AR-22

COURSE STRUCTURE AND DETAILED SYLLABUS

For

M.Tech

Power Systems and Power Electronics

(DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING)

(Applicable for the batches admitted from 2024-2025)

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 JNTUGV,Vizianagaram
K.Kotturu,Tekkali,Srikakulam-532201,AndhraPradesh.

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K.Kotturu, Tekkali, Srikakulam-532201, Andhra Pradesh

Academic Regulations for M.Tech

(Effective for the students admitted into first year from academic year 2022-2023)

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 student shall register for all 68 credits and secure all the 68 credits.

3.0 ATTENDANCE:

3.1 The minimum instruction for each semester 90 clear instruction days.

3.2 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.

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

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

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

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

3.7 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/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 Minor 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, and Constitution of India and Personality development through life enlightenment skills. The courses included under open electives are of importance in the context of special skill development and they are on Industrial safety, Operation research, Composite materials and Waste to Energy. These courses shall make students capable to work in industrial environment.

4.3 The introduction of Minor project ensures preparedness of students to undertake major projects/ dissertation. Students are encouraged to go to Industrial Training/Internship for at least 2-3 months during semester break. 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 consultation 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 like **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. Evaluation is based on continuous assessment.

5.3 Audit course is one among the compulsory courses and does not carry any Credits and no semester 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 Minor 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 minor project. The internal evaluation shall be made on the basis of seminar given by each student on the topic of his/her minor project, which was evaluated by Departmental committee. The Departmental Committee consists of Head of the Department, supervisor and one other senior faculty member from the Department. Out of **40** internal marks **10** marks allotted for literature survey, **15** marks for results and analysis and **15** marks for seminar.

5.6 For Technical Seminar there will be only internal evaluation for **100** marks. A candidate has to secure a minimum of **50%** marks 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 semester 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 in the next academic year.

6.0 EVALUATION OF DISSERTATION Phase – 1/DISSERTATION Phase – 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 dissertation 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 be completed in the III semester itself and it will be evaluated by DRC as Dissertation Phase – 1. 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.

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	Level	Letter Grade	Grade Points
>= 90%	Outstanding	A+	10
80 to <90%	Excellent	A	9
70 to <80%	Very Good	B	8
60 to <70%	Good	C	7
50 to <60%	Fair	D	6
< 50%	Fail	F	0
-	Absent	AB	0

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:

$$\text{SGPA} = \frac{\Sigma(\text{CR} \times \text{GP})}{\Sigma\text{CR}}$$ (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.

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

The CGPA is calculated as below:

$$CGPA = \frac{\Sigma(CR \times GP)}{\Sigma CR}$$ (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.

As per the AICTE regulations, conversion of CGPA into equivalent percentage as follows:

Equivalent Percentage = (CGPA – 0.75) x 10

After a student has satisfied the requirement 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 below divisions:

Table: Award of Divisions

Class Awarded	CGPA Secured	Remarks
First Class with distinction	≥ 7.75 (Without any supplementary appearance)	From the CGPA secured from 68 Credits
First Class	≥ 6.75	
Second Class	≥ 6.0 and < 6.75	

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 withheld in such cases.

9.0 TRANSITORY 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.

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

COURSE STRUCTURE

Semester	Subject Code	Theory/Lab	L	T	P	C
I	22MPS1001	Programmable Logic Controllers & Applications	3	0	0	3
	22MPS1002	Electrical Drives	3	0	0	3
	XXXXXX	Program Elective – I	3	0	0	3
	XXXXXX	Program Elective – II	3	0	0	3
	22MCC1001	Research Methodology and IPR	2	0	0	2
	22MAC1001 22MAC1002 22MAC1003 22MAC1004	Audit Course: English for Research Paper Writing Disaster Management Constitution of India Personality Development through Life Enlightenment Skills	2	0	0	0
	22MPS1101	Programmable Logic Controllers Lab	0	0	4	2
	22MPS1102	Electrical Drives Lab	0	0	4	2
Total			**16**	**0**	**8**	**18**

Semester	Subject Code	Theory/Lab	L	T	P	C
II	22MPS1009	Power System Dynamics and Stability	3	0	0	3
	22MPS1010	Energy Storage Technologies	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
	22MOE1001 22MOE1002 22MOE1003 22MOE1004	Open Elective: Industrial Safety Operations Research Composite Materials Waste to Energy	3	0	0	3
	22MPS1103	Power Electronic Circuits Simulation Lab	0	0	4	2
	22MPS1201	Minor Project	0	0	4	2
Total			**18**	**0**	**8**	**22**

Semester	Subject Code	Theory/Lab	L	T	P	C
III	22MPS2202	Technical Seminar	0	0	4	2
	22MPS2203	Dissertation Phase – I	0	0	20	10
Total			**0**	**0**	**24**	**12**

Semester	Subject Code	Theory/Lab	L	T	P	C
IV	22MPS2204	Dissertation Phase – II	0	0	32	16
Total			**0**	**0**	**32**	**16**

Program Elective – I

Code	Subject
22MPS1003	Advanced Power System Protection
22MPS1004	Reactive Power Compensation and Management
22MPS1005	Flexible AC Transmission Systems

Program Elective – II

Code	Subject
22MPS1006	Advanced Power Electronic Converters
22MPS1007	Electric and Hybrid Vehicles
22MPS1008	Machine Modelling and Analysis

Program Elective – III

Code	Subject
22MPS1011	Smart Grid
22MPS1012	AI Techniques in Power Systems
22MPS1013	Energy Auditing and Management

Program Elective – IV

Code	Subject
22MPS1014	Switched Mode Power Converters
22MPS1015	Power Electronics for Renewable Energy Systems
22MPS1016	IoT Applications to Electrical Engineering

Program Elective – V

Code	Subject
22MPS1017	HVDC transmission
22MPS1018	Analysis of dynamic systems
22MPS1019	Intelligent control

PROGAMMABLE LOGIC CONTROLLERS & APPLICATIONS

Subject Code: 22MPS1001

L	T	P	C
3	0	0	3

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 programming examples using contacts and coils, Drill press operation.
CO3: Able to learn ladder diagrams for different process control.
CO4: Able to learn the Characteristics of PLC Registers.
CO5: Able to learn PLC Functions with application.
CO6: Able to learn data handling functions with application.

UNIT -I
PLC Basics: Introduction, Advantages and Disadvantages of PLC, PLC system, PLC as a Computer , CPU processor, I/O Modules (Interfaces), programming formats, construction of PLC ladder diagrams, process scanning considerations.

UNIT-II
PLC Programming-I: Types of PLC Programming, PLC Input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation. Digital logic gates.

UNIT -III
PLC Programming-II: Boolean algebra PLC programming, conversion examples, Ladder diagrams for process control: Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT-IV
PLC Registers: Characteristics of Registers, module addressing, holding registers, input registers, output registers.

UNIT -V
PLC Functions: PLC Timer functions and Industrial applications, PLC counters, counter function industrial applications, Arithmetic functions (Addition and Subtraction, Multiplication, Division).

UNIT -VI

Data Handling functions: PLC SKIP function and Applications, Master control Relay function and Applications, Jump function with non-return and with return, PLC Move function with application.

TEXT BOOKS:

1. Programmable Logic Controllers – Principle and Applications by John W. Webb and Ronald A. Reiss, Fifth Edition, PHI
2. Programmable Logic Controllers – Programming Method and Applications by JR. Hackworth and F.D Hackworth Jr. – Pearson, 2004.

REFERENCE BOOKS:

1. Introduction to Programmable Logic Controllers- Gary Dunning Cengage Learning.
2. Programmable Logic Controllers –W.Bolton-Elsevier publisher

ELECTRICAL DRIVES

Subject Code: 22MPS1002

L	T	P	C
3	0	0	3

Course Objectives:

- To understand principle of operation of scalar control of AC motor and corresponding speed torque Characteristics.
- To comprehend the vector control for AC motor drive(IM and SM)
- To explain the static resistance control
- To understand the Slip power recovery schemes
- Toexplainsynchronousmotordrivecharacteristicsanditscontrolstrategies
- To comprehend the principle of operation of brushless DC motor.

Course Outcomes:

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

CO1: Understand Closed loop control of DC Drive.

CO2: Summarize Chopper Controlled DC Motor Drives.

CO3: Understand control of Induction Motor.

CO4: Explains Rotor Side Control of Induction Motor Drives.

CO5: Develop Vector Control of Induction Motor Drives.

CO6: Demonstrate Control of Permanent Magnet Synchronous Motor Drives**.**

UNIT–I:

Rectifier controlled DC motor

Separately excited DC motors and DC series motors with single phase semi converter and single phase full converter, Three-phase controlled converter, control circuit, control modeling of three phase converter, Steady state analysis of three phase converter control DC motor drive, Two quadrant, Three phase converter controlled DC motor drive, DC motor, load and converter.

Closed loop control of DC drive

Current and speed controllers, Current and speed feedback, Design of controllers, Current and speed controllers, Motor equations, Filter in the speed feedback loop speed controller, Current reference generator, Current controller and flowchart for simulation, Harmonics and associated problems, Sixth harmonics torque.

UNIT–II:

Chopper Controlled DC Motor Drives

Principle of operation of the chopper, Chopper with other power devices, Model of the chopper, Input to, Steady state analysis of chopper-controlled DC motor drives.

Closed loop operation:

Speed controlled drive system, Current control loop, Pulse width modulated current controller, Hysteresis current controller, Modeling and Design of current controller.

UNIT–III:

Control of Induction Motor

Introduction to motor drive, Torque production, Analysis of equivalent circuit, Toque – Speed characteristics with Variable voltage, Variable frequency, Constant v/f, Variable stator current operation, Induction motor characteristics in constant torque and field weakening regions.

Stator Side Control

Scalar control, Voltage fed inverter control, Open loop v/f control, Speed control slip regulation, Speed control with torque and flux control, Current controlled voltage fed inverter drive.

UNIT-IV

Rotor Side Control of Induction Motor Drives

Slip power recovery schemes, Static Kramer Drive, Phasor diagram, Torque expression, Speed control of Kramer Drive, Static Scheribus Drive, and Modes of operation.

UNIT–V:

Vector Control of Induction Motor Drives

Principles of Vector control, Direct and Indirect methods of vector control, Adaptive control principles, Self tuning regulator Model referencing control, Direct torque control of AC motors.

UNIT–VI:

Control of Permanent Magnet Synchronous Motor Drives

Synchronous motor and its characteristic, Control strategies, Constant torque angle control, Unity power factor control, Constant mutual flux linkage control, Closed loop operation.

TEXTBOOKS:

1. R.Krishnan,“ElectricMotorDrivesPearsonModeling,Analysisandcontrol”,1stEdition,2002.
2. BKBose,“ModernPowerElectronicsandACDrives”,PearsonPublications,1stEdition.

REFERENCES:

1. MDMurthyandFGTurn,“PowerElectronicsandControlofACMotors”,BullPergmanPress1stEdition.
2. BKBose,“PowerElectronicsandACDrives”,PrenticeHallEaglewooddiffsNewJersey,1StEdition.
3. MHRashid,“PowerElectroniccircuitsDeicesandApplications”,PHI,1995.
4. G.K.Dubey,“FundamentalsofElectricalDrives”,Narosapublications,1995.

ADVANCED POWER SYSTEM PROTECTION

(Professional Elective – I)

Subject Code: 22MPS1003

L	T	P	C
3	0	0	3

Course Objectives: To make the student

- To study the basic concepts and classification of relay operation.
- To understand the protection of transmission lines using distance and over current relays
- To understand the protection of transmission lines using Pilot Wire and Carrier Schemes
- To know the operation of relays for transformer protection.
- To know the operation of relays for generator protection.
- To understand the protection of large motors and bus bars

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

CO1: Describe the concepts and operation of protective relays

CO2: Describe the protection of transmission lines using distance and over current Relays

CO3: Describe the protection of transmission lines using Pilot Wire and Carrier Schemes

CO4: Explore the operation of relays for transformer protection

CO5: Analyze the operation of relays for generator protection

CO6: Explain the protection of large motors and bus bars

UNIT – I

Protective Relays

Basic requirement; classification on the applications; principles of operation; over current relay, directional relay- characteristics and connections; distance relays - impedance, reactance and mho types; differential relays and percentage differential relays- voltage and current balance types; negative sequence relay.

UNIT – II

Protection of transmission lines – I (Over Current and Distance Protection)

Unit and non-unit types; time and current graded systems; setting of relays for coordination; distance protection- impedance, reactance and mho types; three zone distance protection.

UNIT – III

Protection of transmission lines – II (Pilot Wire and Carrier Scheme Protection)

Pilot wire protection using current and voltage balance; Translay system; carrier current protection.

UNIT –IV

Protection of transformers

Types of faults- faults in auxiliary equipments, winding faults, overloads and external short circuits; gas actuated devices- pressure relief device, rate of rise pressure relay, gas accumulator relay; biased differential protection for different transformer connections; earth fault protection; over current protection.

UNIT – V

Protection of generators

Types of faults- stator faults, rotor faults, abnormal running conditions; biased differential protection for different stator connections; protection against earth fault, turn to turn fault, rotor earth fault, loss of field excitation; negative phase sequence protection.

UNIT – VI

Protection of large Motors and Bus bars

Large motors protection

Earth fault Protection, thermal overload protection, differential protection, protection against Stalling, negative phase Sequence protection.

Bus bars protection

Circulating current differential protection and biased percentage differential protection.

Text Books

1. T.S. Madhava Rao, Power system Protection static relay, Tata McGrawHill Publishing Company limited, 2nd Edition, 2004.
2. Badri Ram and D.N. Vishwakarma, Power system Protection and Switchgear, Tata McGraw Hill Publication Company limited, 2nd Edition, 2013.

Reference Books

1. Bhavesh Bhalja, R. P. Maheshwari, N. G. Chothani, Protection and Switchgear, Oxford University Press, 2nd Edition, New Delhi, India, 2018.
2. Oza, B. A., N. C. Nair, R. P. Mehta, et al., Power System Protection & Switchgear, Tata McGraw Hill, New Delhi, 1st Edition, 2011.

REACTIVE POWER COMPENSATION AND MANAGEMENT

(Professional Elective – I)

Subject Code: 22MPS1004

L	T	P	C
3	0	0	3

Course Objectives:

- To identify the necessity of reactive power compensation
- To describe load compensation
- To select various types of reactive power compensation in transmission systems
- To illustrate reactive power coordination system
- To characterize distribution side and utility side reactive power management.
- To identify the methods of reactive power management in traction & furnace.

Course Outcomes: After completion of the course, students will be able to:
CO1: Distinguish the importance of load compensation in symmetrical as Well as unsymmetrical loads
CO2: To understand various compensation methods in transmission lines
CO3: Student can able to construct models for reactive power coordination
CO4: Distinguish demand side reactive power management & capacitor placement
CO5: To understand the user side reactive power management techniques.
CO6: To understand the methods of reactive power management in electric traction and arc furnace

UNIT-I:

Load Compensation

Objectives and specifications, Reactive power characteristics, Inductive and capacitive approximate biasing, Load compensator as a voltage regulator, Phase balancing and power factor correction of unsymmetrical loads.

UNIT-II:

Steady–State Reactive Power Compensation In transmission Systems

Uncompensated line, Types of compensation, Passive shunt and series and dynamic shunt compensation, Examples.

Transient State Reactive Power Compensation in TransmissionSystems

Characteristic time periods, Passive shunt compensation, Static compensation, Series capacitor compensation, Compensation using synchronous condenser.

UNIT-III:

Reactive Power Coordination

Objective, Mathematical modeling, Operation planning, Transmission benefits, Basic conceptsof quality of power supply, Disturbances, Steady–state variations, Effect of under-voltages, Frequency, Harmonics, Radio frequency and electromagnetic interference.

UNIT-IV:

Demand Side Management

Load patterns, Basic methods load shaping, Power tariffs, KVAR based tariffs penalties for voltage flickers and Harmonic voltage levels.

Distribution Side Reactive Power Management

System losses, Loss reduction methods, Examples, Reactive power planning, Objectives, Economics planning capacitor placement.

UNIT-V:

User Side Reactive Power Management

KVAR requirements for domestic appliances, Purpose of using capacitors, Selection of capacitors, Types of available capacitor, Characteristics and Limitations.

UNIT-VI:

Reactive Power Management in Electric Traction Systems andArc Furnaces

Typical layout of traction systems, Reactive power control requirements, Distributiontransformers, Electric arc furnaces, Basic operation, Furnaces transformer, Filter requirements, Remedial measures, Power factor of an arc furnace.

TEXT BOOKS:

1. T.J.E.Miller, “Reactive power control in Electric power systems”, John Wiley and sons, 1982.
2. D.M. Tagare,” Reactive power Management”, Tata McGraw Hill, 2004.

REFERENCES:

1. Wolfgang Hofmann, Jurgen Schlabbach, Wolfgang Just, “Reactive Power Compensation: A Practical Guide”, Wiley Publication, April2012.

FLEXIBLE AC TRANSMISSION SYSTEMS

(Professional Elective – I)

Subject Code: 22MPS1005

L	T	P	C
3	0	0	3

Course Objectives:

- To develop the understanding of uncompensated lines and their behavior under heavy loading conditions.
- To understand the concept and importance controllable parameters of FACTS controllers.
- To emphasize the objectives of Shunt compensation, and basic operation of SVC and STATCOM.
- To analyze the functioning of series controllers like GCSC, TSSC and TCSC

Course Outcomes: Upon the completion of this course, the student will be able to

CO1: Choose proper controller for the specific application based on system requirements
CO2: Understand various systems thoroughly and their requirements
CO3: Able to understand Static Shunt Compensation
CO4: Interpret the control circuits of Shunt Controllers SVC & STATCOM for various CO5: functions viz. Transient stability Enhancement, voltage instability prevention and power oscillation damping
CO5: Detect the Power and control circuits of Series Controllers GCSC, TSSC and TCSC
CO6: Able to familiar with Self And Line Commutated Current Source Converter

UNIT-I: FACTS Concepts

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

UNIT-II: Voltage Source Converters

Single phase three phase full wave bridge converters transformer connections for 12 pulse 24 and48 pulse operation. Three level voltage source converter, pulse width modulation converter,basic concept of voltage source Converters, and comparison of current source converters with voltage source converters.

UNIT-III: Static Shunt Compensation

Objectives of shunt compensation, mid-point voltage regulation voltage instability prevention, improvement of transient stability, Power oscillation damping, Methods of controllable VAR generation, variable impedance type static VAR generators switching converter type VAR generators hybrid VAR generators.

UNIT-IV: SVC and Statcom

The regulation and slope transfer function and dynamic performance, transient stability enhancement and power oscillation damping operating point control and summary of compensator control.

UNIT-V: Static Series Compensators

Concept of series capacitive compensation, improvement of transient stability, power oscillation damping, and functional requirements of GTO thyristor controlled series capacitor (GSC),thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC) Control schemes for GSC TSSC and TCSC.

UNIT-VI: Self and Line Commutated Current Source Converter

Basic concepts, 3 phase full wave rectifier, thyristor based converter, basic concept of current source Converters , current sourced converter with turnoff devices, current sourced versus voltage source converter.

TEXT BOOKS:

1. Hingorani H G and Gyugyi. L " Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems" New York, IEEE Press, 2000.
2. Padiyar.K.R, " FACTS Controllers in Power Transmission and Distribution" New Age Int. Publishers, 2007.

REFERENCES:

1. Zhang, Xiao-Ping, Rehtanz, Christian, Pal, Bikash "Flexible AC Transmission Systems: Modeling and Control", Springer, 2012.
2. Yong-Hua Song, Allan Johns, "Flexible AC Transmission Systems", IET, 1999

ADVANCED POWER ELECTRONIC CONVERTERS

(Professional Elective – II)

Subject Code: 22MPS1006

L	T	P	C
3	0	0	3

Course Objectives:

- To understand various advanced power electronics devices.
- To describe the operation of multi level inverters with switching strategies for high power applications.
- To comprehend the design of resonant converters and switched mode power supplies.

Course Outcomes: After completion of the course, students will able to:

CO1: Identify the application various modern power semiconductor devices
CO2: Analyze and design Series resonant inverters.
CO3: Analyze and design Series resonant inverters
CO4: Develop and analyze resonant converters.
CO5: Identify different levels of multilevel inverters and related topology.
CO6: Design AC or DC switched mode power supplies.

UNIT-I:

Modern Power Semiconductor Devices

Modern power semiconductor devices – Insulated Gate Bipolar Transistor (IGBT) –MOSFET-MOSTurnoffThyristor(MTO)–EmitterTurnOffThyristor(ETO)–IntegratedGate-Commutated Thyristors (IGCTs) – MOS controlled thyristors (MCTs)– Power integrated circuits(PICs)–symbol, structure and equivalent circuit–their driver circuits.

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UNIT-II:

Series resonant inverters

Series resonant inverters–series resonant inverters with unidirectional switches – series resonant inverters with bidirectional switches – analysis of half bridge resonant inverter – evaluation of currents and voltages of a simple resonant inverter – analysis of half bridge and full bridge resonant inverter with bidirectional switches – Frequency response of series resonant inverters – for series loaded inverter – for parallel loaded inverter – For series and parallel loaded inverters –numerical problems.

UNIT-III:

Parallel Resonant Inverters

Parallel resonant inverters – Voltage control of resonant inverters –class E resonant inverter – class E resonant rectifier – evaluation of values of C's and L's for class E inverter and Class E rectifier–numerical problems.

UNIT-IV:

Resonant Converters

Resonantconverters–zerocurrentswitchingresonantconverters–LtypeZCSresonantconverter –

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

UNIT-V:

Multilevel Inverters

Multilevel concept – Classification of multilevel inverters – Diode clamped multilevel inverter – principle of operation–main features–improved diode Clamped inverter–principle of operation flying capacitors multilevel inverter-principle of operation–main features–cascaded multilevel inverter– principle of operation–main features.

UNIT-VI:

D.C&A.C Power Supplies

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

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

TEXTBOOKS:

1. MohammedH.Rashid–"PowerElectronics"–PearsonEducation-ThirdEdition–firstIndianreprint-2004.
2. NedMohan,ToreM.UndelandandWilliamP.Robbins-"PowerElectronics"–JohnWiley&Sons–SecondEdition.

REFERENCES:

1. MillimanShepherdandLizang–"Powerconverterscircuits"–Chapter14(Matrixconverter)PP-415-444,
2. M.H.Rashid-Power electronics handbook–
3. MarianP.Kaźmierkowski,RamuKrishnan,FredeBlabjergEdition:"Controlinpowerelectronics"illustratedPublishedbyAcademicPress,2002.
4. NPTELonlinecourse,"PulsewidthModulationforPowerElectronicConverters"Dr.,G.Narayanan.

ELECTRIC AND HYBRID VEHICLES

(Professional Elective – II)

Subject Code: 22MPS1007

L	T	P	C
3	0	0	3

Course Objectives: To make the student

- Analyze the components of an EV and identify the importance of EVs in recent issues related to air pollution and Electric mobility policies in India coupled with energy costs.
- Differentiate the characteristics of series and parallel HEV.
- Develop a model of an Electric Vehicle.
- Analyze the characteristics of various electric motor drive systems for HEVs and identify a suitable motor drive system for HEVs.
- Analyze the characteristics of various energy storage systems and identify a suitable energy storage system for a Hybrid Electric Vehicle.

Course Outcomes (CO): Student will be able to

CO1: Identify the importance of EVs in present days
CO2: Analyze the performance of EVs
CO3: Identify the difficulties in modeling of an EV
CO4: Develop model of an EV by considering Tractive Effort
CO5: Develop model of an EV with its range and acceleration
CO6: Analyze the configuration and characteristics of DC motor Drives

UNIT I Electric Vehicles
Introduction, Components, vehicle mechanics – Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion - Propulsion System Design.

UNIT II Battery
Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design, Properties of Batteries.

UNIT III DC & AC Electrical Machines
Motor and Engine rating, Requirements, DC machines, Three phase A/c machines, Induction machines, permanent magnet machines, switched reluctance machines.

UNIT IV Electric Vehicle Drive Train
Transmission configuration, Components – gears, differential, clutch, brakes regenerative braking, motor sizing.

UNIT V Hybrid Electric Vehicles
Types – series, parallel and series, parallel configuration – Design – Drive train, sizing of components.

UNIT VI Energy Storage

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

TEXT BOOKS:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRCPress,2003.
2. MehrdadEhsani,YimiGao,SebastianE.Gay,AliEmadi,ModernElectric,HybridElectricandFuelCellVehicles:Fundamentals,TheoryandDesign,CRCPress,2004.JamesLarminie,JohnLowry,ElectricVehicleTechnologyExplained,Wiley,2003.

REFERENCE BOOKS:

1. Fundamentals of Hybrid and Electric Vehicles by Prof. K.C.Jain (Author), Dr.Amit R.Patil (Author), Dr. Arvind J. Bhosale (Author).

NPTEL:

https://archive.nptel.ac.in/courses/108/103/108103009/

MACHINE MODELLING AND ANALYSIS

(Professional Elective – II)

Subject Code: 22MPS1008

L	T	P	C
3	0	0	3

Course Objectives:

The main objective of the course is to provide an in-depth knowledge about various fundamentals, modelling and analysis of AC & DC machines using generalized machine theory

Course Outcomes:

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

CO1: Able to understand Principles of electromagnetic energy conversion.
CO2: Able to develop torque equation in Kron's primitive Machine and determine the dynamic model of a DC machine.
CO3: Able to understand Real time model of a two-phase induction machine
CO4: Able to Determine the dynamic model & Small signal model of three phase induction machine based on the dq_0 Transformation and which leads to understand advanced control strategies such as vector control and direct torque control of three phase induction machine.
CO5: Analyze and model the Symmetrical and Unsymmetrical Two-phase induction machine.
CO6: 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. Generalized Theory of Electrical Machines – P.S.Bimbra-Khanna publications-5thEdition-1995
3.Electric Machinery-Charles Kingsle,Jr.,A.E. Fitzgerald, Stephen D.Umans-Tata Mcgraw Hill

REFERENCE BOOKS:

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

RESEARCH METHODOLOGY AND IPR

Subject Code: 22MCC1001

L	T	P	C
2	0	0	2

COURSE OUTCOMES:

On completion of this course, students should be able to
CO1. Understand research problem formulation.
CO2. Analyze research related information
CO3. 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 needofinformationaboutIntellectualPropertyRighttobepromotedamong 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.

Textbooks
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, Chawlaand Sondhi, Vikas
3. Ranjit Kumar,2ndEdition,"ResearchMethodology:AStepbyStepGuide for beginners"
4. Halbert,"ResistingIntellectualProperty",Taylor&FrancisLtd,2007
5. RobertP.Merges,PeterS.Menell,MarkA.Lemley, "IntellectualProperty in New Technological Age", 2016.

ENGLISH FOR RESEARCH PAPER WRITING

(Audit Course)

Subject Code: 22MAC1001

L	T	P	C
2	0	0	0

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

Textbooks

1. GoldbortR(2006). *Writing for Science*. Yale University Press.
2. DayR(2006).*How to Write and Publish a Scientific Paper*. Cambridge University Press.
3. HighmanN(1998).*Hand book of Writing for the Mathematical Sciences*, SIAM. Highman's book .

DISASTER MANAGEMENT
(Audit Course)

Subject Code: 22MAC1002

L	T	P	C
2	0	0	0

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 landslides

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 landslides

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.

Textbooks

1. Natural Hazards in the Urban Habitat" by Iyengar,C.B.R.I.,Tata McGraw Hill.
2. Natural Disaster management",Jon Inglet on(Ed),TulorRose
3. Disaster Management",R.B.Singh(Ed),RawatPublications,2006
4. Anthropology of Disaster management", Sachindra Narayan, GyanPublishingHouse,2000

CONSTITUTION OF INDIA

(Audit Course)

Subject Code: 22MAC1003

L	T	P	C
2	0	0	0

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 administration.
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: 42^{nd}amendment (Mini Constitution) - 44^{th}amendment (1978 – Janatha Govt.)

Unit–III

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: 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 - NationalEmergency–Article352President Rules –Article356-FinancialEmergency– Article 360Prime Minister and Cabinet - Supreme Court of India (Indian Judiciary)

Unit–V

Indian Federalism: Union – State relations; - Legislative, Administrative and Financial relations .LokSabha, Rajya Sabha,Vidhan Sabha & Vidhan Parishad -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–148to150)-Finance Commission(Article–280)-NeethiAayog(Planning Commission) and - Political Parties.

Textbooks:

1) D.DBasu–Indian Constitution.
2) Dr.D.Surannaidu–Indian Political System.
3) Madhav Khosla–The Indian Constitution.

Reference Books:

1) The Constitution of India,1950(BareAct),Government Publication.
2) M.P.Jain, IndianConstitutionLaw,7thEdn., LexisNexis,2014.

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

(Audit Course)

Subject Code: 22MAC1004

L	T	P	C
2	0	0	0

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. Knowthevedanticperspectiveoflifewithregardstounderstandinghumannature,artof 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 Bhartruhari Neeti Satakam)
Wisdom(Verses19,20,21,22)–Pride&Heroism(Verses29,31,32)–Virtues(Verses26,28, 63,65)– Don'ts(Verses52,53,59)–Do's(Verses71,73,75,78)

Unit – III

BhagavadGita:

Chapter 2–Verses17,56,62,68
Chapter 3–Verses 13,21,27,35,36,37,42
Chapter4–Verses 18,38,39
Chapter6–Verses5,13,17,23,35
Chapter12–Verses 13,14,15,16,17,18
Chapter18–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–Meansto Self-realization– Qualifications of a Spiritual Aspirant – 4-fold Spiritual Discipline

Unit–VI

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

TextBooks

1. Personality Development, Swami Vivekananda ,Advaita Ashrama Publication, ISBN 978817552246
2. Three Satakam of Bharatrhari(Niti,Srngara,Vairagya),P.Gopinath,Rashtriya Sanskrit Sansthan Publlication.
3. Bhagavad Gita,Swami Swarupananda,Advaita AshramPublication.
4. Vedanta – Science of Life, 3 Vols, Swami Chinmayananda, Chinmaya Mission Pub (Vol1–UnderstandingHumanNature,Vol2 –ArtofLiving,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. BhagavadGita–Sadhaka Sanjivani, SwamiRamsukhdas, GitaPress Publication(1080, 1081)
3. The Goal and The Way, Swami Satprakashananda,RamakrishnaMath Publication
4. Spiritual Quest, SwamiTapasyananda,Ramakrishna Math Publications, ISBN8171204562
5. MindAccordingtoVedanta,SwamiSatprakashanada,Ramakrishna Math Publication,ISBN 81712065

PROGRAMMABLE LOGIC CONTROLLERS LAB

Subject Code: 22MPS1101

L	T	P	C
0	0	4	2

Course objective:
To enable the students to gain sufficient knowledge on the programmable logic controller & SCADA and their applications.

Course outcomes: Student will be able to

CO1: Develop the ladder logic diagram for Boolean logic gates.
CO2: Develop the ladder logic diagram for Boolean logic expressions.
CO3: Develop the ladder logic diagrams for timers, counters and their combinations.
CO4: Develop the ladder latching logic diagram for counters and timers.
CO5: Develop ladder logic for various practical applications using timers
CO6: Development of ladder logic for various practical applications using timers and counters.

1. Switch on light/off light for logic gates - AND, OR, NOT, NOR, NAND, XOR, XNOR by using Ladder Logic with PLC and SCADA monitoring.

2. Switch on light/off light for logic gates HALF ADDER, FULL ADDER by using Ladder Logic with PLC and SCADA monitoring.

3. Develop the ladder logic for the given Boolean logic function before and after simplification with PLC and SCADA monitoring.

4. Switch on light/off light with timers (on Delay and Off Delay) , counters (up & Down) and their combination by using Ladder logic with PLC and SCADA monitoring.

5. Switch on light/ off light with timers and switch on light/off light with counter by using Ladder latching logic with PLC and SCADA monitoring.

6. Develop small ladder logic programs for traffic signal control with PLC and SCADA monitoring.

7. Develop a ladder logic program that will flash a light once every one second with PLC and SCADA monitoring

8. Develop ladder logic with for the motor which is controlled by two switches PLC and SCADA monitoring. (using Counters only)

9. Develop ladder logic for the motor which is controlled by two switches with PLC and Scada monitoring.(using Timers and counters)

10. Develop ladder logic for microwave oven operation using PLC and SCADA monitoring.

11. Develop ladder logic for conveyor run by switching on or off a motor with PLC and SCADA monitoring.

12. To study the variable frequency drive based 3phase induction motor operation by key pad.

ELECTRICAL DRIVES LAB

Subject Code: 22MPS1102

L	T	P	C
0	0	4	2

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: Experiment with speed control of 3-Phase induction motor with static rotor resistance control, ac voltage controller and DSP based v/f control
CO2: Experiment with speed control DC motor with 3-Phase fully controlled converter and four quadrant chopper.
CO3: Analyze power factor correction boost converter.
CO4: Study the operation of forward and fly back converter.
CO5: Able to understand the operation of 3phase slip ring Induction motor by Static Rotor Resistance controller.
CO6: Able to understand the DSP based V/F Control of 3 phase Induction motor

LISTOF EXPERIMENTS:

1. Operationof3-phaseFull-Converter on R &R-L load.
2. Performance&speedcontrolofD.C.driveusing3-phasefullConverter.
3. Performance &Operation of a four quadrant Chopper on D.C. Drive.
4. Performance&Operationofa3-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 3phase slip ring Induction motor by Static Rotor Resistance controller.
8. Three phase PWM Pulse generation using PIC Microcontroller.
9. PIC Microcontroller based speed control of three phase Induction Motor.
10. DSP based V/F Control of 3phase Induction motor.

POWER SYSTEM DYNAMICS AND STABILITY

Subject Code: 22MPS1009

L	T	P	C
3	0	0	3

Course Objectives:

- To study the model of synchronous machines.
- To study the stability studies of synchronous machines.
- To study the solution method of transient stability.
- To study the effect of different excitation systems.

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

CO1: Determine the model of synchronous machines.
CO2: Know the stability studies of synchronous machines.
CO3: Get the knowledge of solution methods of transient stability.
CO4: Get the knowledge about governor and excite action
CO5: Know the effect of different excitation systems in power systems.
CO6: Familiar with different excitation methods.

UNIT-I

System Dynamics: Synchronous machine model in state space from computer representation for excitation and governor system –modeling of loads and induction machines.

UNIT-II

Steady state stability – steady state stability limit – Dynamics Stability limit – Dynamic stability analysis – State space representation of synchronous machine connected to infinite bus- time response – Stability by eigen value approach.

UNIT-III

Digital Simulation of Transient Stability: Swing equation machine equations – Representation of loads – Alternate cycle solution method – Direct method of solution – Solution Techniques: Modified Euler method – Runge Kutta method – Concept of multi machine stability.

UNIT-IV

Stability: Effect of governor action and excite on power system stability, effect of saturation, saliency & automatic voltage regulators on stability.

UNIT-V

Excitation Systems I : Rotating Self-excited Exciter with direct acting Rheostatic type voltage regulator – Rotating main and Pilot Exciters with Indirect Acting Rheostatic Type Voltage Regulator

UNIT-VI

Excitation Systems II :

Rotating Main Exciter, Rotating Amplifier and Static Voltage Regulator – Static excitation scheme – Brushless excitation system.

TEXT BOOKS :

1. Power System Stability by Kimbark Vol. I&II, III
2. Power System control and stability by Anderson and Fund

REFERENCE BOOKS :

1.Power systems stability and control by PRABHA KUNDUR
2. Computer Applications to Power Systems–Glenn.W.Stagg &Ahmed.H.El.Abiad
3.Computer Applications to Power Systems – M.A.Pai
4.Power Systems Analysis & Stability – S.S.Vadhera Khanna Publishers

ENERGY STORAGE TECHNOLOGIES

Subject Code: 22MPS1010

L	T	P	C
3	0	0	3

Course Objectives:

The objectives of this course is to acquire knowledge on

- Need of energy storage and different types of energy storage.
- Thermal, magnetic, electrical and electrochemical energy storage systems.
- Emerging needs for EES pertaining to Renewable energy
- Types of electrical energy storage systems
- Types of Batteries & Fuel cells and their applications
- Applications of Electrical Energy Storage

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

CO1: Identify the need of energy storage& different types of energy storage in the power systems
CO2: Classify Thermal, magnetic, electrical and electrochemical energy storage systems.
CO3: Illustrates standards of electrical energy storage systems & technical comparison of EES.
CO4: Standards of electrical energy storage systems & technical comparison of EES.
CO5: Identify the types of Batteries & Fuel cells and their applications
CO6: Illustrates the applications of Electrical Energy Storage

UNIT - I: Introduction:
Necessity of energy storage, different types of energy storage, mechanical, chemical, electrical, Electrochemical, biological, magnetic, electromagnetic, thermal, comparison of energy storage Technologies

UNIT - II: Energy Storage Systems:
Thermal Energy storage-sensible and latent heat, phase change materials, Energy and exergy analysis of thermal energy storage, Electrical Energy storage-super-capacitors, Magnetic Energy storage Superconducting systems, Mechanical-Pumped hydro, flywheels and pressurized air energy storage, Chemical-Hydrogen production and storage.

UNIT - III Needs for Electrical Energy Storage:
Emerging needs for EES, more renewable energy-less fossil fuel, Smart Grid uses - the roles of electrical energy storage technologies-the roles from the viewpoint of a utility-the roles from the viewpoint of consumers-the roles from the viewpoint of generators of renewable energy.

UNIT - IV: Types of Electrical Energy Storage systems:
Electrical storage systems, Double-layer capacitors (DLC), Superconducting magnetic energy storage (SMES), super charging stations, Thermal storage systems, Standards for EES, Technical comparison of EES technologies.

UNIT-V: Batteries & Fuel cells

Batteries-classification of batteries-difference between primary and secondary batteries- lead acid batteries - nickel cadmium batteries- lithium ion batteries- applications of batteries.

Concept of fuel cell - classification of fuel cells- working of alkaline fuel cell, phosphoric acid fuel cell, polymer electrolyte membrane fuel cell ,molten carbonate fuel cell and solid oxide fuel cell - advantages ,disadvantages and applications of fuel cells.

UNIT - VI: Design and Applications of Electrical Energy Storage:

Renewable energy storage-Battery sizing and stand-alone applications, stationary (Power Grid application), Small scale application-Portable storage systems and medical devices, Mobile storage Applications- Electric vehicles (EVs), types of EVs, future technologies, hybrid systems for energy storage.

TEXT BOOKS:

1. Energy Storage - Technologies and Applications by Ahmed FaheemZobaa, InTech
2. Fundamentals of Energy Storage by J. Jensen and B. Sorenson, Wiley-Interscalene, NewYork,
3. Energy Storage: Fundamentals, Materials and Applications, by Huggins R. A., Springer.

REFERENCE BOOKS:

1. Thermal energy storage: Systems and Applications by Dincer I. and Rosen M. A., Wileypub.
2. Energy Storage: Fundamentals, Materials and Applications, by Huggins R. A., Springer.
3. Electric & Hybrid Vehicles by G. Pistoia, Elsevier B. V.
4. Fuel cell Fundamentals by R. O' Hayre, S. Cha, W. Colella and F. B. Prinz, Wiley Pub.

SMART GRID
(Professional Elective III)

Subject Code: 22MPS1011

L	T	P	C
3	0	0	3

Course Objective:

To provide students with a working knowledge of fundamentals and development of Smart Grid, from the basic concepts of power systems.

Course outcomes:

After completion of course students will be able to

CO1: Understand the concept of smart grid, its need ,opportunities ,challenges.

CO2: Explain about various types of meters used in smart grid such as real time pricing, outage management system, smart sensor etc.

CO3: Explain different types substations, their automation, smart storage systems and phase measurement units.

CO4: Apply the concept of micro grid, address the issues such as interconnection, protection and control of micro grid, the different energy sources feeding the micro grid.

CO5: Analyze different types of power quality issues, power quality conditioners and power quality monitoring.

CO6: To apply information and communication technology to smart grid.

UNIT-I

Introduction to Smart Grid: Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & challenges of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self- healing Grid, Present development& International policies on Smart Grid.

UNIT-II

Smart Grid Technologies: Part 1: 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 Sensor.

UNIT-III

Smart Grid Technologies: Part2: Smart Substations, Substation Automation, Feeder Automation. Geographic Information System (GIS), Intelligent Electronic Devices (IED), Smart storage like Battery, SMES, Wide Area Measurement System (WAMS), Phase Measurement Unit(PMU).

UNIT-IV

Micro grids and Distributed Energy Resources: Concept of micro grid, need & applications of micro grid, formation of micro grid, Issues of interconnection, protection & control of micro grid. Thin film solar cells, Variable speed wind generators, fuel cells, micro turbines, Integration of renewable energy sources.

UNIT-V

Power Quality Management 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

Information and Communication Technology for Smart Grid: Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN).

TEXTBOOKS:

1. AliKeyhani,MohammadN.Marwali,MinDai"Integration of Green and Renewable Energy in Electric Power Systems", Wiley ClarkW. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response",CRCPress
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama,"Smart Grid:Technology and Applications",Wiley

AI TECHNIQUES IN POWER SYSTEMS
(Professional Elective III)

Subject Code: 22MPS1012

L	T	P	C
3	0	0	3

Course Objectives:

- To provide insight into fundamentals of Artificial Intelligence Techniques to the students
- To understand fuzzy logic, Artificial Neural Networks, Genetic Algorithms & Evolutionary Programming
- To convey application of Artificial Intelligence techniques in power system.

Course Outcomes:

After completion of the course, students will be able to:
CO1: Understand the concepts of artificial intelligence techniques.
CO2: Categorize feed forward and feedback neural networks.
CO3: Realize the concepts of Fuzzy Logic
CO4: Identify fuzzy and neural network Control Principles
CO5: Examine the concept of genetic algorithm
CO6: Apply ANN, fuzzy logic control and GA to Electrical engineering problems

UNIT-I: Artificial Neural Networks:
Biological foundations to intelligent Systems, Artificial Neural Networks, Single layer andMultilayer Feed Forward NN, LMS and Back Propagation Algorithm, Feedback networks and Radial Basis Function Networks.

UNIT-II: ANN Paradigms:
Perceptron, Limitations of the Perceptron Model, Back propagation Algorithm with example problem, Radial Basis Function Network, Hopfield Network.

UNIT-III: Fuzzy Logic Principles:
Fuzzy Logic, Membership Functions, Operations on Fuzzy Sets, Fuzzy System, Knowledge Representation and Inference Mechanism, Defuzzification Methods. Fuzzy Neural Networks and their learning methods.

UNIT-IV: Fuzzy and Neural network Control:
Concept of Fuzzy Control, Historical Perspective, Control Principle, -Radial Basis Function Network, Kohonen's Self-Organizing Feature Map Network, System Identification using Fuzzy and Neural Network.

UNIT-V:

Genetic Algorithms:

Introduction, Fitness Function, Reproduction operators, Genetic operators, Reproduction cross over, Mutation, Introduction to evolutionary program.

UNIT-VI: Applications of AI Techniques:

Applications of above mentioned techniques to practical problems, Load flow studies, Economic load dispatch, Load frequency control, Single area system and two area system.

TEXTBOOKS:

1. J M Zurada , "An Introduction to ANN", Jaico Publishing House.
2. Simon Haykins, "Neural Networks", Prentice Hall.

REFERENCES:

1. Timothy Ross, "Fuzzy Logic with Engg.Applications", McGraw Hill.
2. Driankov, Dimitra, "An Introduction to Fuzzy Control", Narosa Publication.
3. Golding, "Genetic Algorithms", Addison-Wesley Publishing Com.

ENERGYAUDITING AND MANAGEMENT
(Professional Elective III)

Subject Code: 22MPS1013

L	T	P	C
3	0	0	3

Course Objectives: To make the student

- To understand the current energy scenario and importance of energy conservation
- To Analyze the operating principle of energy efficient motors and power factor improvement methods.
- To acquire the knowledge about different energy efficient devices
- To measure thermal efficiency and other renewable resources.
- To design suitable energy monitoring system to analyze and optimize the energy consumption in an electrical system.

Course Outcomes (CO): Student will be able to

CO1: Understand the current energy scenario, Role of Energy Managers and Energy Audit

CO2: Understand the operating principle of energy efficient motors and power factor improvement methods.

CO3: Acquire the knowledge about different case studies and potential energy savings

CO4: Measure efficiency and performance in various devices.

CO5: Identify the equipment and areas of a system where energy conservation and Audit is necessary

CO6: Understand Economic evaluation of energy conservation measures.

UNIT – I: ENERGY AUDIT AND DEMAND SIDE MANAGEMENT (DSM) IN POWER UTILITIES

Energy Scenario & Conservation -Demand Forecasting Techniques- Integrated Optimal Strategy for Reduction of T&D Losses - DSM Techniques and Methodologies- Loss Reduction in Primary and Secondary Distribution system and Role of Energy Managers – Energy Audit-Metering.

UNIT – II: ENERGY EFFICIENT MOTORS AND POWER FACTOR IMPROVEMENT

Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics – variable speed , variable duty cycle systems.

Power factor – Need of power factor -methods of improvement of power factor, location of capacitors.

UNIT – III: ENERGY AUDIT

Energy audit concepts - Basic elements and measurements - Mass and energy balances - Scope of energy auditing in industries - Evaluation of energy conserving opportunities and environmental management - Preparation and presentation of energy audit reports - case studies and potential energy savings.

UNIT – IV: INSTRUMENTATION

General Audit Instrumentation –Measuring building losses – Applications of IR thermo graphy – Measurement of electrical system performance – Measurement of heating, ventilation, air conditioning system performance.

UNIT – V: ENERGY CONSERVATION

Energy conservation in thermal power plants, Solar systems, Fan and Lighting Systems - Different light sources and luminous efficiency.

UNIT – VI: ECONOMIC EVALUATION OF ENERGY CONSERVATION

Energy conservation in electrical devices and systems - Economic evaluation of energy conservation measures - Electric motors and transformers - Inverters and UPS - Voltage stabilizers.

TEXTBOOKS:

1. Frank kreith and D. Yogi goswamy/ Editors, "Energy Management and conservationhandbook". NewYork,2008.
2. WC Turner: Energy Management Handbook, Seventh Edition, (Fairmont Press Inc., 2007)
3. YP Abbi and Shashank Jain: Handbook on Energy Audit and Environment Management, (TERIPress, 2006)

REFERENCE BOOKS:

1. Albert Thumann, and William J. Younger, "Handbook of Energy Audits", Marcel Dekker,Inc., Newyork, 6th edition, 2003.
2. D.A.Reay, Industrial Energy Conservation-Pergamon Press, 1980.
3. T.L.Boten, LiptakB.G.,(Ed)Instrument Engineers Handbook, Chinton Book Company, 2004.
4. Hodge B.K, Analysis and Design of Energy Systems, Prentice Hall, 2002.
5. Larry C.Witte, Schmidt & Brown, Industrial energy management and utilization. Hemisphere publishing, Co.NewYork,1988.

SWITCHED MODE POWER CONVERTERS
(Professional Elective IV)

Subject Code: 22MPS1014

L	T	P	C
3	0	0	3

Course Objectives: To make the student
- Remember and understand the concept of advanced converter topologies.
- Apply the concept of topologies for various switching regulators.
- Analyze the working and waveforms of the converters designed.
- Evaluate the operation of converters in continuous and discontinuous modes.

Course Outcomes (CO): Student will be able to

CO1: Remember and understand the concept of Buck and Boost switching regulator topologies push pull & forward converter ,voltage& current fed topologies.

CO2: Apply the concept of topologies for various switching regulators.

CO3: Analyze the concepts of half &full bridge converter topologies

CO4: Evaluate the operation of continuous and dis-continuous Fly back converter topologies

CO5: Familiar with Voltage-Fed and Current-Fed Topologies.

CO6: Understands Resonant Converters

UNIT–I: FUNDAMENTAL SWITCHING REGULATORS–BUCK AND BOOST TOPOLOGIES

Buck Switching Regulator Topology: Basic Operation - Significant Current waveforms -Buck regulator efficiency-Design relations of output filter inductor and capacitor. Boost Switching Regulator Topology: Basic Operation – Quantitative relations –Discontinuous and Continuous modes-Design relations.

UNIT–II: PUSH-PULL AND FORWARD CONVERTER TOPOLOGIES

Push-PullTopology:BasicOperation–Master/slaveoutputs-Fluximbalance-Powertransformer design relations - Primary, secondary peak and RMS currents - output power and input voltage limitations - output filter design relations. Forward Converter Topology: Basic operation -Design relations - Slave output voltages -secondary load -freewheeling diode andinductorcurrents.Forwardconverterwithunequalpowerandresetwindingturns-powertransformerdesignandoutputfilterdesign.

UNIT–III: HALF AND FULL BRIDGE CONVERTER TOPOLOGIES

Half Bridge Converter Topology: Basic operation-Half bridge magnetic output filter calculations, blocking capacitor to avoid fluxed balance-Half bridge leakage inductance problems. Full Bridge Converter Topology: Basic operation-Full Bridge magnetic–output filter calculations–transformer primary blocking capacitor.

UNIT–IV: FLYBACK CONVERTER TOPOLOGIES

Discontinuous-Mode Fly backs: Basic operation - relation between output voltage versus input voltage on time output load - design relations and sequential decision requirements –fly back converter, disadvantages. Continuous Mode Fly backs: Basic operation - Discontinuous mode tocontinuousmodetransition-designrelations–continuousmodeflybacks.

UNIT–V: VOLTAGE-FED AND CURRENT-FED TOPOLOGIES

Definitions-deficiencies of voltage fed pulse width modulated full wave bridge-buck voltage fedfullwavebridgetopology–basicoperationbuckvoltagefedfullwavebridge–advantages-

Drawbacks in buck voltage fed full wave bridge-buck current fed full wave bridge topology–basic operation–fly back current fed push pull topology.

UNIT–VI: RESONANT CONVERTERS

Resonant Converters: Classification of Resonant converters-Basic resonant circuits- Series resonant circuit-parallel resonant circuits- Resonant switches. Concept of Zero voltage switching, principle of operation, analysis of M-type and L-type Buck or boost Converters. Concept of Zero current switching, principle of operation, analysis of M-type and L-type Buck or boost Converters.

TEXTBOOKS:

1. PressmanA. I,Switching Power Supply Design, McGraw-Hill, 3rdedition,2009.
2. MitchellD.M,DC-DCSwitching Regulator Analysis,McGrawHill,1stedition,1988

REFERENCEBOOKS:

1. Ned Mohan, Power Electronics,JohnWiley,3rdedition,2011.
2. Otmar Kingenstein, Switched Mode Power Supplies in Practice,JohnWiley,1st edition,1991.
3. BillingsK.H., Hand book of Switched Mode Power Supplies,McGrawHill,3rdedition,2010.
4. Nave M.J,PowerLine Filter Design for Switched-Mode Power Supplies, Mark Nave Consultants, 2ndedition,2010

POWER ELECTRONICS FOR RENEWABLE ENERGYSYSTEMS

(Professional Elective IV)

Subject Code: 22MPS1015

L	T	P	C
3	0	0	3

Course Objectives:

- To impart knowledge on different types of renewable energy systems.
- To analyze the operation of electrical generators used for the wind energy conversion Systems.
- To know the operation of AC-DC, DC-DC and AC-AC power converters used in renewable energy systems.
- To know the principles of standalone, grid connected and hybrid operation inrenewable energy systems.
- To know the issues related to the grid and network integration of systems.

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

CO1: Demonstrate the various types of renewable energy technologies that are used to harness electrical power.

CO2: Demonstrate the operating principle and analysis of various types of Wind generators and PV systems.

CO3: Identify a suitable converter such as AC-DC, DC-DC and AC-AC converters for renewable energy systems.

CO4: Demonstrate and analyze the various types of wind and PV systems.

CO5: Interpret the stand alone, grid connected and hybrid renewable energy systems

CO6: Understand the issues related to the grid and network integration of systems

UNIT-I:

Solar cell characteristics and their measurement, PV Module, PV array, Partial shading of a solarcell and a module, The diode, Power conditioning unit, maximum power point tracker, Implementation of Perturb and Observe Method, Incremental Conductance Method.

UNIT-II:

Centralized Inverters, String Inverters, Multi-string Inverters, Module Integrated Inverter/Micro- inverters, Inverter Topology, Model of Inverter.

Types of PV Systems: Grid-Connected Solar PV System, Stand-Alone Solar PV System.

UNIT-III:

Introduction to wind: Characteristics, Wind Turbine, Fixed and Variable-Speed Wind Turbines, Components of WECS, Description of Components, Types of Wind Turbine Generators, Power Converter Topologies for Wind Turbine Generators.

UNIT-IV:

Modeling of Permanent Magnet Synchronous Generators, Doubly Fed Induction Generators,Squirrel cage Induction Generators wind turbine, Control of Power converters for WECS.

UNIT-V:

Hybrid Energy Systems, Need for Hybrid Energy Systems, Range and types of Hybrid systems, Hybrid Solar PV/Wind Energy System, Architecture of Solar-Wind Hybrid System.

UNIT-VI: Network Integration Issues

Overview of grid code technical requirements. LVRT and Fault ride-through capability for wind farms - real and reactive power regulation, voltage and frequency operating limits. Power quality issues.

TEXTBOOKS:

1. "Solar Photovoltaic: "Fundamentals, Technologies and Application" Chetan Singh Solanki., PHI Learning Pvt., Ltd., 1st Edition, 2009.
2. S. N. Bhadra, D.Kastha, S.Banerjee, "Wind Electrical Systems", Oxford University Press,2005.

REFERENCE BOOKS:

1. S.N.Bhadra, D. Kastha, & S. Banerjee "Wind Electrical Systems", Oxford University Press,2009.
2. Rashid .M. H, "Power Electronics Hand book", Academic Press, 2001.
3. Rai. G.D, "Non-conventional energy sources", Khanna Publishers, 1993.
4. Rai. G.D," Solar energy utilization", Khanna Publishes, 1993.
5. Gray, L. Johnson, "Wind energy system", Prentice Hall of India, 1995.
6. B.H.Khan "Non-conventional Energy sources", Mc Graw-hill, 2nd Edition, 2009
7. "Grid integration of wind energy conversion systems", H. Siegfried and R. Waddington, John Wiley and Sons Ltd., 2nd Edition, 2006.

IoT APPLICATIONS TO ELECTRICAL ENGINEERING
(Professional Elective IV)

Subject Code: 22MPS1016

L	T	P	C
3	0	0	3

Course Objectives: On completion of the course the learner will be able to;

- Understand IoT and its design requirements
- Select appropriate Sensors and Actuators for desired application
- Compare various technologies and protocols
- Understand IoT applications in different domains
- Actuators, Microcontrollers and Cloud

Course Outcomes:
CO1. EXPLAIN the Applications/Devices, Protocols and Communication Models of IoT
CO2. DEMONSTARTE small Mechanical Engineering IoT oriented applications using Sensors, Actuators, Microcontrollers and Cloud
CO3. SELECT commonly used IoT Simulation Hardware platforms
CO4. APPLICATION of Interfacing and Communication Technologies for IoT
CO5. ILLUSTRATE IoT Application Development and Security of IoT Ecosystem
CO6. EVALUATE Present and Future Domain specific Applications of IoT Ecosystem

Unit I: Introduction to Internet of Things: IoT: Definition and importance, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Three-layer and Five-layermodel of IoT.

Unit II : Sensors-I: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Scalar sensing, Multimedia sensing, Hybrid sensing, Virtual sensing, Sensing Considerations. Actuators, Actuator Types, Hydraulic actuators, Pneumatic actuators, Electric actuators, Thermal or magnetic actuators, Mechanical actuators, Soft actuators, Actuator Characteristics.

Unit III: Sensors-II: Sensor Technology, Mobile Phone Based Sensors, Medical Sensors, Neural Sensors, Environmental and Chemical Sensors, Radiofrequency Identification, Actuators, IoT Challenges: Design challenges, Development challenges, Privacy and Security challenges, Data Management and Other challenges

Unit IV: IoT Communication network: Architecture of IoT, Communication network: Home Area Network (HAN), Neighborhood Area Network (NAN), Field Area Network (FAN), Wide Area Network (WAN), Wireless Sensor Networks (WSNs)

Unit V: IoT Protocols: IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRa WAN,

Unit VI: Application of IoT: Smart Homes: Smart Appliances, Security and Safety. Smart Energy: Smart Meters, Automatic Meter Reading (AMR), Advanced Metering Infrastructure (AMI), Real-time Pricing, Smart grid, Smart Cities: Smart Vehicles, Smart Lighting, Smart Parking etc.

Recommended Books:

1. Internet of Things by Rajkamal, Tata McGraw Hill publication
2. Internet of things (A-Hand-on-Approach) By Vijay Madisetti and ArshdeepBahga1st Edition,Universal Press
3. The Internet of Things: Connecting Objects by HakimaChaouchi Wiley publication
4. The Internet of Things – Key applications and Protocols By Olivier Hersent, David Boswarthick, Omar Elloumi,, Wiley, 2012

HVDC TRANSMISSION

(Professional Elective V)

Subject Code: 22MPS1017

L	T	P	C
3	0	0	3

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:

CO1: Understand the basics of HVDC Transmission systems, learning about advantages and disadvantages of DC with AC Transmission.
CO2: Analyze HVDC converters and characteristics of 6 and 12 pulse converters with and without overlapping.
CO3: Understand the converter control characteristics, Various controlling methods of converters
CO4: Illustrate generation of harmonics, its adverse effects and also the design of filters for harmonic elimination. Learn about Multi terminal DC systems.
CO5: Design of AC filters.
CO6: Understand Power flow analysis in AC/DC systems

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 ofa 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 of voltage& Current harmonics - Effect of Pulse number on harmonics

Types of AC filters, Design of Single and double 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.

TEXTBOOKS:

1. Padiyar,K.R.,"HVDCpowertransmissionsystem",NewAgeInternational(P)Ltd.,NewDelhi, Second Edition, 2010.
2. EdwardWilsonKimbark,"DirectCurrentTransmission",Vol.I,Wileyinterscience,NewYork, London, Sydney, 1971.
3. RakoshDasBegamudre,"ExtraHighVoltageACTransmissionEngineering",NewAgeInternational (P)Ltd.,NewDelhi, 1990.

REFERENCEBOOKS:

1. KundurP.,"Power System Stability and Control",McGraw-Hill,1993.
2. Colin Adamson and HingoraniNG,"High Voltage Direct Current Power Transmission",Garraway Limited, London, 1960.
3. Arrillaga,J.,"HighVoltageDirect CurrentTransmission",PeterPregrinus,London, 1983.
4. S. Kamakshaiah,V. Kamaraju,'HVDC Transmission',Tata McGraw Hill Education Private Limited, 2011.

ANALYSIS OF DYNAMIC SYSTEMS

(Professional Elective V)

Subject Code: 22MPS1018

L	T	P	C
3	0	0	3

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 computer 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
CO6: Ability to Understand Advanced state space methods

UNIT-I:

Sampling & Reconstruction: Introduction, Sampling theorem, Examples of data control systems, Digital to analog conversion and Analog to Digital conversion, sample and hold 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.

UNITI-V:

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:

Advancedstatespacemethods: Introduction,LinearQuadraticProblem,PropertiesofLQR design, Kalman filter, Linear Quadratic Gaussian (LQG) problem, control.

TEXTBOOKS:

1. ControlSystemEngineering,I.J.NagrathandM.Gopal,NewAgeInternational Publishers, (3rdEdition).
2. DesignofFeedbackControlSystems,Stefane,Shahian,Savant,Hostetter,Oxford University Press, (4thEdition).

REFERENCEBOOKS:

1. Automatic Control Systems, BenjaminC.Kuo, (7thEdition).
2. Modern Control Engineering, Ogata,PrenticeHall,(3rdEdition).
3. NonlinearControlSystemAnalysisbyM.Vidyasagar,2ndedition,PH Inc,1991.

INTELLIGENT CONTROL
(Professional Elective V)

Subject Code: 22MPS1019

L	T	P	C
3	0	0	3

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: Underst and 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.
CO6: Learn the different Neural network applications

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 tool box.

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.

UNITI-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

TEXTBOOKS:

1. Artificial Intelligent based Electrical Machines and Drives- Peter Vas, Oxford University Press
2. Neural Networks: A comprehensive Foundation –SimonHaykins,PearsonEdition,2003.

REFERENCESBOOKS:

1. Neural Network Design-M.T.Hagan, H.B. DemuthandM. Beale,Indianreprint,2008.
2. Principles of Neuro computing for science and Engineering,-FredricM.Hamand Ivica Kostanic, McGraw Hill,2001.
3. NeuralNetworkFundamentalswithGraphs,AlgorithmsandApplications,N.K.Boseand P.Liang, Mc-Graw Hill, Inc.199.

INDUSTRIAL SAFETY

Open Elective

Subject Code: 22MOE1001

L	T	P	C
3	0	0	3

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

Wear and Corrosion and their prevention

Wear- types, causes, effects, wear reduction 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

Periodic and 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

Procedure for periodic and preventive maintenance

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

Text Books:

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

Reference Books:

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

OPERATIONS RESEARCH

Open Elective

Subject Code: 22MOE1002

L	T	P	C
3	0	0	3

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. Calculate critical path for a given net work 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.

Textbooks:

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,Mac Milan Pub.
2. Operations ResearchbyP. RamaMurthy,NewAge Pub.
3. CPM&PERT, L.S.Srinath, Affiliated East West PressPu

COMPOSITE MATERIALS

Open Elective

Subject Code: 22MOE1003

L	T	P	C
3	0	0	3

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 micro mechanics 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 – wet ability, 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, compo casting (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.

Textbooks:

1. Composite Materials: Engineering and Science, by Matthews and Rawlings, CRC Press.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted byR. Bala subramaniam, 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.Hulland T.W.Clyne, Cambridge University press.
3. Metal Matrix Composites, Thermomechanical Behaviourby 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. AFlinnandPKTrojan/Jaico Books.

WASTE TO ENERGY

Open Elective

Subject Code: 22MOE1004

L	T	P	C
3	0	0	3

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, Forest residue, 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 gratecombustors, 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.

Textbooks

1. Rogoff,M.J.andScreve,F.,"Waste-to-Energy:TechnologiesandProject Implementation", Elsevier Store - Reprint - 2011.
2. Hall,D.O.andOvereed,R.P.,"Biomass-RenewableEnergy",JohnWillyand Sons – Reprint - 1987.
3. Harker,J.H. andBackhusrt,J.R., "FuelandEnergy", AcademicPressInc–Reprint-1981.
4. EL-Halwagi,M.M.,"BiogasTechnology-TransferandDiffusion",Elsevier Applied Science – Reprint - 1984.

References Books

1. Non-ConventionalEnergy,Desai,AshokV.,WileyEasternLtd.,1990.
2. BiogasTechnology-APracticalHandBook-Khandelwal,K.C.andMahdi,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.BiomassConversionandTechnology,C.Y.WereKo-BrobbyandE.B.Hagan, John Wiley & Sons, 1996.
4. Mondal,P. and Dalai, A.,“Utilization of natural resources”, CRCPress–Published–2017.
5. YoungG.C.,"Municipal Solid Waste to Energy Conversion processes",John Wiley and Sons –Reprint – 2010.

POWER ELECTRONIC CIRCUITS SIMULATION LAB

Subject Code: 22MPS1103

L	T	P	C
0	0	4	2

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. Demonstrateproficiencyintheuseofhigh-performanceengineeringmodelingand analysis software(MATLAB and SIMULINK)for control system analysis and design in this course and for subsequent engineering practice.

CO2: Identify the application of various power semiconductor devices in electrical engineering.

CO3: Developthesimulationofpowerelectronicscircuitswithdifferentloads.

CO4: Develop the simulation of different converters with PWM techniques.

CO6: Develop the simulation of different inverters with PWM techniques.

CO5: Observe several concepts and procedures learned in electrical system modeling and analysis and also electrical machines.

LISTOFEXPERIMENTS:

Any 10 of the following experiments are to be conducted

1. Switching characteristics of Thyristors, MOSFET and IGBT.
2. Simulation of Single phase full converter using RL load with and without LC Filter.
3. Simulation of Single phase full converter using RL&E load with and without freewheeling diode.
4. Simulation of Three phase full converter using RL&E Loads.
5. Simulation of single phase AC Voltage controller with PWM control for RL load.
6. Simulation of three phase AC Voltage controller using RL load.
7. Simulation of single phase inverter with sinusoidal PWM control for R-load
8. Simulation of Three phase inverter with Sinusoidal PWM control for R-Load.
9. Study of performance of 3-phase to 5-phase induction motor using matrix converter.
10. Simulation of dc-dc Boost converter.

11. DC motor with controlled ac rectification
12. Volts/Hz closed-loop speed control of an induction motor drive.
13. Open-loop Volts/Hz control of asynchronous motor drive.
14. Speed control of a permanent magnet synchronous motor.
15. Single phase IGBT based fully controlled rectifier with PWM control.
16. Three phase IGBT based ac voltage controller with PWM control.
17. Study on the design of PI controllers and stability analysis for a DC-DC buck Converter.
18. Study of performance of 3-phase to 6-phase induction motor using matrix converter.