AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

(Approved by A.I.C.T.E., New Delhi &Permanently Affiliated to JNTU-GV, Vizianagaram)
NAAC Accredited with A+ grade
Tamaram (V), Makavarapalem,Narsipatnam (RD), Anakapalle Dist,Pin-531113

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

ACADEMIC REGULATIONS

COURSE STRUCTURE AND SYLLABUS

For PG-R24

M.Tech – POWER SYSTEMS

(Applicable for batches admitted from 2024-2025)

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www.avanthienggcollege.ac.in, mail: principal@avanthienggcollege.ac.in

Academic Regulations (R24) for M.Tech (Regular) Degree Course

(Applicable for the students of M.Tech from the Academic Year 2024-2025 onwards)

1. ELIGIBILITY FOR ADMISSIONS

Admission to the above program shall be made subject to eligibility, qualification and specialization as prescribed by the Institute from time to time.

Admissions shall be made on the basis of merit/rank obtained by the candidates at the qualifying Entrance Test conducted by the Institute or on the basis of any other order of merit as approved by the Institute, subject to reservations as laid down by the Govt. from time to time.

2. AWARD OF M. Tech DEGREE

a) A student shall be declared eligible for the award of the M.Tech Degree, if he pursues a course of study in not less than two and not more than four academic years.

b) The student shall register for all 68 credits and secure all the 68 credits.

c) The minimum instruction days in each semester are 90.

3. PROGRAMME OF STUDY

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

M.Tech

1. M.Tech- Computer Science & Engineering
2. M.Tech- Power Systems
3. M.Tech- Power Electronics
4. M.Tech- Digital Electronics and Communication Systems
5. M.Tech- VLSI Design

And any other course as approved by AICTE/University from time to time.

4. Departments offering M. Tech Programmes with specializations are noted below:

Department	Programme Code	Title
EEE	56	M.Tech- Power Systems

EEE	43	M.Tech- Power Electronics
ECE	38	M.Tech- Digital Electronics and Communication Systems
ECE	72	M.Tech - VLSI Design
CSE	58	M.Tech - Computer Science & Engineering

5. ATTENDANCE

a) A student shall be eligible to write the examinations of the institute if he acquires a minimum of 75% of attendance in aggregate of all the subjects / courses, and with minimum 50% in each and every course including practicals.

b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester shall be granted by the College Academic Committee.

c) Shortage of Attendance **below** 65% in aggregate shall not be condoned and not eligible to write their end semester examination of that class.

d) Students whose shortage of attendance is not condoned in any semester are not eligibleto write their end semester examination of that class.

e) A prescribed fee shall be payable towards condonation of shortage of attendance.

f) A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek re-admission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for re-admission into the same class.

6. 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 practical, on the basis of InternalEvaluation and End Semester Examination.

a) For the theory subjects 75 marks shall be awarded based on the performance in the End Semester Examination and 25 marks shall be awarded based on the Internal Evaluation. The internal evaluation 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 a total duration of 120 minutes with 4 questions (without choice) each question for 10 marks, and it will be reduced to 25 marks. End semester examination is conducted for 75 marks for all FIVE (5) questions (one question from one unit) to be answered (either or).

b) For practical subjects, 75 marks shall be awarded based on the performance in the End Semester Examinations and 25 marks shall be awarded based on the day-to-day performance as Internal Marks. The internal evaluation based on the day to day work-5 marks, record- 5 marks and the remaining 15 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the examiners, with a breakup mark of Procedure-20, Experimentation-30, Results-10, and Viva-voce-15.

c) For Mini Project with Seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Project Review Committee consisting of Head of the Department, supervisor / mentor and two other senior faculty members of the department. For Mini Project with Seminar, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

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

e) In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.4) he has to re-appear for the End semester Examination in that subject. A candidate shall be given one chance to re-register for each subject provided, the internal marks secured by a candidate are less than 50% and has failed in the end examination. In such a case, the candidate must re-register for the subject(s) and secure the required minimum attendance. The candidate's attendance in the re-registered subject(s) shall be calculated separately to decide upon his eligibility for writing the end examination in those subject(s). In the event of the student taking another chance, his internal marks and end examination marks obtained in the previous attempt shall stand cancelled. For re-registration, the candidates have to apply to the college by paying the requisite fees and get approval from the institute before the start of the semester in which re-registration is required.

f) In case the candidate secures less than the required attendance in any re-registered subject(s), he shall not be permitted to write the End Examination in that subject. He shall again re-register the subject when next offered.

g) Laboratory examination for M. Tech. courses must be conducted with two Examiners, one of them being the Laboratory Class Teacher or teacher of the respective college and the

second examiner shall be appointed by the institute from the panel of examiners submitted by the respective departments.

7. EVALUATION OF PROJECT/DISSERTATION WORK

Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.

a) A Project Review Committee (PRC) shall be constituted with Head of the Department and two other senior faculty members in the department.

b) Registration of Dissertation/ Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects, both theory and practical.

c) After satisfying 6.2, a candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work for approval. The student can initiate the Project work, only after obtaining the approval from the Project Review Committee (PRC).

d) If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the Project Review Committee (PRC). However, the PRC shall examine whether or not to change the topic/supervisor leads to a major change in initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

e) Continuous assessment of Dissertation-I and Dissertation-II during the Semester(s) will be monitored by the PRC.

f) A candidate shall submit his status report in two stages to the PRC, at least with a gap of 3 months between them.

g) The work on the project shall be initiated at the beginning of the II year and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of theory and practical course with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. The candidate has to pass all the theory and practical subjects before submission of the Thesis.

h) Three copies of the Project Thesis certified by the supervisor shall be submitted to the College/School/Institute.

i) The thesis shall be adjudicated by one examiner selected by the institute. For this, the Principal of the College shall submit a panel of 5 examiners, eminent in that field, with the help of the guide concerned and head of the department.

j) If the report of the examiner is not favorable, the candidate shall revise and resubmit the Thesis, in the time frame as decided by the PRC. If the report of the examiner is

unfavorable again, the thesis shall be summarily rejected. The candidates have to re-registered for the project and complete the project within the stipulated time after taking the approval from the Institute.

k) The Head of the Department shall coordinate and make arrangements for the conduct of Viva-Voce examination.

l) If the report of the examiner is favorable, Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the Thesis. The Board shall jointly report the candidate's work for a maximum of 100 marks as one of the following:

I. Excellent
II. Good
III. Satisfactory
IV. Unsatisfactory

m) If the report of the Viva-Voce is unsatisfactory (ie, < 50 marks), the candidate shall retake the Viva- Voce examination only after three months. If he fails to get a satisfactory report at the second Viva-Voce examination, the candidate has to re-register for the project and complete the project within the stipulated time after taking the approval from the college.

8. Cumulative Grade Point Average (CGPA)

As measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed: **A**fter each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Structure of Grading of Academic Performance

Marks Range Theory/ Laboratory (Max – 100)	Marks Range Mini Project/ Project Work or Dissertation (Max – 100)	Letter Grade	Level	Grade Point
≥ 90	≥ 90	S	Superior	10
≥80 to <90	≥80 to <90	A	Excellent	9
≥70 to <80	≥70 to <80	B	Very Good	8
≥60 to <70	≥60 to <70	C	Good	7
≥50 to <60	≥50 to <60	D	Average	6
<50	<50	F	Fail	0
		AB	Absent	0

i) A student obtaining Grade "F" or Grade "Ab" in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.

ii) For non-credit audit courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/ CGPA / Percentage.

Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

SGPA: The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses under gone by a student, i.e.,

$$\mathbf{SGPA=\Sigma (C_i \times G_i) / \Sigma C_i}$$

Where, C_i is the number of credits of the i^{th} subject and G_i is the grade point scored by the student in the i^{th} course.

CGPA: The Cumulative Grade Point Average (CGPA) will be computed in the same manner considering all the courses under gone by a student over all the semesters of a program, i.e.

$$\mathbf{CGPA=\Sigma (C_i \times S_i) / \Sigma C_i}$$

Where "S_i" is the SGPA of the i^{th} semester and C_i is the total number of credits up to that semester.

Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts. While computing the SGPA the subjects in whom the student is awarded Zero grade points will also be included.

Equivalent Percentage = (CGPA-0.75)*10

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by the letters S, A, B, C, D and F.

9. AWARD OF DEGREE AND CLASS

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M. Tech. Degree he shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured	
First Class with Distinction	**≥ 7.75 (Without any supplementary appearance)**	**From the CGPA secured from 68 Credits.**
First Class	**≥ 7.75 (With any supplementary appearance)** **≥ 6.75 and < 7.75 (Without any**	

	supplementary appearance)	
Second Class	**≥ 6.75 and < 7.75 (With any supplementary appearance)** **≥ 6.0 to < 6.75 (Without any supplementary appearance)**	
Pass Class	**≥ 6.0 to < 6.75 (With any supplementary appearance)**	

The Grades secured, Grade points and Credits obtained will be shown separately in the memorandum of marks.

10. WITH HOLDING OF RESULTS

If the student is involved in indiscipline/malpractices/court cases, the result of the student will be withheld.

11. TRANSITORY REGULATIONS (For R24)

a) Discontinued or detained candidates are eligible for re-admission into same or equivalent subjects at a time as and when offered.

b) The candidate who fails in any subject will be given two chances to pass the same subject; otherwise, he has to identify an equivalent subject as per R19 (JNTUK) academic regulations.

12. GENERAL

a) Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

b) The academic regulation should be read as a whole for the purpose of any interpretation.

c) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal / Dean-Academics of the institution is final.

d) The Institute may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institute.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices / Improper conduct	Punishment
	If the candidate:	
1	(a) Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of anoutsider, he will be handed over

	of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination) (b) Gives assistance or guidance or receivesit from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	to the police anda case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all External examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	Smuggles in the Answer book or additional	Expulsion from the examination hall and

	sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all External examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in lettersto the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6	Refuses to obey the orders of the Chief Superintendent/Assistant–Superintendent/ any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work

		and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all External examinations. The continuation of the course by the candidate is subject to the Academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester / year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.

12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Institute for further action to award suitable punishment	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)
   - (i) A show cause notice shall be issued to the college.
   - (ii) Impose a suitable fine on the college.
   - (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

Seminar/ comprehensive vivo evaluation

There shall be two seminar presentations during III semester and IV semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Project Review Committee consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 50 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

(a) For Ist & IInd semesters Seminar 100 marks are allotted for each, which shall be awarded based on the performance of the student on the selected advanced topic which is subdivided as follows.

Marks for assignment	-	20
Marks for Power Point Presentation	-	60
Marks for viva voce (Orals)	-	20
Total marks	-	100

(b) There shall be two seminar presentations during III semester and IV semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Project Review Committee (PRC) consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 50 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

(Dr. R Prasad Rao)
Dean(Academics) &
Member Secretary (AC)

(Dr.C P V N J Mohan Rao)
Chairman
Academic Council

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Program: M.Tech- PS **Regulation R24**

I Year I Semester- Course Structure

S.No	Category	Course Code	Course Name	Hours per Week			
				L	T	P	C
1	PC	2456PC01	Power System Operation & Control	3	0	0	3
2	PC	2456PC02	Analysis of Power Electronic Converters	3	0	0	3
3	PE I		**Program Elective-I**	3	0	0	3
		2456PE01.1	1. Electrical Distribution Automation				
		2456PE01.2	2. Control and Integration of Renewable Energy sources				
		2456PE01.3	3. Power System Deregulation				
4	PE II		**Program Elective-II**	3	0	0	3
		2456PE02.1	1. HVDC Transmission				
		2456PE02.2	2. Digital Power Systems Protection				
		2456PE02.3	3. Power System Reliability				
5	PC	2456PC03	Power System Simulation Laboratory – I	0	0	4	2
6	PC	2456PC04	Power Systems Lab	0	0	4	2
7	MC	24MTMC01	Research Methodology andIPR	2	0	0	2
8	AC		**Audit Course – 1**	2	0	0	0
		24MTAC01.1	1.English for Research paper writing				
		24MTAC01.2	2.Disaster Management				
			Total	**16**	**0**	**8**	**18**

Category	Courses	Credits
PC-Program Core Courses	4	10
PE-Program Elective Courses	2	6
MC-Mandatory Courses	1	2
AC- Audit Courses	1	0
Total	**8**	**18**

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Program: M.Tech-PS **Regulation R24**

I Year II Semester- Course Structure

S.No	Category	Course Code	Course Name	Hours per Week			
				L	T	P	C
1	PC	2456PC05	Power System Dynamics and Stability	3	0	0	3
2	PC	2456PC06	Real Time Control of Power Systems	3	0	0	3
3	PE-III		**Program Elective-III**	3	0	0	3
		2456PE03.1	1. EHVAC Transmission				
		2456PE03.2	2. Flexible AC Transmission Systems				
		2456PE03.3	3. Electric Vehicles & Design				
4	PE-IV		**Program Elective-IV**	3	0	0	3
		2456PE04.1	1. Generation & Measurement of High Voltages				
		2456PE04.2	2. Evolutionary Algorithms and Applications				
		2456PE04.3	3. Programmable Logic Controllers & Applications				
5	PC	2456PC07	Power System Simulation Laboratory – II	0	0	4	2
6	PC	2456PC08	Power Converters Laboratory	0	0	4	2
7	PR	2456PR01	Mini Project with Seminar	0	0	4	2
8	AC		Audit Course – 2	2	0	0	0
		24MTAC02.1	1.Constitution of India				
		24MTAC02.2	2.Value of Education				
			Total	**14**	**0**	**12**	**18**

Category	Courses	Credits
PC-Program Core Courses	4	10
PE-Program Elective Courses	2	6
PR-Mini Project	1	2
AC- Audit Course	1	0
Total	**8**	**18**

POWER SYSTEM OPERATION & CONTROL
I M.TECH- I SEMESTER

Course Title: Power System & Operation	Course Code: 2456PC01
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites: power generation and power systems	

COURSE OBJECTIVES:

1. To study the unit commitment problem for economic load dispatch.
2. To study the load frequency control of single area and two area systems with and without control.
3. To study the effect of generation with limited energy supply.
4. To study the effectiveness of interchange evaluation in interconnected power systems.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Determine the unit commitmentproblem for economic load dispatch
CO2	Explain the need of keeping frequency constant and design theblock diagram for single area control
CO3	Analyze two –area load frequency control in controlled and uncontrolled cases
CO4	Analyze the generation with limited energy supply
CO5	Determine the interchange evaluation in interconnected power systems

COURSE CONTENT (SYLLABUS)

UNIT -I:

Unit commitment problem and optimal power flow solution: Unit commitment: Constraints in UCP, UC solution methods. Priority list method, introduction to Dynamic programming Approach.

Optimal power flow: OPF without inequality constraints, inequality constraints on control variables and dependent variables.

Self-Learning Topics: Shut Down Rule

UNIT-II:

Single area Load Frequency Control: Necessity of keeping frequency constant. Definition of control area, single area control, Block diagram representation of an isolated Power System,

Steady State analysis, Dynamic Response-Uncontrolled case. Proportional plus Integral control of single area and its block diagram representation, steady state response.

Self-Learning Topics: Mathematical Modeling of LFC

UNIT-III:

Two area Load Frequency Control: Load frequency control of two-area system, uncontrolled case and controlled case, tie-line bias control, steady state representation. Optimal two-area L control- performance Index and optimal parameter adjustment. Load frequency control and Economic dispatch control.

Self-Learning Topics: Two Area Block Diagram

UNIT-IV:

Generation with limited Energy supply: Take-or-pay fuel supply contract, composite generation production cost function. Solution by gradient search techniques, Hard limits and slack variables, Fuel scheduling by linear programming.

Self-Learning Topics: Cost Function for Power Generation

UNIT-V:

Interchange Evaluation and Power Pools Economy Interchange: Economy interchange Evaluation, Interchange Evaluation with unit commitment, Multiple Interchange transactions, other types of Interchange, power pools, transmission effects and issues.

Self-Learning Topics: Power Pools

TEXT BOOKS:

1. Power Generation, Operation and Control - by A.J.Wood and F.Wollenberg, John wiley& sonsInc. 1984.
2. Modern Power System Analysis - by I.J.Nagrath & D.P.Kothari, Tata McGraw-Hill PublishingCompany ltd, 2nd edition.

REFERENCE BOOKS:

1. Power system operation and control PSR Murthy B.S publication.
2. Electrical Energy Systems Theory - by O.I.Elgerd, Tata McGraw-Hill Publishing Company Ltd,2nd edition.
3. Reactive Power Control in Electric Systems - by TJE Miller, John Wiley & sons.

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/108/104/108104052/
2. https://archive.nptel.ac.in/courses/108/101/108101040/#

ANALYSIS OF POWER ELECTRONIC CONVERTERS
I M.TECH- I SEMESTER

Course Title: Analysis Of Power Electronic Converters	Course Code: 2456PC02
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites: power electronics	

COURSE OBJECTIVES:

1. To understand the control principle of ac-to-ac conversion with suitable power semi Conductor devices.
2. To have the knowledge of ac to dc conversion and different ac to dc converter topologies.
3. To understand the effect of operation of controlled rectifiers on p.f. and improvement of p.f. with PFC converters
4. To acquire the knowledge on dc-ac converters and to know the different control Techniques of dc-ac converters.
5. To know multilevel inverter configuration to improve the quality of the inverter output Voltage

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Describe and analyze theoperation of AC-DC converters
CO2	Analyze the operation of power factor correction converters.
CO3	Analyze the operation of three phase inverters withPWM control
CO4	Study the principles ofoperation of multi-level inverters and their applications.
CO5	Describe and analyze theoperation of AC-DC converters

COURSE CONTENT (SYLLABUS)

UNIT -I:
Overview of Switching Devices:Power MOSFET, IGBT, GTO, GaN devices-static and dynamic characteristics, gate drive circuitsfor Switching devices.
Self-Learning Topics: Thyristor Protection

UNIT-II:
AC-DC converters: Single phase fully controlled converters with RL load– Evaluation of input power Factor and harmonic factor- Continuous and Discontinuous load current, Power factor Improvements, Extinction angle control, symmetrical angle control, PWM control. Three Phase

AC-DC Converters, fully Controlled converters feeding RL load with continuous and discontinuous load current, Evaluation of input power factor and harmonic factor-three phase dual converters.
Self-Learning Topics: Speed control of AC motors

UNIT-III:
Power Factor Correction Converters: Single-phase single stage boost power factor corrected rectifier, Power circuit principle of operation, and steady state- analysis, three phase boost PFC converter
Self-Learning Topics: Reactive power

UNIT-IV:
PWM Inverters: Principle of operation-Voltage control of single-phase inverters – sinusoidal PWM –Modified PWM – phase displacement Control – Trapezoidal, staircase, stepped, harmonic injection and Delta modulation. Voltage Control of Three-Phase Inverters- Sinusoidal PWM- 60° PWM- Third Harmonic PWM- Space Vector Modulation- Comparison of PWM Techniques- Three phase current source inverters-Variable dc link inverter.
Self-Learning Topics: Filters

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

TEXTBOOKS:

1 Power Electronics: Converters, Applications, and Design- Ned Mohan, Tore M.
2 Undeland, William P. Robbins, John Wiley& Sons, 2nd Edition, 2003.
3 Power Electronics-Md.H.Rashid –Pearson Education Third Edition- First IndianReprint-2008.

REFERENCE BOOKS:

1. Power Electronics Daniel W. Hart - McGraw-Hill, 2011.
2. Elements of Power Electronics – Philip T. Krein, Oxford University press, 2014.
3. Power converters Circuits – William Shepherd & Li Zhang-Yes Dee CRC Press, 2004

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc23_ee81/preview
2. https://nptel.ac.in/courses/108104139
3. https://nptel.ac.in/courses/108106172
4. https://nptel.ac.in/courses/11710610

ELECTRICAL DISTRIBUTION AUTOMATION
I M.TECH- I SEMESTER

Course Title: Electrical Distribution Automation	Course Code: 2456PE01.1
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites: different loads in power systems	

COURSE OBJECTIVES:

1. To learn the importance of economic distribution of electrical energy.
2. To analyze the distribution networks for V-drops, P_{Loss}calculations and reactive power.
3. To understand the co-ordination of protection devices.
4. To impart knowledge of capacitive compensation/voltage control.
5. To understand the principles of voltage control.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Analyze a type of distributionsystem.
CO2	Design the types of distribution feeders and their loading effects
CO3	Identify the protective systems and their co-ordination
CO4	Improve power factor bycapacitive compensation.
CO5	Understand about the Distribution automation

COURSE CONTENT (SYLLABUS)

UNIT -I:

General: Introduction to Distribution systems, an overview of the role of computers in distribution system planning-Load modelling and characteristics - definition of basic terms like demand factor, utilization factor, load factor, plant factor, diversity factor, coincidence factor, contribution factor and loss factor-Relationship between the load factor and loss factor - Classification of loads (Residential, Commercial, Agricultural and Industrial) and their characteristics.

Self-Learning Topics: Classification of Loads

UNIT-II:

Distribution Feeders and Substations: Design consideration of Distribution feeders: Radial and loop types of primary feeders, voltage levels, and feeder-loading. Design practice of the secondary distribution system. Location of Substations: Rating of a Distribution Substation, service area with 'n' primary feeders. Benefits derived through optimal location of substations.

Self-Learning Topics: Substation types

UNIT-III:
Protective devices and coordination: Objectives of distribution system protection, types of common faults and procedure for fault calculation. Protective Devices: Principle of operation of fuses, circuitreclosers, line sectionalizer and circuit breakers. Coordination of protective devices: General coordination procedure; types of coordination.
Self-Learning Topics: Different Types of Protection systems in Power system

UNIT-IV:
Capacitive compensation for power factor control: Different types of power capacitors, shunt and series capacitors, effect of shunt capacitors (Fixed and switched), power factor correction, capacitor location. Economic justification. Procedure to determine the best capacitor location. Voltage control: Equipment for voltage control, effect of series capacitors, effect of AVB/AVR, line drop compensation.
Self-Learning Topics: Reactive Power compensation

UNIT-V:
Distribution automation functions: Electrical system automation, EMS functional scope, DMS functional scope functionality of DMS- Steady state and dynamic performance improvement; Geographic information systems- AM/FM functions and Database management; communication options, supervisory control and data acquisition: SCADA functions and system architecture; Synchro phasors and its application in power systems.
Self-Learning Topics: Automation systems

TEXTBOOKS:

1. "Electric Power Distribution System Engineering " by Turan Gonen, McGraw-Hill BookCompany,1986.
2. Distribution System Analysis and Automation, by Juan M. Gers, The Institution ofEngineeringand Technology, UK 2014.

REFERENCE BOOKS:

1. Electric Power Distribution-by A.S.Pabla, Tata McGraw-Hill Publishing Company,4th edition,1997.
2. Electrical Distribution V.Kamaraju-McGraw Hill
3. Handbook of Electrical Power Distribution – Gorti Ramamurthy-Universities press

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/108/107/108107112/
   https://onlinecourses.nptel.ac.in/noc22_ee35/preview

CONTROL AND INTEGRATION OF RENEWABLE ENERGY SOURCES
I M.TECH- I SEMESTER

Course Title: Control And Integration Of Renewable Energy Sources	Course Code: 2456PE01.2
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites: renewable energy sources	

COURSE OBJECTIVES:

1. Understand different renewable energy sources and storage devices.
2. Model and simulate renewable energy sources.
3. Analyze and simulate control strategies for grid connected and off-grid systems
4. Develop converters to comply with grid standards to obtain grid integration.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Understand state estimation,security and contingency evaluation
CO2	Analyze the performance characteristics of various dynamic energy conversion technologies, including their efficiency, power output, and operational limits.
CO3	Utilize simulation softwareand modeling tools to predict the behavior and performance of static energy conversion systemsunder various conditions.
CO4	Design control systems for various applications, considering constraints such as noise, delays, and nonlinearity.
CO5	Understand operation & control of hybrid energysystems and various standards , codes.

COURSE CONTENT (SYLLABUS)

UNIT -I:

Introduction: Electric grid, Utility ideal features, Supply guarantee, power quality, Stability and cost; Importance & Effects of Renewable Energy penetration into the grid, Boundaries of the actual grid configuration, Consumption models and patterns.

Self-Learning Topics: Renewable Energy Sources

UNIT-II:

Dynamic Energy Conversion Technologies: Introduction, types of conventional and nonconventional dynamic generation technologies, principle of operation and analysis of reciprocating engines, gas and micro turbines, hydro and wind based generation technologies

Self-Learning Topics: Types of Turbines

UNIT-III:

Static Energy Conversion Technologies: Introduction, types of conventional and

nonconventional static generation technologies; Principle of operation and analysis of fuel cell, photovoltaic systems and wind generation technologies; MPPT techniques and its classifications, principle of operation and partial shading effects; Storage Technologies - batteries, fly wheels, super capacitors and ultra-capacitors.

Self-Learning Topics: Solar modules

UNIT-IV:

Control Issues and Challenges: Linear and nonlinear controllers, predictive controllers and adaptive controllers, Load frequency and Voltage Control, PLL, Modulation Techniques, Control of Diesel, PV, wind and fuel cell based generators, Dimensioning of filters, Fault-ride through Capabilities.

Self-Learning Topics: basics of control systems

UNIT-V:

Integration of Energy Conversion Technologies: Introduction & importance, sizing, Optimized integrated systems, Interfacing requirements, Distributed versus Centralized Control, Grid connected Photovoltaic systems –classifications, operation, merits & demerits; Islanding Operations, stability and protection issues, load sharing, operation & control of hybrid energy systems, Solar Photovoltaic applications. IEEE & IEC Codes and standards for renewable energy grid integrations.

Self-Learning Topics: ON-Grid & Off-Grid solar systems

TEXTBOOKS:

1. Renewable and Efficient Electric Power Systems, G. Masters, IEEE-John Wiley and Sons Ltd. Publishers, 2013,2nd Edition.
2. Microgrids and Active Distribution Networks, S. Chowdhury, S. P. Chowdhury, P. Crossley,IET Power Electronics Series, 2012.
3. Integration and Control of Renewable Energy in Electric Power System, Ali Keyhani Mohammad Marwali, Min Dai, John Wiley publishing company, 2010, 2nd Edition.

REFERENCE BOOKS:

1. Solar Photovoltaic: Fundamentals, technologies & Applications, Chetan SinghSolanki, PHIPublishers, 2019, 3rd Edition.
2. Solar PV Power: Design, Manufacturing and Applications from Sand to Systems,RabindraKumar Satpathy, Venkateswarlu Parmuru, Academic Press, 2020.
3. Control of Power Inverters in Renewable Energy and Smart Grid Integration, Quing-ChangZhong, IEEE-John Wiley and Sons Ltd. Publishers, 2013,1st Edition.
4. Power Conversion and Control of Wind Energy Systems, Bin Wu, Yongqiang Lang, NavidZargari, IEEE- John Wiley and Sons Ltd. Publishers,2011,1st Edition.
5. Report on "Large Scale Grid Integration of Renewable Energy Sources - WayForward" Central Electricity Authority, GoI, 2013.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/108/102/108102145/
2. https://nptel.ac.in/courses/103/103/103103206/

POWER SYSTEM DEREGULATION
I M.TECH- I SEMESTER

Course Title: Power System Deregulation	Course Code: 2456PE01.3
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites: power systems	

COURSE OBJECTIVES:

1. To provide in-depth understanding of operation of deregulated electricity market systems.
2. To examine typical issues in electricity markets and how these are handled worldw ide invarious markets.
3. To enable students to analyze various types of electricity market operational and control issuesusing new mathematical models.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Understand of operation of deregulated electricity market systems
CO2	To analyze typical issues in electricity markets
CO3	To analyze various types of electricitymarket operational and control issues using new mathematical models.
CO4	Understand trading and Congestionmanagement in deregulated power system
CO5	Understand ancillary services and Technical, economic & regulatory issues involved in deregulated powersystem

COURSE CONTENT (SYLLABUS)

UNIT -I:

Need and conditions for deregulation. Introduction of Market structure, Market Architecture, Spot market, forward markets and settlements. Review of Concepts: marginal cost of generation, least- cost operation, incremental cost of generation. Power System Operation.

Self-Learning Topics: Compilation and Interpretation

UNIT-II:

Electricity sector structures and Ownership /management, the forms of Ownership and management. Different structure model like Monopoly model, Purchasing agency model, wholesale competition model, Retail competition model.

Self-Learning Topics: Power sector structure

UNIT-III:
Framework and methods for the analysis of Bilateral and pool markets, LMP based markets, auction models and price formation, price based unit commitment, country practices
Self-Learning Topics: Power System Market structure

UNIT-IV:
Transmission network and market power. Power wheeling transactions and marginal costing, transmission costing. Congestion management methods- market splitting, counter-trading; Effect of congestion on LMPs- country practices
Self-Learning Topics: Power Transmission Network

UNIT-V:
Ancillary Services and System Security in Deregulation. Classifications and definitions, AS management in various markets- country practices. Technical, economic, & regulatory issues involved in the deregulation of the power industry.
Self-Learning Topics: Power system deregulation

TEXTBOOKS:

1. Power System Economics: Designing markets for electricity - S. Stoft, wiley.
2. Operation of restructured power systems - K. Bhattacharya, M.H.J. Bollen and J.E. Daalder, Springer.

REFERENCE BOOKS:

1. Power generation, operation and control, -J. Wood and B. F. Wollenberg, Wiley.
2. Market operations in electric power systems - M. Shahidehpour, H. Yaminand Z. Li,Wiley.
3. Fundamentals of power system economics - S. Kirschen and G. Strbac, Wiley.
4.Optimization principles: Practical Applications to the Operation and Markets of the Electric Power Industry - N. S. Rau, IEEE Press series on Power Engineeirng.
5. Competition and Choice in Electricity - Sally Hunt and Graham Shuttleworth

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/108/101/108101005/

HVDC TRANSMISSION
I M.TECH- I SEMESTER

Course Title: Power System Deregulation	Course Code: 2456PE02.1
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites: power electronic	

COURSE OBJECTIVES:

1. To learn various schemes of HVDC transmission.
2. To learn about the basic HVDC transmission equipment.
3. To learn the control of HVDC systems.
4. To be exposed to the interaction between HVAC and HVDC system.
5. To be exposed to the various protection schemes of HVDC engineering.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Understand the various schemes of HVDC transmission
CO2	Understand the basic HVDC transmission equipment.
CO3	Understand the control of HVDC systems.
CO4	Understand the interaction between HVAC and HVDC system.
CO5	Understand the various protection schemes of HVDC engineering.

COURSE CONTENT (SYLLABUS)

UNIT -I:

Limitation of EHV AC Transmission, Advantages of HVDC: Technical economical and reliability aspects. HVDC Transmission: General considerations, Power Handling Capabilities of HVDC Lines, Basic Conversion principles, static converter configuration. Types of HVDC links- Apparatus and its purpose.

Self-Learning Topics: Basic Conversion principles

UNIT-II:

Static Power Converters: 6-pulse bridge circuit and 12-pulse converters, converter station and Terminal equipment, commutation process, Rectifier and inverter operation, equivalent circuit for converter – special features of converter transformers. Comparison of the performance of diametrical connection with 6-pulse bridge circuit

Self-Learning Topics: Rectifier and inverter operation

UNIT-III:

Control of HVDC Converters and Systems: constant current, constant extinction angle and constant Ignition angle control. Individual phase control and equidistant firing angle control, DC power flow control. Factors responsible for generation of Harmonics voltage and current, harmonics effect of variation of α and μ. Filters, Harmonic elimination.

Self-Learning Topics: constant current, constant extinction angle and constant Ignition angle control

UNIT-IV:

Interaction between HV AC and DC systems – Voltage interaction, Harmonic instability problems and DC power modulation. Development of DC circuit Breakers, Multi-terminal DC linksand systems; series, parallel and series parallel systems, their operation and control.

Self-Learning Topics: Development of DC circuit Breakers

UNIT-V:

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

Self-Learning Topics: Converter faults, over current protection

TEXTBOOKS:

1.S Kamakshaih and V Kamaraju: HVDC Transmission- MG hill.

2.K.R.Padiyar : High Voltage Direct current Transmission, Wiley Eastern Ltd., NewDelhi – 1992.

REFERENCE BOOKS:

1.E.W. Kimbark : Direct current Transmission, Wiley Inter Science – New York.2.J.Arillaga : H.V.D.C.Transmission Peter Peregrinus ltd., London UK 1983

3.Vijay K Sood: HVDC and FACTS controllers:Applications of static converters inpower systemsby, Kluwer Academic Press.

ONLINE RESOURCES:

1.https://testbook.com/electrical-engineering/hvdc-transmission

2. https://archive.nptel.ac.in/courses/108/104/108104013

3. https://www.slideshare.net/slideshow/hvdc-transmission-77363658/77363658

4.https://www.tutorialspoint.com/difference-between-hvac-and-hvdc-transmission-systems

DIGITAL POWER SYSTEMS PROTECTION
I M.TECH- I SEMESTER

Course Title: Power System Deregulation	Course Code: 2456PE02.2
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites: power electronics, switch gear protection	

COURSE OBJECTIVES:

1. To learn about classification and operation of static relays.
2. To understand the basic principles and application of comparators.
3. To learn about static version of different types if relays.
4. To understand about numerical protection techniques.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Know the classifications andapplications of static relays.
CO2	Understand the application of comparators.
CO3	Understand the static version of different types of relays.
CO4	Understand the numerical protectiontechniques.
CO5	Know the classifications andapplications of static relays.

COURSE CONTENT (SYLLABUS)

UNIT -I:

Static Relays classification and Tools : Comparison of Static with Electromagnetic Relays, Basic classification, Level detectors and Amplitude and phase Comparators – Duality – Basic Tools – Schmitt Trigger Circuit, Multivibrators, Square wave Generation – Polarity detector – Zero crossingdetector – Thyristor and UJT Triggering Circuits. Phase sequence Filters – Speed and reliabilityof static relays.

Self-Learning Topics: Multivibrators, Square wave Generation

UNIT-II:

Amplitude and Phase Comparators (2 Input) : Generalized equations for Amplitude and Phase comparison – Derivation of different characteristics of relays – Rectifier Bridge circulating and opposed voltage type amplitude comparators – Averaging & phase splitting type amplitude comparators – Principle of sampling comparators.

Phase Comparison : Block Spike and phase Splitting Techniques – Transistor Integrating type, phase comparison, Rectifier Bridge Type Comparison – Vector product devices.

Self-Learning Topics: Derivation of different characteristics of relays

UNIT-III:

Static over current (OC) relays – Instantaneous, Definite time, Inverse time OC Relays, staticdistance relays, static directional relays, static differential relays, measurement of sequence impedances in distance relays, multi input comparators, elliptic & hyperbolic characteristics, switched distance schemes, Impedance characteristics during Faults and Power Swings.

Self-Learning Topics: Instantaneous, Definite time, Inverse time OC Relays

UNIT-IV:

PILOT Relaying schemes: Wire pilot protection: circulating current scheme – balanced voltage scheme – translay scheme – half wave comparison scheme - carrier current protection: phase comparison type – carrier aided distance protection – operational comparison of transfer trip and blocking schemes – optical fiber channels.

Self-Learning Topics: Wire pilot protection: circulating current scheme

UNIT-V:

Microprocessor based relays and Numerical Protection: Introduction – over current relays–impedance relay – directional relay – reactance relay. Numerical Protection: Introduction - numerical relay - numerical relaying algorithms - mann- morrison technique - Differential equation technique and discrete fourier transform technique - numerical over current protection - numerical distance protection.

Self-Learning Topics: numerical relay

TEXTBOOKS:

1. Power System Protection with Static Relays – by TSM Rao, TMH.
2. Power system protection & switchgear by Badri Ram & D N viswakarma, TMH.

REFERENCE BOOKS:

1. Protective Relaying Vol-II Warrington, Springer.
2. Art & Science of Protective Relaying - C R Mason, Willey.
3. Power System Stability KimbarkVol-II, Willey.
4. Electrical Power System Protection –C.Christopoulos and A.Wright- Springer
5. Protection & Switchgear –BhaveshBhalaja, R.PMaheshwari, NileshG.Chothani- Oxfordpublisher

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/108/105/108105167/

POWER SYSTEM RELIABILITY
I M.TECH- I SEMESTER

Course Title: Power System Reliability	Course Code: 2456PE02.3
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites: probability,power generation and networks	

COURSE OBJECTIVES:

1.To get the basic understanding of network modelling and reliability.
2.To get the basic understanding of Markov chains.
3.To get the basic understanding of Reliability analysis of generation systems.
4.To get the basic understanding of Decomposition techniques.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Understand reliability analysis appliedto power systems.
CO2	Understand Markov Chains and application to power systems.
CO3	Perform stability analysis of generation systems.
CO4	Understand decomposition techniquesapplied to power system.
CO5	Understand reliability analysis appliedto power systems.

COURSE CONTENT (SYLLABUS)

UNIT -I:
Basic probability theory – rules for combining probabilities of events – Bernoulli`s trials – probability density and distribution functions – binomial- distributions – expected value and standard deviation of binomial distribution.
Self-Learning Topics: Probability Concepts

UNIT-II:
Network Modelling and Reliability Analysis of Series, Parallel, Series-Parallel networks – complexnetworks – decomposition method Reliability functions F(t), R(t), h(t) and their relationship – exponential distributions – Expectedvalue and standard deviation of exponential distribution – Bath tub curve – reliability analysis ofseries parallel networks using exponential distribution – reliability measures MTTF, MTTR,MTBF
Self-Learning Topics: Series Parallel Networks

UNIT-III:

Markov chains – concept of stochastic transitional probability Matrix, Evaluation of limiting state Probabilities – Markov processes one component repairable system – time dependent probability evaluation using Laplace transform approach – evaluation of limiting state probabilities using STPM – two component repairable models – Frequency and duration concept – Evaluation of frequency of encountering state, mean cycle time, for one, two component repairable models – evaluation of cumulative probability and cumulative frequency of encountering merged states

Self-Learning Topics: Concept of stochastic transitional probability

UNIT-IV:

Generation system reliability analysis – reliability model of a generation system – recursive relation for unit addition and removal – load modelling – merging of generation load model – evaluation of transition rates for merged state model – cumulative Probability, cumulative frequency of failure evaluation – LOLP, LOLE.

Self-Learning Topics: Generation system

UNIT-V:

Composite system reliability analysis decomposition method – distribution system reliability analysis – radial networks – weather effects on transmission lines – Evaluation of load and energy indices.

Self-Learning Topics: Radial networks

REFERENCE BOOKS:

1. Reliability Evaluation of Engg. System – R.Billinton, R.N.Allan, Plenum Press, New York.
2. Reliability Modeling in Electric Power Systems - J. Endrenyi, John Wiley, 1978, Neewyork.
3. An Introduction to Realiability and Maintainability Engineering. Sharies E Ebeling, TATAMcGraw Hill – Edition.

ONLINE RESOURCES:

1. https://www.intechopen.com/chapters/57936
2. https://link.springer.com/chapter/10.1007/978-1-84996-232-2_8

POWER SYSTEM SIMULATIONLABORATORY – I
I M.TECH- I SEMESTER

Course Title: Power System Simulation laboratory – I	Course Code: 2456PC03
Teaching Scheme (L:T:P): 0:0:4	Credits: 2
Type of Course: Practical	Total Contact Periods:
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites:	

COURSE OBJECTIVES:

1 .To understand the modeling of different transmission lines
2 .To understand the mathematical formulation of distribution system load flow
3. To understand the configurations of transmission lines
4. To understand the transients in transmission lines
5. To understand the formation of Z- and Y-bus matrices
4.To get the basic understanding of Decomposition techniques

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Analyze different transmission line andparameters
CO2	Analyze Load flow analysis
CO3	Analyze Load dispatch

COURSE CONTENT (SYLLABUS)

List of Experiments

1. Performance analysis of short and medium transmission lines.
2. Performance analysis of long transmission lines.
3. Computation of sag of transmission lines for equal and unequal heights of towers.
4. Distribution load flow analysis.
5. Computation of B- co-efficient in economic load dispatch problem.
6. Computation of line parameters (R, L, C) for different configuration of 3-ϕ symmetrical transmission lines.
7. Computation of line parameters (R, L, C) for different configuration of 3-ϕunsymmetrical transmission lines with and without transposition.
8. Computation reflection and refraction co-efficient of voltages and currents of transmission lineform different conditions.
9. Formation of Y-bus by direct inspection method.
10. Formations of Z-bus by building algorithm

POWER SYSTEM LABORATORY
I M.TECH- I SEMESTER

Course Title: Power System Laboratory	Course Code: 2456PC04
Teaching Scheme (L:T:P): 0:0:4	Credits: 2
Type of Course: practical	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites:	

COURSE OBJECTIVES:

1.To understand the experimental determination of various parameters used in power system areaand

2. to analyze the performance of transmission line with and without compensation.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Determine the sequence impedance ofalternator and transformer.
CO2	Determine the transmission line parameters,voltage regulation of transmission lines without and with shunt regulation and studythe Ferranti effect.
CO3	Perform the experiment on 3-winding transformer and calculate the parameters of transformer.
CO4	Design and simulation of the power angle characteristics of a salient pole synchronous machine.
CO5	Perform the experiment on 3-single phase transformer

COURSE CONTENT (SYLLABUS)

List of Experiments

1. Determination of Sequence Impendence of an Alternator by direct method.
2. Determination of Sequence impedance of an Alternator by fault Analysis.
3. Measurement of sequence impedance of a three phase transformer(a). By application of sequence voltage. (b). Using fault analysis.
4. Power angle characteristics of a salient pole Synchronous Machine.
5. Poly-phase connection on three single phase transformers and measurement of phase displacement.
6. Determination of equivalent circuit of 3-winding Transformer.
7. Measurement of ABCD parameters on transmission line model.
8. Performance of long transmission line without compensation.
9. Study of Ferranti effect in long transmission line.
10. Performance of long transmission line with shunt compensation

RESEARCH METHODOLOGY AND IPR
I M.TECH- I SEMESTER

Course Title: Research Methodology And IPR	Course Code: 24MTMC01
Teaching Scheme (L:T:P): 0:0:4	Credits: 2
Type of Course: Lecture	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites:	

COURSE CONTENT (SYLLABUS)

UNIT– I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT– II

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT – III:

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 PCT.

UNIT- IV:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT-V:

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.

REFERENCE BOOKS:

1.Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"

2.Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners

4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd,2007.

5. .Mayall, "Industrial Design", McGraw Hill, 1992

ENGLISH FOR RESEARCH PAPER WRITING
I M.TECH- I SEMESTER

Course Title: English For Research Paper Writing	Course Code: 24MTAC01.1
Teaching Scheme (L:T:P): 2:0:0	Credits: 0
Type of Course: Lecture	
Continuous Internal Evaluation: 0	Semester End Exam: 0
Pre requisites:	

Course objectives:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title Ensure the good quality of paper at very firsttime submission

COURSE CONTENT (SYLLABUS)

Unit-1

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

Unit-2

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

Unit-3

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

Unit-4

key skills are needed when writing a Title, key skills are neededwhen writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Unit -5

skills are needed when writing the Methods, skills needed whenwriting the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions, useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

SUGGESTED STUDIES:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman‟sbook .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York DordrechtHeidelberg London, 2011.

DISASTER MANAGEMENT
I M.TECH- I SEMESTER

Course Title: Disaster Management	Course Code: 24MTAC01.2
Teaching Scheme (L:T:P): 2:0:0	Credits: 0
Type of Course: Lecture	
Continuous Internal Evaluation: 0	Semester End Exam: 0
Pre requisites:	

Course Objectives: -

Students will be able to:

- learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

COURSE CONTENT (SYLLABUS)

Unit-1:Introduction, Disaster:

Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

Unit-2:Repercussions Of Disasters and Hazards:

Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man- made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit-3:Disaster Prone Areas In India Study Of Seismic Zones:

Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics .

Unit-4:Disaster Preparedness and Management Preparedness:

Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Unit-5 :Risk Assessment & Disaster Mitigation

Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People‟s Participation In Risk Assessment. Strategies for Survival. Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation In India.

References:

1.R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies ""New Royal book Company.

2.Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.

3.Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

POWER SYSTEM DYNAMICS AND STABILITY
I M.TECH- II SEMESTER

Course Title: Power System Dynamics And Stability	Course Code: 2456PC05
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites: steady state and transient stabilities	

COURSE OBJECTIVES:

1. To study the model of synchronous machines.
2. To study the stability studies of synchronous machines.
3. To study the solution method of transient stability.
4. To study the effect of different excitation systems.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Determine the models of synchronous machines
CO2	Know the stability studies of synchronous machines
CO3	Get the knowledge of solution methods of transient stability
CO4	To know Effect of governor action and excite on power system stability
CO5	Know the effect of different excitations systems in power systems

COURSE CONTENT (SYLLABUS)

UNIT– I

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

Self-Learning Topics: Rotating magnetic fields

UNIT– II

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

Self-Learning Topics: Time response of different signals

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.

Self-Learning Topics: Types of loads

UNIT- IV:

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

Self-Learning Topics: Voltage Regulators

UNIT-V:

Excitation Systems : Rotating Self-excited Exciter with direct acting Rheostatic type voltage regulator – Rotating main and Pilot Exciters with Indirect Acting Rheostatic Type Voltage Regulator – Rotating Main Exciter, Rotating Amplifier and Static Voltage Regulator – Static excitation scheme – Brushless excitation system.

Self-Learning Topics: Rotating Amplifier

TEXT BOOKS:

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

REFERENCE BOOKS:

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

Web References:

1. http://powerunit-ju.com/wp-content/uploads/2018/01/Power-System-Stability-and-Control-by- Prabha-Kundur.pdf
2. https://nptel.ac.in/courses/108106026
3. https://www.accessengineeringlibrary.com/content/book/9781260473544
4. https://digital-library.theiet.org/content/books/po/pbpo076e

REAL TIME CONTROL OF POWERSYSTEMS
I M.TECH- II SEMESTER

Course Title**:** Real Time Control Of Powersystems	Course Code: 2456PC06
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites: power system analysis	

COURSE OBJECTIVES:

1. To understand the importance of state estimation in power systems.
2. To know the importance of security and contingency analysis.
3. To understand SCADA, its objectives and its importance in power systems.
4. To know the significance of voltage stability analysis.
5. To know the applications of AI to power systems problems

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Understand state estimation, security and contingencyevaluation.
CO2	Understand about Supervisory control and data acquisition
CO3	Real time softwareapplication to stateestimation.
CO4	Know the Stability in Power systems
CO5	Understand application of AI in power system.

COURSE CONTENT (SYLLABUS)

UNIT– I

State Estimation: Different types of State Estimations, Theory of WLS state estimation, sequential and non-sequential methods to process measurements. Bad data Observability, Bad data detection, identification and elimination

Self-Learning Topics: Power system Optimisation

UNIT– II

Security and Contingency Evaluation: Security concept, Security Analysis and monitoring, Contingency Analysis for Generator and line outages by iterative linear power flow method, Fast Decoupled model, and network sensitivity methods.

Self-Learning Topics: Types of Generators

UNIT – III:

Computer Control of Power Systems: Need for real time and computer control of power systems,

operating states of a power system, SCADA - Supervisory control and Data Acquisition systems implementation considerations, energy control centers, software requirements for implementing theabove functions.

Self-Learning Topics: Operating stages of a power system

UNIT- IV:

Voltage Stability, voltage collapse, and voltage security, relation of voltage stability to rotor angle stability. Voltage stability analysis Introduction to voltage stability analysis `P-V' curves and `Q- V' curves, voltage stability in mature power systems, long-term voltage stability, power flow analysis for voltage stability, voltage stability static indices.

Self-Learning Topics: Reference Bus, Slack Bus

UNIT-V:

Synchro phasor Measurement units: Introduction, Phasor representation of sinusoids, a generic PMU, GPS, Phasor measurement systems, Communication options for PMUs, Functional requirements of PMUs and PDCs, Phasors for nominal frequency signals, types of frequency excursions in power systems, DFT estimation at off nominal frequency with a nominal frequency clock.

Self-Learning Topics: Phasor measurement systems

TEXT BOOKS:

1. John J.Grainger and William D.Stevenson, Jr. : Power System Analysis, McGraw-Hill,1994,International Edition
2. Allen J.Wood and Bruce F.Wollenberg : Power Generation operation andcontrol, JohnWiley &Sons, 1984.
3. A.G.Phadka and J.S. Thorp, "Synchronized Phasor Measurements and TheirApplications",Springer, 2008

REFERENCE BOOKS:

1. R.N.Dhar : Computer Aided Power Systems Operation and Analysis, Tata McGraw Hill,1982
2. L.P.Singh : Advanced Power System Analysis and Dynamics, Wiley Eastern Ltd. 1986
3. PrabhaKundur : Power System Stability and Control -, McGraw Hill, 1994
4. P.D.Wasserman : `Neural Computing : Theory and Practice' Van Nostrand – Feinhold , NewYork.

Web References:

1. https://ieeexplore.ieee.org/abstract/document/1451471
2. https://ijece.iaescore.com/index.php/IJECE/article/view/12530
3. https://npti.gov.in/smart-power-control
4. https://ieeexplore.ieee.org/document/508825

EHVAC TRANSMISSION
I M.TECH- II SEMESTER

Course Title**: Ehvac Transmission**	Course Code: 2456PE03.1
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites: transmission lines in power systems	

COURSE OBJECTIVES:

1. To calculate the transmission line parameters.
2. To calculate the field effects on EHV and UHV AC lines.
3. To have knowledge of corona, RI and audible noise in EHV and UHV lines.
4. To have knowledge of voltage control and compensation problems in EHV and UHVtransmissionsystems.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Calculate the transmission line parameters.
CO2	Calculate the field effectson EHV and UHV AC lines
CO3	Determine the corona, RIand audible noise in EHVand UHV lines.
CO4	Analyse voltage control and compensation problems in EHV and UHVtransmission systems
CO5	Understand reactive powercompensation using SVC and TCR

COURSE CONTENT (SYLLABUS)

UNIT– I:

A.C. Transmission, line trends and preliminary aspects, standard transmission voltages-power handling capacities and line losses-mechanical aspects. Calculation of line resistance and inductance: resistance of conductors, temperature rise of conductor and current carrying capacity. Properties of bundled conductors and geometric mean radius of bundle, inductance of two conductorlines and multi conductor lines, Maxwell's coefficient matrix. Line capacitance calculation. Capacitance of two conductor line, and capacitance of multi conductor lines, potential coefficients for bundled conductor lines, sequence inductancesand capacitances and diagonalization.

Self-Learning Topics: Properties of bundled conductors

UNIT– II:

Calculation of electro static field of AC lines - Effect of high electrostatic field on biological organisms and human beings. Surface voltage Gradient on conductors, surface gradient on

two conductor bundle and cosine law, maximum surface voltage gradient of bundle with more than sub conductors, Mangolt formula.

Self-Learning Topics: Electrostatic fields

UNIT – III:

Corona : Corona in EHV lines – corona loss formulae – attenuation of traveling waves due to corona– Audio noise due to corona, its generation, characteristics and limits, measurement of audio noise.

Self-Learning Topics: Factors effecting Carona

UNIT- IV:

Power Frequency voltage control: Problems at power frequency, generalized constants, No-loadvoltage conditions and charging currents, voltage control using synchronous condenser, cascadeconnection of components: Shunt and series compensation, sub synchronous resonance in series capacitor compensated lines

Self-Learning Topics: charging currents

UNIT-V:

Reactive power compensating systems: Introduction, SVC schemes, Harmonics injected into network by TCR, design of filters for suppressing harmonics injected into the system.

Self-Learning Topics: Harmonics

TEXT BOOKS:

1. Extra High Voltage AC Transmission Engineering – Rakesh Das Begamudre, WileyEasternltd., New Delhi – 1987.
2. EHV Transmission line reference book – Edison Electric Institute (GEC) 1986.

Web References:

1. https://electengmaterials.com/ehvac-transmission/#google_vignette
2. https://www.e-cigre.org/publications/detail/c4-305-2012-a-review-on-ehvac-transmission- line-lightning-performance.html
3. https://www.e-cigre.org/publications/detail/c1-302-2018-converting-regional-ehv-ac- transmission-to-hvdc.html

https://nptel.ac.in/courses/108108099

FLEXIBLE AC TRANSMISSION SYSTEMS
I M.TECH- II SEMESTER

Course Title: Flexible Ac Transmission Systems	Course Code: 2456PE03.2
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites: power systems and power electronics	

COURSE OBJECTIVES:

1. To study the performance improvements of transmission system with FACTS.
2. To study the effect of static shunt compensation.
3. To study the effect of static series compensation.
4. To study the effect of UPFC

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Know the performance improvement of transmission system with FACTS.
CO2	Get the knowledge of effect of static shunt and series compensation.
CO3	Know transfer function and dynamic performance SVC and STATCOM
CO4	Know the principle of operation and various controls of UPFC
CO5	Determine an appropriate FACTS device for different types of applications

COURSE CONTENT (SYLLABUS)

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.

Self-Learning Topics: Dynamic stability

UNIT– II

Basic concept of voltage and current source converters, comparison of current source converters with voltage source converters.

Static shunt compensation : Objectives of shunt compensation, midpoint voltage regulation, voltage instability prevention, improvement of transient stability, Power oscillation damping, methods of controllable VAr generation, variable impedance type static VAr generation, switchingconverter type VAr generation, hybrid VAr generation.

Self-Learning Topics: voltage and current source converters

UNIT – III:

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

Self-Learning Topics: Power oscillation damping

UNIT- IV:

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

Self-Learning Topics: Thyristor family devices

UNIT-V:

Unified Power Flow Controller: Basic operating principle, conventional transmission control capabilities, independent real and reactive power flow control, comparison of the UPFC to series compensators and phase angle regulators. Introduction to Inter line Power Flow Controller (IPFC)

Self-Learning Topics: real and reactive power flow control

TEXT BOOKS:

1. "Understanding FACTS Devices" N.G.Hingorani and L.Guygi, IEEE Press.
Indian Edition isavailable:--Standard Publications

Reference Books:

1. Sang.Y.HandJohn.A.T, "Flexible AC Transmission systems" IEEE Press (2006).
2. HVDC & FACTS Controllers: applications of static converters in power systems-Vijay K.Sood-Springer publishers

Web References:

1. https://www.siemens-energy.com/global/en/home/products-services/product-offerings/flexible-ac- transmission-systems.html
2. https://www.infineon.com/cms/en/applications/industrial/power-transmission-and- distribution/flexible-ac-transmission-systems-facts/
3. https://www.sciencedirect.com/topics/engineering/flexible-ac-transmission-systems
4. https://nptel.ac.in/courses/108107114

ELECTRIC VEHICLES & DESIGN
I M.TECH- II SEMESTER

Course Title: Electric Vehicles & Design	Course Code: 2456PE03.3
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites: power electronics and EV vehicles	

COURSE OBJECTIVES:

1. To understand the fundamental concepts, principles, analysis and design of hybrid and electric vehicles. ·
2. To know the various aspects of hybrid and electric drive train such as their configuration, types of electricmachines that can be used energy storage devices, etc.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Understand the models to describe hybrid vehiclesand their performance
CO2	Understand the different possible ways of energystorage.
CO3	Understand the different strategies related to energy storage systems.
CO4	Know different batteriesand other energy storage systems

COURSE CONTENT (SYLLABUS)

UNIT– I

Conventional Vehicles: Basics of vehicle performance, Vehicle power source characterization, Transmission characteristics, Mathematical models to describe vehicle performance.

Self-Learning Topics: vehicle performance

UNIT– II

Introduction To Hybrid Electric Vehicles

History of hybrid and electric vehicles, Social and environmental importance of hybrid and electricvehicles, Impact of modern drive-trains on energy supplies.

Hybrid Electric Drive-Trains: Basic concept of hybrid traction, Introduction to various hybrid drive-train topologies, Power flow control in hybrid drive-train topologies, Fuel efficiency analysis

Self-Learning Topics: electric vehicles

UNIT– III

Electric Drive-Trains: Basic concept of electric traction, introduction to various electric drive train topologies, Power flow control in electric drive-train topologies, Fuel efficiency analysis.

Electric Propulsion Unit: Introduction to electric components used in hybrid and electric

vehicles,Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives,Configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, Drive system efficiency.
Self-Learning Topics: Power grid

UNIT– IV
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, SuperCapacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.
Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE),Sizing the propulsion motor, Sizing the power electronics, selecting the energy storage technology, Communications, Supporting subsystems
Self-Learning Topics: power electronics

UNIT– V
Energy Management Strategies: Introduction to energy management strategies used in hybrid andElectric vehicles, Classification of different energy management strategies, Comparison of different energyManagement strategies, Implementation issues of energy management strategies.
Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).
Self-Learning Topics: power generation

TEXT BOOKS:

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with
Practical Perspectives", John Wiley & Sons, 2011.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies",
Springer, 2015.

REFERENCES:

1. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and FuelCell
Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
2.T. Denton, "Electric and Hybrid Vehicles", Routledge, 2016.

Web Resources:

(PDF) Control of Renewable Energy Systems (researchgate.net)

GENERATION AND MEASUREMENT OF HIGH VOLTAGES
I M.TECH- II SEMESTER

Course Title: Generation And Measurement Of High Voltages	Course Code: 2456PE04.1
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites: power electronics and ac voltages	

COURSE OBJECTIVES:

1. To study the numerical methods for analyzing electrostatic field problems.
2. To study the fundamental principles of generation of high voltage for testing.
3. To study the methods for measurement of high AC, DC and transient voltages.
4. To Study the measurement techniques for high AC, DC and impulse currents.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Understand numerical computation of electrostatic problems.
CO2	Understand the techniques of generation of high AC, DCand transient voltages
CO3	Know the Generation of ImpulseVoltages
CO4	Measure high AC, DC andtransient voltages.
CO5	Measurement of Impulse Voltages, Impulse Currents

COURSE CONTENT (SYLLABUS)

UNIT-I

Electrostatic fields and field stress control : Electric fields in homogeneous Isotropic materialsand in multi dielectric media-Simple configurations-field stress control. Methods of computing electrostatic fields-conductive analogues-Impedance networks Numerical techniques-finite difference method-finite element method and charge simulation method.

Self-Learning Topics: Electric fields

UNIT– II

Generation of High AC & DC Voltages:

Direct Voltages : AC to DC conversion methods, electrostatic generators, Cascaded Voltage Multipliers.

Alternating Voltages : Cascading transformers-Resonant circuits and their applications, Teslacoil.

Self-Learning Topics: AC to DC conversion methods

UNIT – III:

Generation of Impulse Voltages :

Impulse voltage specifications-Impulse generation circuits-Operation, construction and design ofImpulse generators-Generation of switching and long duration impulses.

Impulse Currents: Generation of high impulse currents and high current pulses.
Self-Learning Topics: Impulse Currents

UNIT- IV:
Measurement of High AC & DC Voltages :
Measurement of High D.C. Voltages : Series resistance meters, voltage dividers and generatingvoltmeters.
Measurement of High A.C. Voltages : Series impedance meters electrostatic voltmeters potentialtransformers and CVTS-voltage dividers and their applications.
Self-Learning Topics: Series resistance meters

UNIT-V:
Measurement of Peak Voltages :
Sphere gaps, uniform field gaps, rod gaps. Chubb-Fortesque method, passive and active rectifier circuits for voltage dividers.
Measurement of Impulse Voltages: Voltage dividers and impulse measuring systems-generalized voltage measuring circuits-transfer characteristics of measuring circuits-L.V. Arms for voltage dividers-compensated dividers.
Measurement of Impulse Currents: Resistive shunts-current transformers-Hall Generators and Faraday generators and their applications-Impulse Oscilloscopes.
Self-Learning Topics: Compensated dividers

TEXT BOOKS:
1.High Voltage Engineering – by E.Kuffel and W.S.Zaengl. Pergaman press Oxford, 1984. 2.High Voltage Engineering – by M.S.Naidu and V.Kamaraju, Mc.Graw-Hill Books Co.,NewDelhi, 2nd edition, 1995.

Reference Books:

1. High Voltage Technology – LL Alston, Oxford University Press 1968.
2. High Voltage Measuring Techniques – A. Schwab MIT Press, Cambridge,USA, 1972.
3. Relevant I.S. and IEC Specifications

Web References:

1. https://uom.lk/sites/default/files/elect/files/HV_Chap6.pdf
2. https://www.sciencedirect.com/science/article/abs/pii/S1386276699800061
3. https://archive.nptel.ac.in/courses/108/104/108104048/
4. https://biet.ac.in/pdfs/IV-HVE.pdf

EVOLUTIONARY ALGORITHMS AND APPLICATIONS
I M.TECH- II SEMESTER

Course Title: Evolutionary Algorithms And Applications	Course Code: 2456PE04.2
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites: optimization techniques	

COURSE OBJECTIVES:

1. To distinguish between conventional optimization algorithms and evolutionary optimizationalgorithms.
2. To apply genetic algorithm and particle swarm optimization algorithm to power systemoptimizationproblems.
3. To analyse and apply Ant colony optimization algorithm and artificial Bee colony algorithm tooptimize the control parameters. /power system optimization problems.
4. To apply shuffled frog leaping algorithm and bat optimization algorithm to power system optimization problem.
5. To apply multi-objective optimization algorithm to power system multi-objective problems.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	State and formulate the optimization problem without and with constraints, by using design variables from an engineering design problem
CO2	Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or withconstraints, and arrive at an optimal solution
CO3	Formulate a mathematical modeland apply linear programming technique by using Simplex method. Also extend the conceptof dual Simplex method for optimal solutions.
CO4	Apply gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions
CO5	Apply Genetic algorithms for simple electrical problems and able to solve practical problems using PSO

COURSE CONTENT (SYLLABUS)

UNIT-I: Fundamentals of Soft Computing Techniques

Definition-Classification of optimization problems- Unconstrained and Constrained optimization Optimality conditions- Introduction to intelligent systems- Soft computing techniques- Conventional Computing versus Swarm Computing - Classification of meta-heuristic techniques - Single solution based and population based algorithms – Exploitation and exploration in population based algorithms -Properties of Swarm intelligent Systems - Application domain - Discrete and continuous problems - Singleobjective and multi-objective

problems.

Self-Learning Topics: Power system optimization

UNIT– II:Genetic Algorithm and Particle Swarm Optimization

Genetic algorithms- Genetic Algorithm versus Conventional Optimization Techniques - Genetic representations and selection mechanisms; Genetic operators- different types of crossover and mutation operators -Bird flocking and Fish Schooling – anatomy of a particle-equations based on velocity and positions -PSO topologies - control parameters – GA and PSO algorithms for solving ELD problem without loss, Selective Harmonic Elimination in inverters and PI controller tuning.

Self-Learning Topics: Genetic operators

UNIT – III: Ant Colony Optimization and Artificial Bee Colony Algorithms

Biological ant colony system - Artificial ants and assumptions - Stigmergic communications - Pheromone updating- local-global - Pheromone evaporation - ant colony system- ACO models-Touring ant colony system-max min ant system - Concept of Elitist Ants-Task partitioning in honeybees - Balancing foragers and receivers - Artificial bee colony (ABC) algorithms-binary ABC algorithms – ACO and ABC algorithms for solving Economic Dispatch without loss and PI controllertuning.

Self-Learning Topics: Stigmergic communications

UNIT- IV:Shuffled Frog-Leaping Algorithm and Bat Optimization Algorithm

Bat Algorithm- Echolocation of bats- Behaviour of microbats- Acoustics of Echolocation-Movement of Virtual Bats- Loudness and Pulse Emission- Shuffled frog algorithm-virtual population of frogs comparison of memes and genes -memeplex formation- memeplex updation - BA and SFLA algorithms for solving ELD without loss and PI controller tuning.

Self-Learning Topics: Echolocation of bats

UNIT-V:Multi Objective Optimization

Multi-Objective optimization Introduction- Concept of Pareto optimality - Non-dominant sorting technique-Pareto fronts-best compromise solution-min-max method-NSGA-II algorithm and application togeneral two objective optimization problem.

Self-Learning Topics: Optimization Techniques

TEXT BOOKS:

1. Xin-She Yang, „Recent Advances in Swarm Intelligence and Evolutionary Computation‟,Springer International Publishing, Switzerland, 2015.
2. Kalyanmoy Deb „Multi-Objective Optimization using Evolutionary Algorithms‟, JohnWiley &Sons, 2001.
3. James Kennedy and Russel E Eberheart, „Swarm Intelligence‟, The Morgan KaufmannSeries inEvolutionary Computation, 2001.

REFERENCE BOOKS:

1. Eric Bonabeau, Marco Dorigo and Guy Theraulaz, „Swarm Intelligence-From natural toArtificialSystems‟, Oxford university Press, 1999.

2. David Goldberg, „Genetic Algorithms in Search, Optimization and Machine Learning‟,PearsonEducation, 2007.
3. Konstantinos E. Parsopoulos and Michael N. Vrahatis, „Particle Swarm Optimization andIntelligence: Advances and Applications‟, InformatIonscIence reference, IGI Global, ,2010.
4. N P Padhy, „Artificial Intelligence and Intelligent Systems‟, Oxford University Press, 2005.

WEB REFERENCES:

1. https://www.worldscientific.com/doi/10.1142/9781848166820_0006
2. https://iwaponline.com/h2open/article/3/1/135/74697/Evolutionary-algorithms-swarm-intelligence-methods
3. https://link.springer.com/book/10.1007/978-3-662-03423-1
4. https://nptel.ac.in/courses/112103301

PROGRAMMABLE LOGIC CONTROLLERS &APPLICATIONS
I M.TECH- II SEMESTER

Course Title: Programmable Logic Controllers &Applications	Course Code: 2456PE04.3
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites: basics in mpmc and switch theory and logic design	

COURSE OBJECTIVES:

1. To have knowledge on PLC.
2. To acquire the knowledge on programming of PLC.
3. To understand different PLC registers and their description.4.To have knowledge on data handling functions of PLC.
5. To know how to handle analog signal and converting of A/D in PLC.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Understand the PLCs and their I/O modules
CO2	Develop control algorithms to PLC using ladder logic etc
CO3	Manage PLC registers for effective utilization in different applications
CO4	Handle data functions and control of two axis and their axis robots with PLC
CO5	Design PID controller withPLC.

COURSE CONTENT (SYLLABUS)

UNIT– I:PLC Basics:

PLC system, I/O modules and interfacing, CPU processor, programming equipment, programmingformats,construction of PLC ladder diagrams, devices connected to I/O modules.

Self-Learning Topics: digital electronics

UNIT– II:PLC Programming:

Input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation. Digital logic gates, programming in the Boolean algebra system, conversion examples. Ladder diagrams for process control: Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

Self-Learning Topics: Digital logic gates

UNIT – III:PLC Registers:

Characteristics of Registers, module addressing, holding registers, input registers, output registers. PLC Functions: Timer functions and Industrial applications, counters, counter

function industrial applications, Arithmetic functions, Number comparison functions, number conversion functions.

Self-Learning Topics: relay logic

UNIT- IV:Data Handling functions:

SKIP, Master control Relay, Jump, Move, FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axis and three axis Robots with PLC, Matrix functions

Self-Learning Topics: Master control Relay

UNIT-V:Analog PLC operation:

Analog modules and systems, Analog signal processing, multi bit data processing, analog output application examples, PID principles, position indicator with PID control, PID modules, PID tuning,PID functions.

Self-Learning Topics: PID principles

TEXT BOOKS:

1. Xin-She Yang, „Recent Advances in Swarm Intelligence and Evolutionary Computation‟,Springer International Publishing, Switzerland, 2015.
2. Kalyanmoy Deb „Multi-Objective Optimization using Evolutionary Algorithms‟, John Wiley &Sons, 2001.
3. James Kennedy and Russel E Eberheart, „Swarm Intelligence‟, The Morgan Kaufmann Series inEvolutionary Computation, 2001.

REFERENCE BOOKS:

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

Web References:

1. https://www.gbctechtraining.com/blog/world-plcs-closer-you-think-plc applications-our-everyday-lives
2. https://tulip.co/blog/programmable-logic-controller-what-is-a-plc/
3. https://en.wikipedia.org/wiki/Programmable_logic_controller
4. https://nptel.ac.in/courses/108105088

POWER SYSTEM SIMULATION LABORATORY-II
I M.TECH- II SEMESTER

Course Title: Power System Simulation Laboratory-II	Course Code: 2456PC07
Teaching Scheme (L:T:P): 0:0:4	Credits: 2
Type of Course: Practical	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites:	

COURSE OBJECTIVES:

The student should understand the modelling of various aspects of Power System analysis and develop the MATLAB programming.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	The student should analyze load flow solution obtained using GS and NR methods
CO2	The student should analyze symmetrical and unsymmetrical faults
CO3	The student should analyze Transient stability and load frequency deviation in single and two area systems

COURSE CONTENT (SYLLABUS)

List of Experiments

1.Load Flow Solution Using Gauss Siedel Method

2.Load Flow Solution Using Newton Raphson Method

3.Load Flow Solution Using Decoupled Method

4.Symmetrical Fault analysis using Z-bus

5.Unsymmetrical Fault analysis using Z-bus

6.Economic Load Dispatch with & without transmission losses

7.Transient Stability Analysis using modified Euler's method.

8.Transient Stability Analysis using modified R-K method.

9.Transient Stability Analysis Using Point By Point Method

10.Load Frequency Control of Single Area Control & Two Area Control system with and without controllers.

Exercise Problems

1. Determination of Load Flow Solution of an Alternator.
2. Fault analysis on Alternator
3. Measurement of Economic Load Dispatch on transmission line model
4. Determination of Transient Stability Analysis.
5. Determination of Load Frequency Control of Single Area Control & Two Area Control system

POWER CONVERTERS LABORATORY
I M.TECH- II SEMESTER

Course Title: Power Converters Laboratory	Course Code: 2456PC08
Teaching Scheme (L:T:P): 0:0:4	Credits: 2
Type of Course: Practical	
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites:	

COURSE OBJECTIVES:

1. To expose students to operation and characteristics of power semiconductor devices andpassive components, their practical application in power electronics.
2. To provide a practical exposure to operating principles, design and synthesis of differentpower electronic converters.
3. To introduce students to industrial control of power electronic circuits as well as safeelectrical connection and measurement practices.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Analyze and test the power semiconductordevices and their applications
CO2	Compare and contrast various power semiconductor devices according to theirapplications.

List of Experiments:

1. Study of DC-DC non-isolated converters such as Buck & Boost converter
2. Study of DC-DC Buck-Boost and Cuk converters.
3. Study of 1-ϕ dual converter.
4. Determination of input p.f. and harmonic factor for 1-ϕsemi- converterand 1-ϕ fullconverter (Inductive load)
5. Study of p.f. improvement in 1-ϕ full-converter with symmetric andextinction angle control..
6. Study of 1-ϕ square wave and sinusoidal PWM inverter
7. Study of 3-ϕ inverter with 120o and 180omode of operation.
8. Study of 3-ϕ sinusoidal PWM inverter.
9. Study of 3-level NPC inverter
10. Study of 5-level cascaded H-bridge inverter.
11. Determination of input p.f. and harmonic factor for 3-ϕ full converter .
12. Determination of input p.f. and harmonic factor for 3-ϕ semi converter
13. Study the characteristics of IGBT, MOSFET & GTO‟s.
14. Design of gate drive circuits for IGBT & MOSFET‟s.

Exercise Problems

1. Study of DC – DC Converters
2. Study of 1-phase Dual converter
3. Study of 3-level NPC Inverter
4. Study of 5-level cascaded H-bridge Inverter

MINI PROJECT WITH SEMINAR
I M.TECH- IISEMESTER

Course Title: MINI PROJECT	Course Code: 2456PR01
Teaching Scheme (L:T:P): 3:0:0	Credits: 2
Type of Course: Lecture	
Continuous Internal Evaluation: 100 Marks	Semester End Exam: 70 Marks
Pre requisites:	

Syllabus Contents:

The students are required to search / gather the material / information on a specific a topic comprehend it and present / discuss in the class.

Course Outcomes:

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

1. Understand of contemporary / emerging technology for various processes and systems.
2. Share knowledge effectively in oral and written form and formulate documents

CONSTITUTION OF INDIA
I M.TECH- IISEMESTER

Course Title: CONSTITUTION OF INDIA	Course Code: 24MTAC02.1
Teaching Scheme (L:T:P): 2:0:0	Credits: 0
Type of Course: Lecture	
Continuous Internal Evaluation: 0	Semester End Exam: 0
Pre requisites:	

COURSE OBJECTIVES:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address 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.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	scuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
CO2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
CO3	s the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
CO4	Discuss the passage of the Hindu Code Bill of 1956.

COURSE CONTENT (SYLLABUS)

UNIT-I:

History of Making of the Indian Constitution: History, Drafting Committee,(Composition & Working)

UNIT-2:

Philosophy of the Indian Constitution, Preamble Salient Features

Contours of Constitutional Rights & Duties: Fundamental Rights Right to Equality Right to Freedom. Right against Exploitation Right to Freedom of Religion Cultural and Educational Rights. Right to Constitutional Remedies Directive Principles of State Policy Fundamental Duties.

Unit-3

Organs of Governance:

Parliament Composition, Qualifications and Disqualifications Powers and Functions Executive President Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions.

Unit-4

Local Administration:

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

Unit-5

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

VALUE EDUCATION
I M.TECH- IISEMESTER

Course Title: Value Education	Course Code: 24MTAC02.2
Teaching Scheme (L:T:P): 2:0:0	Credits: 0
Type of Course: Lecture	
Continuous Internal Evaluation:0	Semester End Exam: 0
Pre requisites:	

COURSE OBJECTIVES

Students will be able to

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Knowledge of self-development
CO2	Learn the importance of Human values
CO3	Developing the overall personality

COURSE CONTENT (SYLLABUS)

Unit-1:Values and self-development

Social values and individual attitudes. Work ethics, Indian vision of humanism, Moral and non- moral valuation. Standards and principles, Value judgements.

Unit-2:Importance of cultivation of values.

Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness, Honesty, Humanity. Power of faith, National Unity, Patriotism, Love for nature ,Discipline.

Unit-3:Personality and Behavior Development

Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labor, Universal brotherhood and religious tolerance, True friendship, Happiness Vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature. Character and Competence –Holy books vs Blind faith, Self-management and Good health, Science of reincarnation, Equality, Nonviolence ,Humility, Role of Women. All religions and same message.Mind your Mind, Self-control.Honesty, Studying effectively

1 Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi