204562
5. Mind According to Vedanta, Swami Satprakashanada, Ramakrishna Math Publication, ISBN 81712065

ELECTRICAL DRIVES LABORATORY

L	P	C	INT	EXT
0	4	2	40	60

19MPE1101

Course Objectives:

The main objective of the course is to:

•To develop, analyze fully controlled converters, choppers and their functions of all types of power electronic converter drives.

Course Outcomes:

CO1: The students can analyze of fully controlled converters, four quadrant Chopper, ac voltage controllers, and PWM inverters how they are applied on electric drives.

LIST OF EXPERIMENTS:

1. Operation of 3- phase Full-Converter on R & R-L load.
2. Performance & speed control of D.C. drive using 3-phase full Converter.
3. Performance & Operation of a four quadrant Chopper on D.C. Drive
4. Performance & Operation of a 3-phase A.C. Voltage controller on motor load.
5. Single Phase IGBT based PWM Inverter on R & R-L load
6. Operation of 3-phase IGBT based PWM Inverter on R & R-L load.
7. Performance & speed control of 3 phase slip ring Induction motor by Static Rotor Resistance controller.
8. Three phase PWM Pulse generation using PIC Micro controller
9. PIC Microcontroller based speed control of three phase Induction Motor
10. DSP based V/F Control of 3 phase Induction motor

POWER ELELCTRONICS SYTEMS SIMULATION LAB

L	P	C	INT	EXT
0	4	2	40	60

19MPE1102

Course Objectives:

The main objective of the course is to:

- To develop, analyze and experience with principle and working of thyristors, functions of all types of power electronic converter drives.

Course Outcomes:

CO1: The students can analyze how the thyristors can work along with their characteristics, analysis of half controlled and fully controlled converters, choppers, cyclo-converters,

CO2: AC voltage controllers, inverters how they are applied on electric drives by using MATLAB/ SIMULINK.

LIST OF EXPERIMENTS:

Any 10 of the following experiments are to be conducted

1. Switching characteristics of Thyristor, MOSFET,IGBT using PSPICE Simulation
2. PSPICE Simulation of Single phase full converter using RL load with and without LC Filter.
3. PSPICE Simulation of Single phase full converter using RL & E load with and without free wheeling diode
4. PSPICE Simulation of Three phase full converter using RL & E Loads.
5. PSPICE Simulation of single phase AC Voltage controller with PWM control for RL load.
6. PSPICE Simulation of three phase AC Voltage controller using RL load.
7. PSPICE Simulation of single phase inverter with sinusoidal PWM control for R-load
8. PSPICE Simulation of Three phase inverter with Sinusoidal PWM control for R-Load.
9. PSPICE Simulation of single phase current source inverter with RL Load.
10. PSPICE Simulation of dc-dc Boost converter.
11. DC motor with controlled ac rectification using Matlab/Simulink
12. Development and Simulation of 3-phase PWM Inverter with sinusoidal pulse-width modulation using Matlab/Simulink

13. Cascade position control of a DC motor drive (PI controller) using Matlab/Simulink

14. Characteristics of induction machines under balanced and symmetrical conditions for the following using Matlab/Simulink
    a) dq model in synchronous reference frame
    b) dq model in stator reference frame
    c) dq model in rotor reference frame

15. Volts/Hz closed-loop speed control of an induction motor drive using Matlab/Simulink

16. Open-loop Volts/Hz control of a synchronous motor drive using Matlab/Simulink

17. Speed control of a permanent magnet synchronous motor using Matlab/Simulink

18. Capacitor-start capacitor-run single-phase induction motor using Matlab/Simulink

19. Single phase IGBT based fully controlled rectifier with PWM control using Matlab-Simpower blockset

20. Three phase IGBT based ac voltage controller with PWM control using Matlab-Simpower blockset.

POWER ELECTRONIC CONTROL OF AC DRIVES

L	P	C	INT	EXT
3	0	3	40	60

19MPE1009

Course Objectives:

The main objective of the course is to:

- The course provides basic understanding of main principles of VSI and CSI motor drives, control of Induction motors and Synchronous machines and special motors.

Course Outcomes:

CO1: Able to generalize the concept of VSI and CSI fed induction motor drives.
CO2: Able to Analyze the Slip power recovery scheme.
CO3: Able to design vector control of Induction motors drive.
CO4: Able to discuss control schemes of Synchronous machines.
CO5: Able to explain about PMSM- Motor, Brushless dc motor and Variable Reluctance motor drives.

UNIT I:

VSI & CSI fed Induction motor drives: Scalar control- Voltage fed Inverter control-Open loop volts/Hz control-Speed control with 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/Hz control of Current-Fed Inverter drive-Efficiency optimization control by flux program.

UNIT II:

Slip power recovery schemes: Slip-power recovery Drives-Static Kramer drive-Phasor diagram-Torque expression- Speed control of a Kramer drive-Static scherbius drive-Modes of operation.

UNIT III:

Vector control of Induction Motor: Principles of vector control, Direct vector control, derivation of indirect vector control, implementation – block diagram; estimation of flux, flux weakening operation.

UNIT IV:

Control of Synchronous motor drives: Synchronous motor and its characteristics- Control strategies-Constant torque angle control- power factor control, constant flux control, flux weakening operation, Load commutated inverter fed synchronous motor drive, motoring and regeneration, phasor diagrams.

UNIT V:

PMSM and BLDC Drives: Characteristics of permanent magnet, synchronous machines with permanent magnet, vector control of PMSM- Motor model and control scheme. Modeling of PM brushless dc motor, drive scheme -Three-phase full wave Brushless dc motor -Sinusoidal type of Brushless dc motor - current controlled Brushless dc motor Servo drive

UNIT VI:

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

TEXT BOOK:

1. Electric Motor Drives Modeling, Analysis & control -R. Krishnan- Pearson Education

REFERENCE BOOKS:

1. Modern Power Electronics and AC Drives –B. K. Bose-Pearson Publications-
2. Power Electronics control of AC motors – MD Murphy & FG Turn Bull Pergman Press -1st edition-1998
3. Fundamentals of Electrical Drives – G.K. Dubey – Narosa Publications -1995
4. Power Semiconductor drives- G.K. Dubey-Prentice hall.

SWITCHED MODE POWER CONVERTERS

L	P	C	INT	EXT
3	0	3	40	60

19MPE1010

Course Objectives:

The main objective of the course is to:

- Understand the concepts and basic operation of efficient switched-mode power electronic converters including basic circuit operation and magnetic circuit design and transformer isolation in switched-mode power converters.
- Understand how to analyze power circuit and steady-state analysis of Forward and fly-back converters and push pull topologies.
- Understand how to analyze power circuit and steady-state analysis of half bridge and full-bridge converters.
- Understand the averaged circuit models of dc-dc converters and small-signal model and converter transfer functions.
- Understand concept of bode plot, phase and gain margins, bandwidth, controller specifications.
- Understand how to analyze resonant converters and Quasi-Resonant Converters i.e. ZCS and ZVS resonant converters.

Course Outcomes:

CO1: Understand of the basic principles of switch mode power conversion and design Forward and fly- back converters and push pull topologies.

CO2: Analyze and design the half bridge and full-bridge converters.

CO3: Design Small-Signal Model Development and Analysis for switched-mode dc-dc converters using averaging techniques, including the derivation and visualization of converter small-signal transfer functions.

CO4: Analyze the P, PI, PID controller.

CO5: Analyze, modeling and design resonant converters and Quasi-Resonant Converters i.e. ZCS and ZVS resonant converters.

UNIT I:

Single-switch Isolated converters & Push-Pull Converters: Requirement for isolation in the switch-mode converters, transformer connection,Forward and fly-back converters, utilization of magnetic circuits in single switch and push-pull topologies, power circuit and steady-state analysis.

UNIT II:

Isolated Bridge converters: Half bridge and full-bridge converters, Power circuit and steady-state analysis, utilization of magnetic circuits and comparison with previous topologies.

UNIT III:

Dynamic Analysis of dc-dc converters: Formulation of dynamic equation of buck and boost converters, averaged circuit models, linearization technique, small-signal model and converter transfer functions.

UNIT IV:

Controller Design: Review of frequency-domain analysis of linear time-invariant systems, concept of bode plot, phase and gain margins, bandwidth, controller specifications, proportional(P), proportional plus integral (PI), proportional plus integral plus integral controller (PID), selection of controller parameters.

UNIT V:

Resonant Converters:

Classification of Resonant converters-Basic resonant circuits- Series resonant circuit- parallel resonant circuits- Resonant switches.

UNIT VI:

Quasi Resonant Converters: Quasi-Resonant Converters-I: Concept of Zero voltage switching, principle of operation, analysis of M-type and L-type Buck or boost Converters. Quasi-Resonant Converters-II: Concept of Zero current switching, principle of operation, analysis of M-type and L-type Buck or boost Converters.

TEXT BOOKS:

1. Fundamentals of Power Electronics – Robert Erickson and Dragon Maksivimovic, Springer Publications.
2. Power Electronics–Issa Batarseh- John Wiely

REFERENCE BOOKS:

1. Elements of Power Electronics - Philip T.Krein – Oxford University Press
2. Power Electronics, L. Umanand, Tata Mc-Graw Hill.

ANALYSIS OF DYNAMIC SYSTEMS

Program Elective-III

L	P	C	INT	EXT
3	0	3	40	60

19MPE1011

Course Objectives:

The main objective of the course is to:

- To explain the nature of lumped parameters for dynamic system models and their impact on system transient response.
- To manipulate block diagrams and derive various transfer functions of feedback loops.
- To design simple PID controllers based of given control specifications.
- To understand data acquisition and the various parameters chosen in sampling dynamic signals.

Course Outcomes:

CO1: Ability to model electrical systems.
CO2: Ability to select operating points and compute system variables at steady-state conditions using nonlinear models.
CO3: Ability to find stability of a discrete time systems.
CO4: Ability to design controllers by different classical methods.
CO5: Ability to represent the discrete time in state space representation in advance methods

UNIT I:

Sampling & Reconstruction: Introduction, Sampling theorem, Examples of data control systems, Digital to analog conversion and Analog to Digital conversion, sample and old operations, spectrum analysis of sampling process, shifting and scaling operator, periodic and non periodic signals, Linear time invariant systems.

UNIT II:

Z- transforms : z- transform, properties of z-transform, Inverse z-transforms, solving difference equations, pulse transfer function for linear discrete systems, block diagram and analysis of sampled-data systems, z and s–domain relationship, Jury’s stability test, bilinear transformation.

UNIT-III:

Design of discrete data systems: Introduction, digital implementation of analog controllers, PID controllers, lag and lead controllers, phase lead and phase lag controllers in w-domain, design with dead- beat response.

UNIT IV:

State feedback controllers and observers: state feedback and pole placement, tracking problems, observer design, full and reduced order observer design.

UNIT V:

State Space analysis: State Space Representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and it's properties, Methods for Computation of State Transition Matrix. Discretization of continuous time state – space equations.

UNIT VI:

Advanced state space methods: Introduction, Linear Quadratic Problem, Properties of LQR design, Kalman filter, Linear Quadratic Gaussian (LQG) problem, control.

TEXT BOOKS:

1. Control System Engineering, I.J.Nagrath and M.Gopal, New Age International Publishers, (3rd Edition).
2. Design of Feedback Control Systems, Stefane, Shahian, Savant, Hostetter, Oxford University Press, (4th Edition).
3. Nonlinear Control System Analysis by M. Vidyasagar, 2nd edition, PH Inc, 1991.

REFERENCE BOOKS:

1. Automatic Control Systems, Benjamin C.Kuo, (7th Edition).
2. Modern Control Engineering, Ogata, Prentice Hall, (3rd Edition).

INTELLIGENT CONTROL

Program Elective-III

L	P	C	INT	EXT
3	0	3	40	60

19MPE1012

Course Objectives:

The main objective of the course is to:

- This course provides brief overviews of the main areas of intelligent control. The objective here is not to provide a comprehensive treatment. We only seek to present the basic ideas to give a flavor of the approaches in Artificial Neural Networks, Data Pre-Processing and Genetic Algorithm

Course Outcomes:

CO1: Understand the basics of adaptive control systems.
CO2: Understand the fundamentals of fuzzy sets theory and fuzzy-logic control.
CO3: Learn the constructions, properties and uses of neural networks.
CO4: Identify applications of intelligent control systems to specific areas.
CO5: Develop skills to design and implement intelligent control systems.

UNIT I:

Introduction and motivation: Approaches to intelligent control. Architecture for intelligent control. Symbolic reasoning system, rule-based systems, the AI approach. Knowledge representation. Expert systems. Concept of Artificial Neural Networks and its basic mathematical model, McCulloch-Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron. Learning and Training the neural network.

UNIT II:

Data Pre-Processing: Scaling, Fourier transformation, principal-component analysis and wavelet transformations. Networks: Hopfield network, Self-organizing network and Recurrent network. Neural Network based controller Case studies: Identification and control of linear and nonlinear dynamic systems using Matlab-Neural Network toolbox.

UNIT III:

Genetic Algorithm: Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters. Solution of typical control problems using genetic algorithm. Concept on some other than GA search techniques like tabu search and ant- colony search techniques for solving optimization problems.

UNIT IV:

Introduction to crisp sets and fuzzy sets: basic fuzzy set operation and approximate reasoning. Introduction to Fuzzy logic modeling and control of a system. Fuzzification, inference and defuzzification. Fuzzy knowledge and rule bases. Fuzzy modeling and control schemes for nonlinear systems. Self-organizing fuzzy logic control. Implementation of fuzzy logic controller using Matlab fuzzy-logic toolbox.

UNIT V:

Fuzzy logic applications to Drives: Design of Fuzzy PI controller for speed control of DC motor- Flux programming efficiency improvement of three phase induction motor-Induction motor speed control- Slip gain tuning of indirect vector control of induction motor-stator resistance estimation.

UNIT VI:

Neural network applications to Drives: PWM Controller-Selected harmonic elimination PWM-Space vector PWM-Vector controlled drive-feedback signal estimation-speed estimation and flux estimation of induction motor

TEXT BOOKS:

1. Neural Networks: A comprehensive Foundation – Simon Haykins, Pearson Edition, 2003.
2. Fuzzy logic with Fuzzy Applications – T.J.Ross – Mc Graw Hill Inc, 1997.
3. Genetic Algorithms- David E Goldberg.
4. Modern Power Electronics and AC Drives –B.K.Bose-Pearson Publications
5. Artificial Intelligent based Electrical Machines and Drives- Peter Vas, Oxford University Press

REFERENCES BOOKS:

1. Neural Network Design-M.T.Hagan, H. B. Demuth and M. Beale, Indian reprint, 2008.
2. Principles of Neurocomputing for science and Engineering,- Fredric M.Ham and Ivica Kostanic, McGraw Hill, 2001.
3. Neural Network Fundamentals with Graphs, Algorithms and Applications, N.K. Bose and P.Liang, Mc-Graw Hill, Inc. 1996.
4. Intelligent System- Modeling, Optimization and Control- Yung C. Shin and Chengying Xu,CRC Press, 2009.
5. Soft computing & Intelligent Systems- Theory & Applications – N.K.Sinha and Modan M Gupta. Indian Edition, Elsevier, 2007.
6. Fuzzy logic Intelligence, Control, and Information- John Yen and Reza Langari, Pearson Education, Indian Edition, 2003.
7. Fuzzy Control and Fuzzy Systms, Witold Pedrycz, Overseas Press, Indian Edition, 2008.

ADVANCED DIGITAL SIGNAL PROCESSING AND APPLICATIONS

Program Elective-III

L	P	C	INT	EXT
3	0	3	40	60

19MPE1013

Course Objectives:

The main objective of the course is to:

- To have an overview of signals and systems and DFT & FFT Transforms.
- To study the design of IIR & FIR filters.
- To study the applications of DSP techniques in processors and its applications.
- To study the multi rate signal processing.

Course Outcomes:

CO1: Understand types of digital signals and Transforms and its application to signals and systems.

CO2: Design of IIR & FIR filters.

CO3: Understand different DSP processors and basic programming skills.

CO4: Understand multi rate DSP systems

CO5: Design and Implementation of Digital filters using MATLAB.

UNIT I:

Introduction to Digital Signal Processing: Introduction -Linear time invariant systems- A Digital Signal Processing System, The sampling -quantization – Discrete time sequences – Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT, Digital filters Decimation & Interpolation.

UNIT II:

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:

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.

UNIT IV:

FIR digital filter design & Finite word Length effects: 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. Design of computationally efficient FIR digital filters. Introduction- Effects of coefficients on Quantization- Quantization in sampling analog signals-Finite register length effects in realization of Digital Filters- Discrete Fourier transform computations

UNIT V:

Architecture of TMS320LF 2407A & Addressing Modes and Assembly Language Instructions of C2xxx Introduction –Architectural overview – Memory and I/O spaces -Internal architecture–Central Processing Unit (CPU) – Program control. Data formats – Addressing modes–groups of addressing mode – Assembly language instructions.

UNIT VI:

Peripherals (The Event Managers) Event Manager (EV) Functional Blocks-Event Manager (EV) Register Addresses- General-Purpose (GP) Timers -Compare Units- PWM Circuits Associated With Compare Units-PWM Waveform Generation With Compare Units and PWM Circuits- Space Vector PWM- Capture Units- Quadrature Encoder Pulse (QEP) Circuit - Event Manager (EV) Interrupts

TEXT BOOKS:

1. Sanjit K Mitra, " Digital Signals Processing: A Computer Based Approach", Tata McGraw- Hill Publishing Company Limited, 2nd Edition, 2004.
2. Alan Oppenheim. V and Ronald W.Schafer, "Digital Signal Processing", Prentice Hall of India Private. Limited., New Delhi, 1989.

REFERENCE BOOKS:

2. B.Venkatramani, M.Bhaskar "Digital Signal Processors- Architecture, programming and applications", Tata McGraw- Hill Publishing Company Limited.
3. JohnG. Proakis and Manolakis.D.G, "Digital Signal Processing: Principles Algorithms and Applications," Prentice Hall of India, New Delhi, 2004.
4. TMS320F/C24x DSP Controllers-Reference Guide-CPU and Instruction Set
5. TMS320LF/LC240Xa-DSP Controllers-Reference Guide-System and Peripherals.

ENERGY AUDITING, CONSERVATION AND MANAGEMENT

Program Elective-IV

L	P	C	INT	EXT
3	0	3	40	60

19MPE1014

Course Objectives:

The main objective of the course is to:

- This course deals with various energy auditing methods and the equipment used, management of reactive power and their applications in Air conditioning & Refrigeration.

Course Outcomes:

CO1: Students will able to understand the necessity of energy auditing and electricity tariffs.
CO2: Students will able to understand Efficiency of Electrical Equipments.
CO3: Students will able to understand Reactive power management, capacitor sizing.
CO4: Students will able to understand concept of Cogeneration.

UNIT I:

Energy auditing: System approach and end use approach to efficient use of electricity, electricity tariff types, energy auditing, types and objectives, audit instruments, ECO assessment and economic methods, specific energy analysis, minimum energy paths, consumption models, case study.

UNIT II:

Energy Efficiency of Electrical Motors: Electric motors, energy efficient controls and starting efficiency, motor efficiency and load analysis, energy efficient /high efficient motors, case study, load matching and selection of motors

UNIT III:

Energy Efficiency of Transformers

Transformer loading/efficiency analysis, feeder/cable loss evaluation, case study.

UNIT IV:

Reactive Power Management: Reactive power management, capacitor sizing, degree of compensation, capacitor losses, location, placement, maintenance, case study, peak demand controls, methodologies, types of industrial loads, optimal load scheduling, case study, lighting, energy efficient light sources, energy conservation in lighting schemes, electronic ballast, power quality issues, luminaries, case study.

UNIT V:

Cogeneration: Cogeneration, types and schemes, optimal operation of cogeneration plants, case study, variable speed drives, pumps and fans, efficient control strategies, optimal selection and sizing, optimal operation and storage, case study.

UNIT VI:

Electric loads of Heat transfer devices: Electric loads of air conditioning & refrigeration, energy conservation measures, cool storage, types, optimal operation, case study, electric water heating, geysers, solar water heaters, power consumption in compressors, energy conservation measures, electrolytic process.

TEXT BOOKS:

1. Art and Science of Utilisation of Electrical Energy, Partab H., Dhanpat Rai and Sons, New Delhi.
2. Electric Energy Utilization And Conservation, Tripathy S.C., Tata McGraw Hill.

REFERENCE BOOKS:

2. Recommended Practice for Energy Conservation and cost effective planning in Industrial facilities, IEEE Bronze Book, IEEE Inc, USA.
3. Plant Engineers and Managers Guide to Energy Conservation Albert Thumann, P.W, Seventh Edition, TWI Press Inc, Terre Haute.
4. Energy Efficiency Manual, Donald R. W., Energy Institute Press.
5. Guide Book on Promotion of Sustainable Energy Consumption, NESCAP.

NON-CONVENTIONAL ENERGY SOURCES AND APPLICATIONS

Program Elective-IV

L	P	C	INT	EXT
3	0	3	40	60

19MPE1015

Course Objectives:

The main objective of the course is to:

- To familiarize the students with the different types of non conventional energy resources like solar, wind, biomass and ocean energy sources.

Course Outcomes:

CO1: Extend the principles of various renewable energy sources and applications of Solar power in day to day life.
CO2: Examine the working of wind turbines (Horizontal and Vertical Axis Turbines)
CO3: Outline the working of OTEC & Geothermal power plants.
CO4: Generalize the concepts of Bio gas and MHD plants.
CO5: Illustrate the necessity of Hybrid systems.

UNIT I:

Introduction: Introduction to Energy Conversion, Principle of Renewable Energy Systems, Technical and Social Implications, Solar Radiation, Thermoelectric Conversion, Principles of Solar Energy collection, Different types of solar collectors. Solar energy applications, water heaters, air heaters, solar cooling, solar cooking, solar drying and power generation, solar tower concept, solar pump, Introduction to Photovoltaic cells, PV array and PV module.

UNIT II:

Wind energy: Wind energy, Advantages and Disadvantages, Characteristics, Aerodynamics, Power extraction, Types of wind turbines- Horizontal axis and Vertical Axis wind Machines.

UNIT-III:

Ocean & Geothermal Energy: Ocean Thermal Energy Conversion Systems (Open and Closed Cycles), Different types of Tidal power plants- Wave power (Wave Power Conversion Devices, Use of Wave Power), Geothermal Power Plants (Principle of Operation, Indirect Condensing Cycle, Direct Non-Condensing Cycle)

UNIT IV:

BIO- Energy: Energy from Bio-mass, Bio conversion processes. Bio-gas generation, Bio-gas plants various types, Industrial Wastes, Municipal waste, Burning, Plants, Energy from the Agricultural wastes.

UNIT V:

MHD Power Generation & Fuel Cells: Principle of MHD Generators and types of MHD Generators, Fuel cells types and applications.

UNIT-VI:

Hybrid- Energy System: Necessity of Hybrid systems, Diesel Generator and Photo-Voltaic System, Wind-Diesel Hybrid System, Wind- Photovoltaic Systems.

TEXTBOOKS:

1. Non-Conventional Energy Sources, G.D.Rai, Khanna publishers, Fourth Edition, 2009.
2. Wind electrical systems, S.N.Bhadra, D. Kastha, S. Banerjee Oxford University press.

REFERENCE BOOKS:

1. Solar Energy: Principles of Thermal Collection and Storage, Sukhatme, S.P., Tata McGraw-Hill, New Delhi.
2. Fuel Cell Systems, James Larminie , Andrew Dicks , John Weily & Sons Ltd.
3. Wind Energy Explained , J.F.Manwell,J.G.McGowan,A.L.Rogers ,John Weily& Sons Ltd.
4. Renewable Energy Resources Second edition John Twidell and Tony Weir

SMART GRIDS

Program Elective-IV

L	P	C	INT	EXT
3	0	3	40	60

19MPE1016

Course Objectives:

Students will be able to:

1. Understand concept of smart grid and its advantages over conventional grid.
2. Know smart metering techniques.
3. Learn wide area measurement techniques.
4. Understanding the problems associated with integration of distributed generation & its solution through smart grid.

Course Outcomes

Students will be able to:

CO1: Appreciate the difference between smart grid & conventional grid.

CO2: Apply smart metering concepts to industrial and commercial installations.

CO3: Formulate solutions in the areas of smart substations, distributed generation and wide area measurements.

CO4: Come up with smart grid solutions using modern communication technologies

UNIT-I

Introduction to smart grid:

Introduction to Smart Grid, Evolution of Electric Grid-Concept of Smart Grid, Definitions, Need of Smart Grid-Concept of Robust &Self-Healing Grid, Present development & International policies in Smart Grid

UNIT-II

Smart meters:

Introduction to Smart Meters, Real Time Prizing, Smart Appliances-Automatic Meter Reading(AMR)-Outage Management System(OMS)-Plug in Hybrid Electric Vehicles(PHEV)-Vehicle to Grid, Smart Sensors-Home & Building Automation, Smart Substations, Substation Automation, Feeder Automation

UNIT-III

Energy storage devices:

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

UNIT-IV

Introduction to micro grid:

Concept of micro-grid, need & applications of micro-grid-Formation of micro-grid, Issues of inter connection-Protection & control of micro-grid-Plastic & Organic solar cells, thin film solar cells-Variable speed wind generators, fuel-cells, micro-turbines-Captive power plants, Integration of renewable energy sources.

UNIT-V

Power quality issues in smart grid:

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

UNIT-VI

Smart grid communication:

Advanced Metering Infrastructure (AMI), Home Area Network(HAN)-Neighborhood Area Network (NAN), Wide Area Network(WAN)-Bluetooth, ZigBee, GPS, Wi-Fi, Wi-Max based communication-Wireless Mesh Network. Basics of CLOUD Computing &Cyber Security for Smart Grid-Broadband over Power line (BPL). IP based protocols.

TEXT BOOKS:

1. Ali Keyhani, "Design of smart power grid renewable energy systems", WileyIEEE,2011.
2. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response",CRC Press,2009.Ali Keyhani, "Design of smart power grid renewable energy systems", ileyIEEE,2011.
3. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRC Press,2009.

REFERENCE BOOKS:

1. Stuart Borlas'e, "Smart Grid:Infrastructure, Technology and solutions "CRCPress.
2. A.G.Phadke , "Synchronized Phasor Measurement and theirApplications",Springer.

HVDC TRANSMISSION

Program Elective-V

L	P	C	INT	EXT
3	0	3	40	60

19MPE1017

Course objectives:

- To understand the concept, planning of DC power transmission and comparison with AC Power transmission.
- To analyze HVDC converters.
- To study about the HVDC system control.
- To analyze harmonics and design of filters.
- To model and analysis the DC system under study state.

Course outcomes:

CO 1: Understand the basics of HVDC Transmission systems, learning about advantages and disadvantages of DC with AC Transmission.
CO 2: Analyze HVDC converters and characteristics of 6 and 12 pulse converters with and without overlapping.
CO 3: Understand the converter control characteristics, Various controlling methods of converters
CO 4: Illustrate generation of harmonics, its adverse effects and also the design of filters for harmonic elimination. Learn about Multi terminal DC systems.
CO 5: Design of AC filters.

UNIT I
Introduction

DC Power transmission technology – Comparison of AC and DC transmission – Application of DC transmission – Description of DC transmission system – Planning for HVDC transmission – Modern trends in HVDC technology – DC breakers – Operating problems – HVDC transmission based on VSC – Types and applications of MTDC systems.

UNIT II
Analysis of HVDC converters

Line commutated converter – Analysis of Graetz circuit with and without overlap – Pulse number – Choice of converter configuration – Converter bridge characteristics – Analysis of a 12 pulse converters – Analysis of VSC topologies and firing schemes.

UNIT III
Converter and HVDC system control

Principles of DC link control – Converter control characteristics – System control hierarchy – Firing angle control – Current and extinction angle control – Starting and stopping of DC link – Power control – Higher level controllers – Control of VSC based HVDC link.

UNIT IV
Converter fault & protection

Converter Fault & Protection: Converter faults - protection against over current and over Voltage in converter station - surge arresters - smoothing reactors - DC breakers - Audible noise space charge field-corona effects on DC lines-Radio interference.

UNIT V

Harmonics & filters

Harmonics & Filters: Generation of Harmonics-Characteristics harmonics, calculation of AC Harmonics, Non- Characteristics harmonics, adverse effects of harmonics - Calculation ofvoltage & Current harmonics - Effect of Pulse number on harmonics

Types of AC filters, Design of Single and double tuned tuned filters –Design of High pass filters

UNIT VI

Power flow analysis in AC/DC systems

Per unit system for DC quantities – DC system model – Inclusion of constraints – Power flow analysis – case study.

TEXT BOOKS:

1. Edward Wilson Kimbark, "Direct Current Transmission", Vol. I, Wiley interscience, New York, London, Sydney, 1971.

2.Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", New Age International (P) Ltd., New Delhi, 1990.

3. Kundur P., "Power System Stability and Control", McGraw-Hill, 1993.

4.S. Kamakshaiah, V. Kamaraju, 'HVDC Transmission', Tata McGraw Hill Education Private Limited, 2011

REFERENCE BOOKS:

1. Colin Adamson and Hingorani N G, "High Voltage Direct Current Power Transmission", Garraway Limited, London, 1960.

2.Arrillaga, J., "High Voltage Direct Current Transmission", Peter Pregrinus, London, 1983.

FACTS AND CUSTOM POWER DEVICES

Program Elective-V

L	P	C	INT	EXT
3	0	3	40	60

19MPE1018

Course objectives:

- To understand the need for FACTS.
- To learn shunt and series compensation techniques.
- To educate on static VAR compensators and their applications.
- To learn the concept of unified power flow controller.
- To provide knowledge on UPFC.

Course outcomes:

CO1: Transmission line performance without FACTS.
CO2: Transmission line performance with FACTS.
CO3: Construction & operation characteristics of different FACTS.
CO4: Construction & operation characteristics of IPFC
CO5: Construction & operation characteristics of different Custom power Devices

UNIT-I

Flexible ac transmission system: Transmission inter connections, flow of power in ac systems, loading capability, dynamic stability considerations, basic types of FACTS controllers.

UNIT-II

Static shunt compensators: Objectives of shunt compensation, static var compensators, STATCOM configuration, characteristics and control, comparison between STATCOM and SVC.

UNIT-III

Static series compensation: Objectives of series compensation, Variable Impedance type series compensators, switching converter type series compensators, external control for series reactive compensators.

UNIT-IV

UPFC: Principle of operation and characteristics & controllers, independent active and reactive power flow control, comparison of UPFC with the series compensators and phase angle regulators.

UNIT-V

IPFC: Principle of operation and characteristics and control aspects.

UNIT-VI

Custom power devices: Introduction to custom power devices, DSTATCOM and DVR operating principles, their applications In Distribution Systems

TEXT BOOKS:

1. K R Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International Publishers, 2007.
2. X P Zhang, C Rehtanz, B Pal, "Flexible AC Transmission Systems- Modelling and Control", Springer Verlag, Berlin, 2006.

REFERENCE BOOKS:

1. N.G. Hingorani, L. Gyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", IEEE Press Book, Standard Publishers and Distributors, Delhi, 2001.
2. K.S.Sureshkumar , S.Ashok , "FACTS Controllers & Applications", E-book edition, Nalanda Digital Library, NIT Calicut,2003.
3. G T Heydt , Power Quality, McGraw-Hill Professional, 2007.
4. T J E Miller, Static Reactive Power Compensation, John Wiley and Sons, Newyork, 1982.

SCADA SYSTEMS AND APPLICATIONS

Program Elective-V

L	P	C	INT	EXT
3	0	3	40	60

19MPE1019

Course Objectives:
Students will be able to:
1. To understand what is meant by SCADA and its functions.
2. To know SCADA communication.
3. To get an insight into its application.

Course Outcomes
CO1: Describe the basic tasks of Supervisory Control Systems (SCADA) as well as their typical applications**.**
CO2: Acquire knowledge about SCADA architecture, various advantages and disadvantages of each system.
CO3: Knowledge about single unified standard architecture IEC 61850.
CO4: To learn about SCADA system components: remote terminal units, PLCs, intelligent electronic devices, HMI systems, SCADA server.
CO5: Learn and understand about SCADA applications in transmission and distribution sector, industries etc.

UNIT-I
Introduction to SCADA: Data acquisition systems, Evolution of SCADA, Communication technologies.

UNIT-II
Monitoring and supervisory functions, SCADA applications in Utility Automation, Industries SCADA

UNIT-III
Industry SCADA System Components: Schemes- Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Programmable Logic Controller (PLC), Communication Network, SCADA Server, SCADA/HMI Systems

UNIT-IV
SCADA Architecture: Various SCADA architectures, advantages and disadvantages of each system - single unified standard architecture -IEC 61850.

UNIT-V
SCADA Communication: various industrial communication technologies-wired and wireless methods
and fiber optics. open standard communication protocols.

UNIT-VI
SCADA Applications: Utility applications- Transmission and Distribution sector operations, monitoring, analysis and improvement. Industries - oil, gas and water. Case studies, Implementation, Simulation Exercises

TEXT BOOKS:

1. Stuart A. Boyer: “SCADA-Supervisory Control and Data Acquisition”, Instrument Society of AmericaPublications, USA,2004.
2. Gordon Clarke, Deon Reynders: “Practical Modern SCADA Protocols: DNP3, 60870.5 and RelatedSystems”, Newnes Publications, Oxford, UK,2004.

REFERENCE BOOKS:

1. William T. Shaw, “Cybersecurity for SCADA systems”, PennWell Books, 2006.
2. David Bailey, Edwin Wright, “Practical SCADA for industry”, Newnes, 2003.
3. Wiebe, “A guide to utility automation: AMR, SCADA, and IT systems for electric power”,PennWell 1999.

INDUSTRIAL SAFETY
Open Elective

L	P	C	INT	EXT
3	0	3	40	60

19MOE1001

Course Outcomes:

At the end of the course, the student should be able to

1. Understand the types, causes and preventive steps of mechanical and electrical hazards.
2. Identify types of maintenance and apply relevant tools of maintenance.
3. Understand the types, causes, applications of wear and types and prevention methods of corrosion
4. Understand the concepts of fault tracing and decision tree for different machine tools
5. List the applications of periodic maintenance.
6. Illustrate the applications of preventive maintenance.

Unit – I
Industrial safety

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

Unit – II
Fundamentals of maintenance engineering

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

Unit – III
Wearand Corrosionandtheirprevention

Wear- types,causes, effects, wearreduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit – IV
Fault tracing

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

Unit – V

Periodicand preventive maintenance

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance.

Unit – VI

Procedureforperiodicand preventive maintenance

Steps/procedureforperiodicand preventivemaintenance of: I. Machinetools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Books:

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

Reference Books:

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

OPERATIONS RESEARCH

Open Elective

L	P	C	INT	EXT
3	0	3	40	60

19MOE1002

Course Outcomes

On completion of this course, students should be able to

1. Formulate, solve linear programming problem using graphical and simplex method along with its Big-M and 2-Phase variations.
2. Solve both balanced and unbalanced transportation and assignment problems.
3. Students should able to apply the concept of non-linear programming
4. Compute queue performance characteristics for various queuing models.
5. Solve game theory problems by applying standard solution methods.
6. Calculatecritical path for a given network using PERT and CPM techniques.

Unit – I

Linear Programming: Introduction to linear programming problem formulation, Graphical solution, Simplex method, Artificial variables techniques, Degeneracy.

Unit – II

Transportation Problem: Formulation, Optimal solution, unbalanced transportation problems, Degeneracy.

Assignment Problem: Formulation, Optimal solution, Traveling salesman problem.

Unit - III

Nonlinear Programming Problems: Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem.

Unit – IV

Queuing Theory: Characteristics of Queuing models, Classification, (M/M/1):(FCFS/∞/∞), (M/M/1):(FCFS/N/∞), (M/M/C):(FCFS/∞/∞) models.

Unit – V

Theory of Games: Introduction, Two-person Zero-sum games, Maximum-Minimax principle, Games without saddle points, Mixed Strategies, m x 2 & 2 x n games, Graphical solutions, Dominance property, Algebraic solutions to rectangular games.

Unit – VI

Network models: Project network, CPM and PERT, Critical path scheduling, Cost considerations in project scheduling.

Text Books:

1. Introduction to Operations Research by Prem Kumar Gupta, D.S. Hira, S. Chand Publishers
2. Operations Research, S.D.Sharma, Kedarnath Ramanadh Pub.

References Books:

1. Operations Research, J.K. Sharma, MacMilan Pub.
2. Operations Research by P. Rama Murthy, New Age Pub.
3. CPM & PERT, L.S. Srinath, Affiliated East West Press Pu

COMPOSITE MATERIALS

Open Elective

L	P	C	INT	EXT
3	0	3	40	60

19MOE1003

Course Outcomes:

On completion of this course, students should be able to

1. Illustrate the concept and classification of composites
2. Understand fundamental fabrication processes for polymer matrix,
3. Analyze the strengthening mechanism and structural effect on properties of composite materials.
4. Understand the fundamental concepts of metal matrix, and ceramic matrix composites
5. Understand and Predict elastic properties of long fiber and short fiber composites.
6. Design different types of composite by apply the micromechanics principles.

Unit – I

Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

Unit – II

Reinforcements and the reinforcement matrix interface: natural fibers; synthetic organic fibers – aramid, polyethylene; and synthetic inorganic fibers – glass, alumina, boron, carbon, silicon based fibers; particulate and whisker reinforcements, reinforcement-matrix interface – wettability, interfacial bonding, and methods for measuring bond strength.

Unit – III

Metal Matrix Composites: Introduction, important metallic matrices; metal matrix composite processing: solid state processing – diffusion bonding, powder metallurgy; liquid state processing – melt stirring, compocasting (rheocasting), squeeze casting, liquid infiltration under gas pressure; deposition – spray co-deposition and other deposition techniques like CVD and PVD; in situ processes. Interface reactions.

Properties of MMCs – physical properties; mechanical properties like elastic properties, room temperature strength and ductility, properties at elevated temperatures, fatigue resistance.

Unit – IV

Ceramic Matrix Composites: Introduction; processing and structure of monolithic materials – technical ceramics, glass-ceramics. Processing of ceramics: conventional mixing and pressing – cold pressing and sintering, hot pressing, reaction bonding processes, techniques involving slurries, liquid state processing – matrix transfer moulding, liquid infiltration, sol-gel processing, vapour deposition techniques like CVD, CVI, liquid phase sintering, lanxide process and in situ

processes. Processing, properties and applications of alumina matrix composites - SiC whisker reinforced, zirconia toughened alumina; Glass-ceramic matrix composites; Carbon-carbon composites - porous carbon-carbon composites, dense carbon-carbon composites.

Unit – V

Polymer Matrix Composites: Introduction; polymer matrices – thermosetting, thermoplastic, rubbers. Processing of PMCs , Processing, properties and applications of fibre-reinforced epoxies, PEEK matrix composites, rubber matrix composites. Damping characteristics. Environmental effects in polymer matrix composites. Recycling of PMCs.

Unit – VI

Micromechanics of unidirectional composites: micromechanics models for stiffness – longitudinal stiffness, transverse stiffness, shear modulus, Poisson's ratio.

Text Books:

1. Composite Materials: Engineering and Science, by Matthews and Rawlings, CRC Press.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

Reference Books:

1. Composite Materials Science and Engineering, K.K.Chawla, Springer.
2. An Introduction to composite material, by D.Hull and T.W. Clyne, Cambridge University press.
3. Metal Matrix Composites, Thermomechanical Behaviour by M.Taya, and R.J.Arsenault, Pergamon Press, Oxford.
4. Fundamentals of Metal Matrix Composites by S.Suresh, A.Martensen, and A.Needleman, Butterworth, Heinemann
5. Engineering Materials and Their Applications – R. A Flinn and P K Trojan / Jaico Books.

WASTE TO ENERGY
Open Elective

L	P	C	INT	EXT
3	0	3	40	60

19MOE1004

Course Objective:
To deal with various types of wastes generated in the contemporary world and technological options of their exploitation for obtaining useful energy, minimization of wastes.

Course Outcomes:
At the end of the course, students will be able to:

1. Diagnosis the different wastes and their conversion devices.
2. Assess the diverse pyrolysis types of biomass and production methods of different fuel oils.
3. Evaluate the gasification methods of biomass, their design, construction and operation.
4. Suggest the combustion processes of biomass, their design, construction and operation.
5. Analyze the types of biogas plants.
6. Design and develop the biomass conversion processes.

Unit – I
Introduction to Energy from Waste: Classification and Characterization of waste as fuel – Agro based, Forestresidue, Industrial waste – Municipal Solid Waste Conversion devices – Incinerators, gasifiers, digesters.

Unit – II
Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods -Yields and application – Manufacture of pyrolytic oils and gases, yields and applications- Oil from waste plastics - Alcohol production from biomass - Bio diesel production.

Unit – III
Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit – IV
Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs,fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit – V

Biogas: Properties of biogas (Calorific value and composition) - Types of biogas Plants – Applications - Technologyand status of Biogas plants - Bio energy system - Design and constructional features - Biomass energy program in India.

Unit – VI

Biomass: Biomass resources and their classification - Biomass conversion processes – Thermo-chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Urban waste to energy conversion.

Text Books

1. Rogoff, M.J. and Screve, F., "Waste-to-Energy: Technologies and Project Implementation", Elsevier Store - Reprint - 2011.
2. Hall, D.O. and Overeed, R.P.," Biomass - Renewable Energy", John Willy and Sons – Reprint - 1987.
3. Harker, J.H. and Backhusrt, J.R., "Fuel and Energy", Academic Press Inc – Reprint - 1981.
4. EL-Halwagi, M.M., "Biogas Technology- Transfer and Diffusion", Elsevier Applied Science – Reprint - 1984.

References Books

1. Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.
4. Mondal, P. and Dalai, A., "Utilization of natural resources", CRC Press – Published – 2017.
5. Young G.C., "Municipal Solid Waste to Energy Conversion processes", John Wiley and Sons – Reprint – 2010.

DIGITAL SIGNAL PROCESSING LAB

L	P	C	INT	EXT
0	4	2	40	60

19MPE1103

List of Experiments:

PART – A

Write a MATLAB program

1. To generate standard signals in continuous time and discrete time domain.
2. To generate sum of sinusoidal signals having frequencies 300Hz, and 1 KHz.
3. To verify Linear and Circular Convolution.
4. To find frequency response of analog LP/HP filters.
5. To find the Discrete Fourier transform and inverse Discrete Fourier Transform of the given sequence and also find power spectral density.
6. To design FIR (LP/HP) filter using windowing techniques. a. Using Rectangular Window b. Using Triangular Window c. Using Kaiser Window.
7. To design IIR (LP/HP) filter using Chebyshev and Butterworth filtering techniques.
8. To find FFT of given 1-D signal and plot magnitude and phase spectrums.

PART – B

1. To study the architecture of DSP Chips – TMS320C 5X/6X instructions.
2. To implement FIR (LP/HP) filter on DSP Processor using CC Studio.
3. To implement IIR (LP/HP) filter on DSP Processor using CC Studio.

PART – C

Write a SIMULINK program

1. To design FIR (LP/HP) filter using windowing techniques. a. Using Bartlett Window b. Using Hamming Window c. Using Blackman Window.
2. To design IIR (LP/HP) filter using Chebyshev Typr – I, Type – II and Butterworth filtering techniques.