UNIVERSITY VISION MISSION

VISION

B.S. Abdur Rahman Institute of Science & Technology aspires to be a leader in Education, Training and Research in Engineering, Science, Technology and Management and to play a vital role in the Socio-Economic progress of the Country.

MISSION

- To blossom into an internationally renowned University
- To empower the youth through quality education and to provide professional leadership
- To achieve excellence in all its endeavors to face global challenges
- To provide excellent teaching and research ambience
- To network with global Institutions of Excellence, Business, Industry and Research Organizations
- To contribute to the knowledge base through Scientific enquiry, Applied Research and Innovation

VISION & MISSION STATEMENT OF THE DEPARTMENT OF EEE

VISION

To achieve excellence in the programs offered by the Department of Electrical and Electronics Engineering through quality teaching, holistic learning, innovative research and extension.

MISSION

- To offer Under Graduate, Post Graduate & Research programs of industrial and societal relevance.

- To provide knowledge and skill in the Design and realization of Electrical and Electronic circuits and systems.

- To impart necessary managerial and soft skills to face the industrial challenges.

- To pursue academic and collaborative research with industry and research institutions in India and abroad.

- To disseminate the outcome of research and projects through publications, seminars and workshops.

- To provide conducive ambience for higher education, teaching and research.

B. Tech. PART TIME DEGREE PROGRAMMES REGULATIONS 2013

1.0 PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i) **"Programme"** means B.Tech. Degree Programme

ii) **"Branch"** means specialization or discipline of B.Tech Degree Programme like Civil Engineering, Polymer Technology, etc.,

iii) **"Course"** means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, Engineering Graphics, Computer Practice, etc.,

iv) **"University"** means B.S.Abdur Rahman University.

v) **'Dean (Academic Courses)'** means Dean (Academic Courses) of B.S.Abdur Rahman University..

vi) **'Dean (Students)'** means Dean(Students) of B.S.Abdur Rahman University

vii) **"Controller of Exams"** means the Controller of Examination of B.S.Abdur Rahman University, who is responsible for conduct of examinations and declaration of results.

2.0 ADMISSION

2.1 Candidates for admission to the first semester of the SEVEN semester Part-Time (Evening) B.Tech. degree programme shall be required to have passed the Diploma examination in Engineering / Technology / of the Department of Technical Education, Tamilnadu or any other examination of any other authority accepted by the University as equivalent thereto.

2.2 The eligibility criteria such as marks, number of attempts and physical fitness shall be as prescribed by the University from time to time.

3.0 BRANCHES OF STUDY

3.1 Regulations are applicable to the following B.Tech. degree programmes in various branches of Engineering and Technology, each distributed over SEVEN semesters with two semesters per academic year.

B.Tech. DEGREE PROGRAMMES:

1. Aeronautical Engineering
2. Automobile Engineering
3. Civil Engineering
4. Computer Science and Engineering
5. Electrical and Electronics Engineering
6. Electronics and Communication Engineering
7. Electronics and Instrumentation Engineering
8. Information Technology
9. Manufacturing Engineering
10. Mechanical Engineering
11. Polymer Engineering

4.0 STRUCTURE OF PROGRAMMES:

4.1 Every Programme will have a curriculum with syllabi consisting of theory and practical courses such as,

i) Basic Sciences (BS)
ii) Humanities & Social Sciences (HS)
iii) Management Sciences (MS)
iv) Engineering Fundamental Courses (EF)
v) Engineering Core Courses (EC)
vi) Professional Electives (PE)
vii) General Electives (GE)
viii) Workshop practice, laboratory work, industrial training, seminar presentation, project work, etc.

4.2 Each course is normally assigned certain number of credits

one credit per lecture period per week

one credit per tutorial period per week

one credit for two to three periods and two credits for four periods of laboratory or practical courses,

one credit for two periods of seminar or project work per week

one credit for two weeks of industrial training

4.3 Each semester curriculum shall normally have a blend of lecture courses not exceeding SEVEN and practical courses not exceeding FOUR.

4.4 For the award of the degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study. This minimum will lie between 130 and 140 credits, depending on the program.

4.5 The medium of instruction, examinations and project report will be English, except for courses on languages other than English.

5.0 DURATION OF THE PROGRAMME

5.1 A student is ordinarily expected to complete the B.Tech. programme In SEVEN semesters, but in any case not more than 14 semesters.

5.2 Each semester shall normally consist of around 90 working days or 270 working hours. End semester examination will normally follow immediately after the last working day of the semester.

6.0 CLASS ADVISOR AND FACULTY ADVISER

6.1 CLASS ADVISOR

A faculty member will be nominated by the HOD as Class Advisor for the whole class (1st to 7th semester).

He/she is responsible for maintaining academic, curricular and co-curricular records of all students throughout their period of study.

6.2 FACULTY ADVISOR

To help the students in planning their courses of study and for general counseling on the academic programme, the Head of the Department of the student will attach a certain number of students to a faculty member of the department who shall function as Faculty Advisor for the students throughout their period of study. Such Faculty Advisor shall offer advice to the students on academic and personal matters, and guide the students in taking up courses for registration and enrolment every semester.

7.0 COURSE COMMITTEE

Common course offered to more than one discipline or group, shall have a "Course Committee", comprising all the faculty members teaching the common course with one of them nominated as Course Coordinator. The nomination of the course coordinator shall be made by the Head of the Department / Dean (Academic Affairs), depending on whether all the faculty members teaching the common course belong to the same department / different departments.

8.0 CLASS COMMITTEE

A class committee is constituted by the Head of the Department every semester to monitor and govern the teaching, learning and evaluation.

8.1 The class committee will have the following composition

i) One senior faculty member preferably not teaching to the concerned class, appointed as Chairman by the Head of the Department

ii) Faculty members of individual courses

iii) Two students, (preferably one male and one female) of the class per group of 30 students or part thereof, to be nominated by the Head of the Department, in consultation with the faculty advisors.

iv) All faculty advisors and the class advisor of the class

v) Head of the Department

8.2 The class committee shall meet at least thrice during the semester. The first meeting will be held within two weeks from the date of class commencement, in which the type of assessments, like test, assignment, assignment based test etc., will be decided for the first, second and third assessments. The second meeting will be held within a week after the date of first assessment report, to review the students' performance and for follow up action. The third meeting will be held within a week after the second assessment report, to review the students' performance and for follow up action.

8.3 During these three meetings the student members representing the entire class, shall meaningfully interact and express opinions and suggestions of the class students to improve the effectiveness of the teaching-learning process.

8.4 The class committee, **excluding the student members and the invited members,** shall meet within 10 days from the last day of the end-semester examination to analyse the performance of the students in all the components of assessments and decide the grades secured by students in each course. The grades in a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the concerned course coordinator.

9.0 REGISTRATION AND ENROLMENT

9.1 Except for the first semester, every student shall register for the ensuing semester during a specified week before the end semester examination of the current semester. Every student shall submit a completed Registration form indicating the list of courses intended to be credited during the ensuing semester. Late registration with the approval of Dean(AC) along with a late fee will be permitted up to the last working day of the current semester.

9.2 From the second semester onwards, all students shall pay the prescribed fees for the semester on a specific day at the beginning of the semester confirming the registered courses. Late enrolment, with the approval of Head of the Institution along with a late fee, will be permitted up to two weeks from the date of commencement of classes. If a student does not enroll, his/her name will be removed from rolls.

9.3 The students of first semester shall register and enroll at the time of admission by paying the prescribed fees.

9.4 A student should have registered for all preceding semesters before registering for a particular semester.

10.0 CHANGE OF A COURSE

A student can change a course within a period of 15 days from the Commencement of the course, with the approval of the Dean(AC), on the recommendation of the Head of the Department of the student.

11.0 WITHDRAWAL FROM A COURSE

A student can withdraw from a course at any time before the second assessment for genuine reasons, with the approval of the Dean(AC), on the recommendation of the Head of the Department of the student.

12.0 TEMPORARY BREAK OF STUDY FROM A PROGRAMME

A student can take a one time temporary break of study covering the current semester and/or next semester period with the approval of the Head of the Institution at any time before the start of third assessment of current semester, within the maximum period of 14 semesters . If any students is debarred or suspended for want of attendance or due to any act of indiscipline it will not be considered as break of study.

13.0 CREDIT LIMIT FOR ENROLMENT

13.1 A student can enroll for a maximum of 24 credits during a semester period including arrears courses.

13.2 Minimum credit requirement to move to the higher semester is

- Not less than a total of 18 credits, to move to the 3rd semester
- Not less than a total of 35 credits, to move to the 5th semester
- Not less than a total of 55 credits, to move to the 7th semester

13.3 However, a student who has secured "I" grade (due to shortage of attendance) in all the courses of a particular semester is not eligible to move to the next higher semester.

14.0 SUMMER TERM COURSES

14.1 A student can register for a maximum of two courses during summer term, if such courses are offered by the concerned department during the summer term.

14.2 The Head of the department, in consultation with the department consultative committee and with the approval of Head of the Institution may arrange for the conduct of a few courses during summer term, depending on the availability of teachers during summer and subject to certain minimum of students registering for such courses, which will be fixed from time to time by the Dean (AC).

14.3 The number of contact hours and the assessment procedure for any course during summer term will be the same as those during regular semesters except that there is no provision either for withdrawal from a summer term course or for substitute examination.

15.0 ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

15.1 Every theory course shall have a total of four assessments during a semester as given below:

Assessment No.	Course Coverage in Weeks	Duration	Weightage of Marks
Assessment 1	1 to 4	1.5 hours	15%
Assessment 2	5 to 8	1.5 hours	15%
Assessment 3	9 to 12	1.5 hours	15%
Attendance #	-	-	5%
Semester End Exam	1 to 18 (full course)	3 hours	50 %

 # 76-80% - 1 Mark ; 81-85 – 2 Marks ; 86-90 – 3 Marks ; 91-95 – 4 Marks and 96 – 100 – 5 Marks

15.2 Appearing for semester end examination for each course is mandatory and a student should secure a minimum of 40% marks in each course in semester end examination for the successful completion of the course.

15.3 Every practical course will have 60% weightage for continuous assessment and 40% for semester end examination. However, a student should have secured a minimum of 50% marks in the semester end practical examination.

15.4 In the case of Industrial training, the student shall submit a report, which will be evaluated along with an oral examination by a committee of faculty members, constituted by the Head of the department. A progress report from the industry will also be taken into account for evaluation.

15.5 In the case of project work, a committee of faculty members constituted by the Head of the Department will carry out three periodic reviews. Based on the project report submitted by the student(s), an oral examination (viva-voce) will be conducted as the semester end examination, for which one external examiner, approved by the Controller of Examinations, will be included. The weightage for periodic review will be 50% and remaining 50% for the project report and the Viva Voce examination.

15.6 Assessment of seminars and comprehension will be carried out by a committee of faculty members constituted by the Head of the Department.

15.7 The continuous assessment marks earned for a course during his/her first appearance will be used for grading along with the marks earned in the end-semester / arrear examination for that course until he/she completes.

16.0 SUBSTITUTE EXAMINATIONS

16.1 A student who has missed, for genuine reasons, a maximum of one of the four assessments of a course may be permitted to write a substitute examination. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accident or admission to a hospital due to illness, etc. by a committee constituted by the Dean of School for that purpose.

16.2 A student who misses any assessment in a course shall apply in a prescribed form to the Dean (AC) through the Head of the department within a week from the date of missed assessment. However the substitute examination will be conducted within two weeks after the last day of the end-semester examination, with the approval of the Dean (AC).

17.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION

17.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% (for genuine reasons such as medical grounds or representing the University in approved events etc.) to become eligible to appear for the end-semester examination in that course, failing which the student shall be awarded "I" grade in that course. If the course is a core course, the candidate should register for and repeat the course when it is offered next

17.2 The faculty member of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in that course to the class advisor. The class advisor will consolidate and furnish the list of students who have earned less that 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department. Thereupon, the Dean (Academic Affairs) shall announce, course-wise, the names of such students prevented from writing the semester end examination in each course.

17.3 A student should register to re-do a core course wherein "I" or "W" grade is awarded. If the student is awarded, "I" or "W" grade in an elective course either the same elective course may be repeated or a new elective course may be taken.

17.4 A student who is awarded "U" grade in a course will have the option of either to write semester end arrear exam at the end of the subsequent semesters, or to

redo the course during summer term / regular semester. Marks earned during the redo period in the continuous assessment for the course, will be used for grading along with the marks earned in the end-semester (re-do) examination. If any student obtained "U" grade during summer term course, the marks earned during the redo period for the continuous assessment for that course will be considered for further appearance as arrears.

17.5 If a student with "U" grade prefers to redo any particular course fails to earn the minimum 75% attendance while doing that course, then he/she will be awarded "I" grade in that course.

18.0 PASSING AND DECLARATION OF RESULTS AND GRADE SHEET

18.1 All assessments of a course will be made on absolute marks basis. However, the class committee without the student members and invited members will meet within 10 days after the end-semester examinations and analyze the performance of students in all assessments of a course and award letter grade. The letter grades and the corresponding grade points are as follows:

Letter grade	Grade points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
I	--
W	--
AB	--

"W" denotes withdrawal from the course

"I" denotes inadequate attendance in the course and hence prevention from writing semester end examination.

"U" denotes unsuccessful performance in the course.

"AB" denotes Absent for the semester end examination

18.2 A student who earns a minimum of five grade points in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student

18.3 The results, after awarding of grades, shall be signed by the Head of the Department and declared by the Controller of Examinations.

18.4 Within one week from the date of declaration of result, a student can apply for revaluation of his / her end semester examination answer paper in a course, on payment of a prescribed fee, through proper application to Dean (AC), who shall constitute a revaluation committee consisting of the Head of the Department as convener, the teacher of the course and a senior member of faculty knowledgeable in that course. The committee shall meet within a week to revalue the answer paper and submit its report to the Controller of Examinations for consideration and decision

18.5 After results are declared, grade sheets shall be issued to each student, which will contain the following details. The list of courses enrolled during the semester including summer term courses, if any, and the grade scored, the Grade Point Average (GPA) for the semester and the Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards. GPA is the ratio of the sum of the products of the number of credits of courses registered and the points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester, including summer courses, if any.

If C_i, is the number of credits assigned by for i^{th} course and GP_i is the Grade Point obtained in the i^{th} course

$$GPA = \frac{\sum_i (Ci)(GPi)}{\sum_i Ci}$$

The Cumulative Grade Point Average CGPA shall be calculated in a similar manner, considering all the courses enrolled from first semester.

"I" and "W" grades will be excluded for calculating GPA .

"U", "I" AB" and "W" grades will be excluded for calculating CGPA.

18.6 After successful completion of the programme, the Degree will be awarded with the following classifications based on CGPA

Classification	**CGPA**
First Class with Distinction	8.50 and above and passing all examinations in the first appearance and completing the programme within the normal 7 semesters.
First Class	6.50 and above and completing the programme within a maximum of 9 semesters.
Second Class	All others

19.0 ELECTIVE CHOICE

19.1 Apart from the various elective courses listed in the curriculum for each branch of specialization, the student can choose a maximum of two electives from any other specialization under any department, during the entire period of study, with the approval of the Head of the parent department and the Head of the other department offering the course.

19.2 In the curriculum of SEVENth Semester, along with the project work, if two elective courses alone are listed, then the Head of the Institution may permit a student, as per approved guidelines, on the recommendation of the Head of the department, to do a full semester major industrial project work. In such a case, the above two elective courses or any other two elective courses in lieu thereof have to be enrolled during any semester including the summer, preceding or succeeding the project work, if offered.

20.0 DISICIPLINE

20.1 Every student is required to observe disciplined and decorous behaviour both inside and outside the campus

and not to indulge in any activity which will tend to bring down the prestige of the institution.

19.2 Any act of indiscipline of a student, reported to the Dean (Students), will be referred to a Discipline and Welfare Committee, nominated by the Vice-Chancellor, for taking appropriate action.

21.0 ELIGIBILITY FOR THE AWARD OF DEGREE

21.1 A student shall be declared to be eligible for the award of the B.Tech. degree provided the student has:

i) successfully completed all the required courses specified in the programme curriculum and earned the number of credits prescribed for the specialization, within a maximum period of 14 semesters from the date of admission, including break of study.

ii) no dues to the Institution, Library, Hostels

iii) no disciplinary action pending against him / her.

20.2 The award of the degree must have been approved by the University.

22.0 POWER TO MODIFY

Notwithstanding all that has been stated above, the Academic Council has the right to modify the above regulations from time to time.

B.TECH ELECTRICAL & ELECTRONICS ENGINEERING

(SEVEN SEMESTERS / PART TIME)

PROGRAMME EDUCATIONAL OBJECTIVES

- To upgrade the diploma engineers in Electrical and Electronics Engineering to graduate engineers by providing sound theoretical knowledge, practical experience and an all round development, so that, they can excel in their profession.
- To provide the student with an education that enhances and complements their knowledge and experience.
- To impart skills required to appreciate both technical and non-technical features of other disciplines, in order to deal with the impact of technology in a global and societal context.
- To involve the practicing engineers in design projects and to enhance their professional practices, so as to meet the global standards / demands.

CURRICULUM

SEMESTER I

SL. NO	GROUP CODE	COURSE CODE	COURSE TITLE	L	T	P	C
1.	BS	PTMAB1181	Complex Analysis & Ordinary Differential Equation	3	1	0	4
2.	ESF	PTGEB1101	Engineering Mechanics	3	0	0	4
3.	EC	PTEEB1101	Electric Circuit Analysis	3	0	0	3
4.	EC	PTEEB1102	Electronic Devices and Circuits	3	0	0	3
5.	ESF	PTEEB1103	Engineering Materials	3	0	0	3
6.	EC	PTEEB1104	Electric circuit analysis laboratory	0	0	2	1
7.	EC	PTEEB1105	Electronic Devices and circuits laboratory	0	0	2	1
			TOTAL	**15**	**1**	**4**	**19**

SEMESTER II

SL. NO	GROUP CODE	COURSE CODE	COURSE TITLE	L	T	P	C
1.	BS	PTMAB1282	Transforms and Partial Differential Equations	3	1	0	4
2.	EC	PTEEB1211	Electromagnetic Theory	3	0	0	3
3.	EC	PTEEB1212	Electrical Machines	3	0	0	3
4.	ESF	PTMEB1281	Applied Thermodynamics & Fluid Mechanics	3	0	0	3
5.	EC	PTEEB1213	Network Analysis & Synthesis	3	0	0	3
6.	EC	PTEEB1214	Electrical Machines Laboratory	0	0	2	1
7.	ESF	PTMEB1282	Fluid and Thermal laboratory	0	0	2	1
			TOTAL	**15**	**1**	**4**	**18**

SEMESTER III

SL. NO	GROUP CODE	COURSE CODE	COURSE TITLE	L	T	P	C
1.	BS	PTMAB2283	Numerical Methods and Laplace Transforms	3	1	0	4
2.	EC	PTEEB2101	Control Systems	3	0	0	3
3.	EC	PTEEB2102	Transmission and Distribution	3	0	0	3
4.	EC	PTEEB2103	Measurements & Instrumentation	3	0	0	3
5.	HS	PTSSB2181	Sociology, Ethics And Human Values	3	0	0	3
6.	EC	PTEEB2104	Control and Instrumentation Laboratory	0	0	2	1
7.	EC	PTEEB2105	Modeling & Simulation of Electrical Apparatus	0	0	2	1
			TOTAL	**15**	**1**	**4**	**18**

SEMESTER IV

SL. NO.	GROUP CODE	COURSE CODE	COURSE TITLE	L	T	P	C
1.	EC	PTEEB2211	Power System Analysis	3	1	0	4
2.	EC	PTEEB2212	Microprocessors and Microcontroller	3	0	0	3
3.	EC	PTEEB2213	Design of Electrical Apparatus	3	0	0	3
4.	EC	PTEEB2214	Digital System & Integrated Circuits	3	0	0	3
5.	HS	PTCHB2281	Environmental Science and Engineering	3	0	0	3
6.	EC	PTEEB2215	Digital System & Integrated Circuits Laboratory	0	0	2	1
7.	EC	PTEEB2216	Microprocessor & Microcontroller Laboratory	0	0	2	1
			TOTAL	**15**	**1**	**4**	**18**

SEMESTER V

SL. NO.	GROUP CODE	COURSE CODE	COURSE TITLE	L	T	P	C
1.	EC	PTITB3181	C++ Programming	3	1	0	4
2	EC	PTEEB3101	Power System Operation & Control	3	0	0	3
3.	EC	PTEEB3102	Power Electronics & Drives	3	0	0	3
4.	HS	PTMSB3181	Management of Business Organization	3	0	0	3
5.	PE		Professional Elective – I	3	0	0	3
6.	EC	PTEEB3103	Power Electronics and Drives Laboratory	0	0	2	1
7.	EC	PTEEB3104	Power System Simulation Lab	0	0	2	1
			TOTAL	**15**	**1**	**4**	**18**

SEMESTER VI

SL. NO.	GROUP CODE	COURSE CODE	COURSE TITLE	L	T	P	C
1.	**EC**	PTEIB3281	PLC, SCADA & DCS	3	0	0	3
2.	EC	PTEEB3212	Power System Protection & Switchgear	3	0	0	3
3.	EC	PTEEB3213	Evolutionary Computing	3	0	0	3
4.	PE		Professional Elective -II	3	0	0	3
5.	HS	PTSSB3282	Law for Engineers	3	0	0	3
6.	**EC**	PTEIB3282	PLC Programming Laboratory	0	0	2	1
7.	EC	PTEEB3214	Mini Project	0	0	8	4
			TOTAL	**15**	**0**	**10**	**20**

SEMESTER VII

L. NO.	GROUP CODE	COURSE CODE	COURSE TITLE	L	T	P	C
1.	EC	PTEEB4101	Generation, Quality and Conservation of Electrical Energy	3	0	0	3
2.	EC	PTEEB4102	High Voltage Engineering	3	0	0	3
3.	PE		Professional Elective–III	3	0	0	3
4.	PE		Professional Elective-IV	3	0	0	3
5.	GE		General elective - I	3	0	0	3
6.	EC	PTEEB4103	Project Work	0	0	16	8
			TOTAL	**15**	**0**	**16**	**23**

MINIMUM CREDITS TO BE EARNED FOR THE AWARD OF DEGREE =134

PROGRAMME LEARNING OUTCOME :

On completion of Program, the graduates will

- ✓ Possess knowledge to excel in their profession.
- ✓ Able to learn on their own, any new concept or technology, based on the need.
- ✓ Exhibit professional approach, work in a team and demonstrate soft skills acquired, in their organization.
- ✓ Have skills to design, simulate, fabricate & develop models.
- ✓ Able to become an expert in the chosen domain.
- ✓ Able to comprehend engineering solutions in global, economic, and societal context.
- ✓ Able to adopt professional and ethical responsibility.

LIST OF ELECTIVES

Electives Category

1. Professional Electives

1. Power System
2. Power Electronics & Drives
3. High Voltage Engineering
4. Electronics, Communication & Instrumentation
5. Computer Science & Information Technology
6. Electronics, Communication & Instrumentation

Note 1: Choice of other Department Electives

- **Apart from the various electives courses listed in the curriculum for each branch of specialization, the student can choose a maximum of two electives from any other specialization under any department of our University during the entire period of study, with the approval of Head of the parent Department and Head of the Department offering the said course.**

1) Power System

PTEEBX01	Power Distribution System
PTEEBX02	Power System Planning & Reliability
PTEEBX03	EHV AC & DC Transmission Engineering
PTEEBX04	Power System Dynamics
PTEEBX05	Power System Transients
PTEEBX06	Smart Power Grid
PTEEBX07	Wind Energy Conversion systems
PTEEBX08	Flexible AC Transmission Systems
PTEEBX09	Industrial Power System Analysis & Design

2) Power Electronics & Drives

PTEEBX10	Special Electrical Machines
PTEEBX11	CAD for Electrical Apparatus
PTEEBX12	Software for Circuit Simulation
PTEEBX13	FEA for Electrical Engineers

PTEEBX14	Chopper Controller DC Drives
PTEEBX15	Solid State AC & DC Drives
PTEEBX16	Converter, Application & Design
PTEEBX17	Power Electronics Application to Renewable Energy Systems
PTEEBX18	Embedded Control of Electric Drives
PTEEBX19	Electric Vehicles

3) High Voltage Engineering

PTEEBX20	Bio-Electrics
PTEEBX21	Microgrid Protection
PTEEBX22	High Voltage DC Transmission
PTEEBX23	Power Quality
PTEEBX24	Electromagnetic Interference and Electromagnetic Compatibility
PTEEBX25	Outdoor Polymers and Insulators
PTEEBX26	High Voltage Generation and Measurement
PTEEBX27	Insulation Technology
PTEEBX28	Electromagnetic Field Computation and Modeling
PTEEBX29	Pulsed Electric Field and Food Preservation

4) Computer Science & Information Technology

PTITB3103	Database Management Systems
PTITBX21	Web Collaboration & Technology
PTITB2101	Data Structures
PTITB2104	Computer Networks
PTITBX82	Java Programming
PTCSBX53	Computer Hardware and Interfacing
PTCSBX47	Cyber Security
PTCSBX08	Cloud Computing
PTCSBX51	Operating systems

5) Electronics, Communication & Instrumentation

PTEIBX81	Bio Instrumentation and Signal Analysis
PTECBX81	Introduction to Computer and Image Processing
PTEIBX82	Sensors for Bio-Medical Application
PTECBX82	VLSI Design
PTECBX83	Integrated Circuits and System Design
PTECBX84	Communication System Security

PTECBX85	Embedded Hardware & Software System Design
PTECBX86	Speech Processing
PTEIBX83	Intelligent Control

General Electives (GE)

PTGEBX01	Disaster Management
PTGEBX02	Nano Technology
PTGEBX03	Control Systems
PTGEBX04	Green Design and Sustainability
PTGEBX05	Knowledge Management
PTGEBX06	Appropriate Technology
PTGEBX07	System Analysis and Design
PTGEBX08	Value Analysis and Engineering
PTGEBX09	Optimization Techniques
PTGEBX10	Engineering System Modeling and Simulation
PTGEBX11	Supply Chain Management
PTGEBX12	Artificial Intelligence and Robotics
PTGEBX13	Total Quality Management
PTGEBX14	Physics of Human Body
PTGEBX15	Energy Studies
PTGEBX16	Robotics
PTGEBX17	Cyber security
PTGEBX18	Usability Engineering
PTGEBX19	Industrial Safety

SYLLABUS

SEMESTER I

		L	T	P	C
PTMAB1181	**COMPLEX ANALYSIS & ORDINARY DIFFERENTIAL EQUATION**	3	1	0	4

COURSE OBJECTIVES:

The course is aimed at developing the skills of engineering students in the basics of chosen topics of Mathematics that are imperative for effective understanding of engineering subjects. It also lays the foundation for learning further topics of Mathematics in higher semesters in a graded manner. The learners will be enabled to appreciate the important role of mathematical concepts in engineering applications**.** The course aims at the following

- To identify algebraic eigen value problems from practical areas and obtain the eigen solutions in certain cases and to introduce the technique of diagonalizing a matrix which would render the eigen solution procedure very simple**.**
- To understand and handle functions of more than one variable, from the point of view of their differentiation, expansions and extreme values, along with differentiation under integral sign which are encountered in engineering studies**.**
- To have a good knowledge of analytic functions and their interesting properties which could be exploited in a few engineering areas, and to introduce the concept of conformal mappings with a few standard examples that have direct application.
- To grasp the basics of complex integration and the concept of contour integration which is an important tool for evaluation of certain integrals encountered in practice.
- To learn the method of solving differential equations of certain types, including systems of differential equations that they might encounter in their studies of other subjects in the same or higher semesters.

MODULE I MATRICES 8

Characteristic equation – Eigen values and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Cayley–Hamilton Theorem – Diagonalization of matrices - Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms

MODULE II FUNCTIONS OF SEVERAL VARIABLES 8

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobeans – Partial differentiation of implicit functions – Taylor's series for functions of two variables - Maxima and minima of functions of two variables.

MODULE III VECTOR ALGEBRA 6

Vectors: Operations on vectors – Dot Product, Cross Product, Scalar Triple Product, Vector Triple Product, Projection of Vectors - Angle between two vectors - Gradient, divergence and curl.

MODULE IV ANALYTIC FUNCTION 8

Analytic functions – Necessary and sufficient conditions for analyticity – Properties – Harmonic conjugates – Construction of analytic function – Conformal Mapping – Mapping by functions w = a + z , az, 1/z, - Bilinear transformation.

MODULE V COMPLEX INTEGRATION 8

Line Integral – Cauchy's theorem and integral formula – Taylor's and Laurent's Series – Singularities – Residues – Residue theorem – Application of Residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis

MODULE VI ORDINARY DIFFERENTIAL EQUATIONS 7

Linear equations of second order with constant and variable coefficients - Simultaneous first order linear equations with constant coefficients - Homogeneous equations of Euler type - equations reducible to homogeneous form - method of variation of parameter

LECTURE HOURS: 45	TUTORIAL HOURS: 15	PRACTICE HOURS: 0	**TOTAL: 60 Hours**

REFERENCES:

1. Grewal B.S., Higher Engineering Mathematics (40th Edition), Khanna Publishers, Delhi (2007).
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill Co. Ltd., New Delhi (2007)
3. Glyn James, Advanced Modern Engineering Mathematics, Pearson Education (2007)
4. Veerarajan, T., Engineering Mathematics (For First Year), Tata McGraw-Hill Pub. Pvt Ltd., New Delhi (2006).
5. Rajasekaran.S., Chandrasekaran A., "Engineering Mathematics" Volume I (Revised Edition) Dhanam publishers, Chennai. (2009)

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Capability of identifying algebraic eigen value problems from practical areas and obtain the eigen solutions in certain cases and to have acquired the technique of diagonalising a matrix which would render the eigen solution procedure very simple.
- Understanding and handling functions of more than one variable, from the points of view of their

differentiation, expansions and extreme values, along with differentiation under integral sign which are encountered in engineering studies.

- Have learnt the method of solving differential equations of certain types, including systems of differential equations that they might encounter in their studies of other subjects in the same or higher semesters.
- Have a good grasp of analytic functions and their interesting properties which could be exploited in a few engineering areas, and be introduced to the host of conformal mappings with a few standard examples that have direct application.
- Have grasped the basics of complex integration and the concept of contour integration which is an important tool for evaluation of certain integrals encountered in practice.

PTGEB1101	ENGINEERING MECHANICS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To impart knowledge about the basic laws of statics and dynamics and their applications in problem solving
- To acquaint both with scalar and vector approaches for representing forces and moments acting on particles and rigid bodies and their equilibrium
- To give on exposure on inertial properties of surfaces and solids
- To provide an understanding on the concept of work energy principle, friction, kinematics of motion and their relationship.

MODULE - I VECTOR APPROACH TO MECHANICS 7

Introduction - Units and Dimensions - Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments –Vector Algebra and its Physical relevance in Mechanics -Coplanar Forces – Resolution and Composition of forces- Equilibrium of a particle.

MODULE - II EQUILIBRIUM OF PARTICLE 6

Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

MODULE - III EQUILIBRIUM OF RIGID BODY 6

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis –Vectorial representation of moments and couples – Scalar components of a moment –Varignon's theorem - Equilibrium of Rigid bodies in two dimensions –Examples

MODULE - IV PROPERTIES OF SURFACES 8

Determination of Areas – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow section by using standard formula – second and product moments of plane area – Physical relevance - Rectangle, triangle, circle from integration - T section,

I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia.

MODULE - V **LAWS OF MOTION** 10

Review of laws of motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

MODULE - VI **FRICTION** 8

Introduction to friction- types of friction-Laws of Coloumb friction- Frictional force – simple contact friction – Rolling resistance –ladder friction

LECTURE HOURS: 45	TUTORIAL HOURS: 15	PRACTICE HOURS: 0	TOTAL: 60 Hours

REFERENCES:

1. Beer,F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers, Dynamics & Statics", Third SI Metric Edition, Tata McGraw-Hill International Edition, 2001.

2. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition Pearson Education Asia Pvt. Ltd., 2003

3. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000–

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Ability to resolve forces, moments and solve problems using various principles and laws
- Understanding the concept of equilibrium, kinetics and kinematics and capable of formulating the governing equations to practical problems and provide solutions for those equations

PTEEB1101 ELECTRIC CIRCUIT ANALYSIS

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To learn circuit laws, theorems and circuit solution methods
- To be able to analyze DC circuits, 1Φ and 3 Φ AC circuits
- To be able to analyze magnetic circuits and magnetically coupled electric circuits.

MODULE - I DC CIRCUITS 8

Circuit elements : R, L and C - sources : Independent (ideal and practical), and dependent voltage and current sources - ohm's and kirchoff's laws - power and energy - solution of DC circuits - use of source transformations - network reduction by Y-Δ transformations.

MODULE - II AC FUNDAMENTALS 7

Sinusoidal voltages and currents : Average and RMS Values, peak and form factors - concept of phasor and its use in representing sinusoidal voltages and currents - impedance and admittance - Real, reactive and apparent power - Analysis of simple series and parallel circuits.

MODULE - III AC NETWORK ANALYSIS 7

Solution of series-parallel AC circuits - Resonance : RLC series and parallel resonance, resonant frequency, half-power frequencies, Q-factor - Node voltage and mesh current method of analysis - concept of super nodes and super meshes

MODULE - IV NETWORK THEOREMS 8

Network Theorems : Superposition theorem, Millman's Theorem, Thevenin's Theorem, Norton's Theorem and Maximum power transfer theorem - Application to DC and AC networks

MODULE - V MAGNETIC CIRCUITS 8

Magnetic circuits : Definition of magnetic quantities i.e., permeability, flux, flux density, field intensity and their units and relationships - magnetic curves of ferromagnetic materials - magnetic circuit concept and analogies - magnetic circuit computations - Hysteresis and eddy current losses.

MODULE - VI COUPLED AND THREE PHASE CIRCUITS 7

Magnetically coupled circuits : self and mutual inductances, Dot rule for coupled circuits, coupled circuits

analysis - Three phase circuits: generation of 3 - phase voltages - star and delta connection - relation between phase and line quantities - balanced and unbalanced 3 - phase loads - power measurement by 2 - wattmeter method.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL: 45 Hours

REFERENCES:

1. Electrical and Electronic Technology, Edward Hughes, PH (UK) 9th edition (2004), 11th revised edition (2012)
2. Vincent Del Toro, “Principles of Electrical Engineering”, 2nd Edition, Prentice - Hall of India, 1984
3. William H.Hayt, Jr.Jack E.Kemmerly, Steven M.Durbin, “Engineering Circuit Analysis”, Sixth Editions, Tata McGraw - Hill Edition, 2002.
4. Joseph A.Edminister, Mahmood Nahvi, ‘Electric Circuits’, Schaum’s Series, Tata McGraw Hill publishing Co. Ltd., New Delhi 2001.
5. Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis”, Tata McGraw Hill, 2007
6. R.C. Dorf, ‘Introduction to Electric Circuits’, John Wiley & Sons Inc, New York, Second Edition, 2003

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Familiarity with circuit laws, theorems and solution methods
- Analysis of 1Φ and 3Φ circuits.
- Analysis of magnetic circuits
- Basic concepts for future advanced courses

PTEEB1102 ELECTRONIC DEVICES AND CIRCUITS	L	T	P	C
	3	0	0	3

COURSE OBJECTIVES:

- To familiarize the student with the principle of operation, capabilities and limitation of various electronic devices and their applications.

MODULE I P-N JUNCTION DIODE 8

Semi Conductors- charge carriers, electrons and holes in intrinsic and extrinsic semi conductors-Hall Effect. Diodes-PN junction-current equation, junction capacitance, breakdown characteristics, V-I characteristics, PN junction diode ratings. Diode Applications- Clippers, clampers and Rectifiers (Half wave and Full wave). Zener diode-VI Characteristics, applications.

Elementary Physics of Opto electric Devices – LED and Photo-Diode.

MODULE II BIPOLAR JUNCTION TRANSISTOR (BJT) 7

Physical behaviour of a BJT – Ebers – Moll model, large signal current gains, Modes of transistor operation - Common Base, Common Emitter and Common Collector configurations, Input and output characteristics, Early effect, Thermal runaway. AC and DC load lines - Need for stability of Q-Point, Bias stability – fixed bias, collector to base bias, self bias. Transistor switching times, Transistor as a switch and an amplifier, High frequency effects, BJT ratings. Introduction to photo transistors

MODULE III FILTERS AND REGULATORS 7

Harmonic component in rectifiers-ripple factor- inductor filter, Capacitor filter, PI section filter.Comparision of filter in terms of ripple factor. Regulators- series and shunt. UPS – Principle of operation- types

MODULE IV FIELD EFFECT TRANSISTOR 8

JFET operation - V-I characteristics, transfer characteristics, regions of operation. DC analysis - JFET biasing. Small signal JFET model, JFET as a switch, Voltage variable resistor and an amplifier.

MOSFET- Constructional details- Operation of Enhancement and Depletion type MOSFETs , V-I characteristics, Transfer characteristics, analytic expression for drain current, Comparison of PMOS and NMOS devices - MOSFET biasing, MOSFET as a switch, resistor and amplifier, Introduction to CMOS

devices.

MODULE V FEEDBACK AMPLIFIERS AND OSCILLATOR 8

Amplifier classification- feedback concept- characteristics of negative feedback- effect of feedback on input and output characteristics

Oscillator-Principle, condition for oscillator, RC oscillator- Wien bridge oscillator and Phase shift oscillator, LC oscillator-Hartley and Colpitts, Crystal oscillator.

MODULE VI ANALYSIS OF SMALL SIGNAL AMPLIFIERS 7

Two port devices and hybrid model, Transistor hybrid model-analysis of transistor amplifier using h parameter – CE,CB and CC (actual and approximate model)-comparision. Small signal analysis of –CE and CC amplifier, JFET amplifier

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Boylestead L. R., Nashelsky L.,"Electronic Devices and Circuit Theory", Pearson Education India Sries, New Delhi, 10th Edition, 2009.
2. Gupta.J.B. "Electronic Devices and Circuits", S.K.Kataria & Sons, New Delhi, 3rd Edition, 2010
3. Millman J., C.C.Halkias, Sathyabaratha Jit, "Electronic Devices and Circuits", Tata McGraw-Hill Publishing company limited, 2nd edition, 2007 Company Limited, New Delhi, 2nd Edition, 2007.
4. Thomas L. Floyd, "Electronic Devices", Pearson Education India Series, New Delhi, 7th Edition, 2007.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- an overview of various semiconductor devices
- Ability to analyze amplifier circuits, oscillators and filter circuits.

PTEEB1103 ENGINEERING MATERIALS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts of various theories of solids.
- To gain basic knowledge in conducting, semiconducting, dielectric, magnetic, optical and new engineering materials, their properties and their applications.
- To introduce the fundamentals of science for engineering applications.
- To enable the students to correlate theoretical principles with applications.

MODULE I CONDUCTING MATERIALS 10

Electron ballistics : charged particle, force on charged particles in an electric field, force on charged particles in Magnetic field - Parallel electric and magnetic field - Perpendicular electric and magnetic field - Classical free electron theory of metals – Derivation for electrical conductivity – Merits and drawbacks of classical theory – Quantum free electron theory of metals and its importance (qualitative) – Energy distribution of electrons in metals – Fermi distribution function – Density of energy states and carrier concentration in metals (derivation) – Fermi energy – Classification of solids into conductors, semiconductors and insulators on the basis of band theory.

MODULE II SEMICONDUCTING MATERIALS 9

Elemental and compound semiconductors – Drift and diffusion current - Intrinsic semiconductors –Carrier concentration (derivation) – Fermi energy – Variation of Fermi energy level with temperature – Mobility and electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in n-type and p-type semiconductor (derivation) – Variation of Fermi level with temperature and impurity concentration – Variation of Electrical conductivity with temperature – Hall effect – Experiment and applications of Hall effect.

MODULE III DIELECTRIC MATERIALS 7

Dielectric constant – Electric Susceptibility – Types of dielectric polarization – Frequency and temperature dependence of polarization – Internal field and deduction of Clausius-Mosotti’s equation(derivation) – Dielectric loss – Types of dielectric breakdown – Uses of dielectric materials (capacitor & transformer).

MODULE IV MAGNETIC MATERIALS 6

Origin of magnetic moment –Types of magnetic materials and their properties –Ferromagnetism – Domain theory of ferromagnetism, hysteresis, soft and hard magnetic materials – Anti ferromagnetic materials (qualitative) – Ferrites – Applications-Magnetic memory – Tapes & magnetic disk drives.

MODULE V SUPERCONDUCTING MATERIALS 6

Superconductivity - BCS theory - Meissner effect - Critical magnetic field - Type I and type II superconductors - High temperature superconductors - Applications of superconductors: SQUID and magnetic levitation.

MODULE VI OPTICAL AND NEW ENGINEERING MATERIALS 7

Optical properties of semiconductors – Direct and indirect bandgap semiconductors – Color centers, exciton – Luminescence – Fluorescence – Phosphorescence – Liquid crystal display, Solar cell – Electro optic effect-Pockel's effect - Kerr effect – Faraday effect. Metallic glasses – Preparation, properties and applications - Shape Memory Alloys – Preparation, properties and applications, Nano phase materials – Synthesis, properties and applications.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Palanisamy P.K., Physics II, Material Science for ECE, Scitech Publications (India) Pvt Ltd., 2006.
2. Safa O. Kasap, Principles of Electronic materials and devices, McGraw Hill Publishers, 3rd Edition, 2006.
3. Arumugam.M, Physics II, Material Science for ECE, Anuradha Publishers, 5th Edition, 2005.
4. Jacob Millman, Christos C.Halkais, Electronic Devices and Circuits, Tata McGraw-Hill, New Delhi, 1991.
5. Charles Kittel, Introduction to solid state physics, 7th Edition, John Wiley & sons (ASIA) Pvt. Ltd.
6. Sze. S.M., Semiconductor Devices – Physics and Technology, 2nd edn. John Wiley, 2002.
7. Nandita Das Gupta and Amitava Das Gupta, Semiconductor Devices – Modelling and Technology, Prentice Hall of India, 2004.
8. Donald A. Neamen, "Semiconductor Physics and Devices" 3rd Ed., Tata McGraw Hill, 2002.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Understand the concepts of electron ballistics and theories of solids.
- Gain knowledge about theory of semiconducting, dielectric, magnetic and optical materials and their applications in engineering field.
- Be familiar with the principle and working of optoelectronic devices.
- Understand the various types of new engineering materials such as metallic glasses, shape memory alloys, nano phase materials and its applications to engineering fields.
- Thermal conductivity and its application.

PTEEB1104 ELECTRIC CIRCUIT ANALYSIS LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- To impart hands on experience in verification of circuit laws and theorems, measurement of circuit parameters, study of circuit characteristics and simulation of time response.

LIST OF EXPERIMENTS

1. Verification of Kirchoff's voltage and current laws.
2. Verification of Thevenin's and Norton's Theorems.
3. Verification of Superposition theorem.
4. Verification of Maximum Power Transfer Theorem.
5. Study of oscilloscope and measurement of sinusoidal voltage, frequency and power factor.
6. Transient response of RC, RL and RLC circuits.
7. Study of the effect of Q on frequency response of series and parallel resonant circuits.
8. Measurement of real power, reactive power, power factor and impedance of RC, RL and RLC circuits using 3 voltmeters and 3 ammeters.
9. Power measurement in a three phase circuit by using two Wattmeter method.

LECTURE HOURS: 0	TUTORIAL HOURS: 0	PRACTICE HOURS: 30	TOTAL: 30 Hours

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Complement the knowledge acquired in the theory class.

PTEEB104	ELECTRONIC DEVICES AND CIRCUITS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To get a practical exposure of the various electronic devices and its application circuitry
- To design and implement waveform generators and amplifiers

LIST OF EXPERIMENTS

1. Study of CRO
2. VI characteristics of PN diode and Zener diode
3. Characteristics of BJT
4. Characteristics of photodiode and photo transistor
5. Transfer characteristics of JFET and MOSFET
6. Characteristics of FET amplifier
7. Design and fabrication of Transistor amplifier
8. Bridge Rectifier
9. RC Phase shift oscillator and Wein Bridge oscillator
10. Hartley and Colpitt oscillator
11. Design and fabrication of voltage regulators-series and shunt

LECTURE HOURS: 0	TUTORIAL HOURS: 0	PRACTICE HOURS: 30	**TOTAL: 30 Hours**

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Ability to enhance the skills to use modern engineering tools to design electronic circuits.

SEMESTER II

PTMAB1282 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
	3	1	0	4

COURSE OBJECTIVES:

To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics, the course aims at the following

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
- To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic
- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes
- To develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems

MODULE - I FOURIER SERIES **7**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Complex form of Fourier series – Parseval's identity – Harmonic Analysis.

MODULE - II FOURIER TRANSFORM 9

Fourier integral theorem – Fourier transform pair-Sine and Cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity

MODULE – III PARTIAL DIFFERENTIAL EQUATIONS 8

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Singular solutions – Lagrange's Linear equation – Integral surface passing through a given curve – Solution of linear equations of higher order with constant coefficients.

MODULE – IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9

Method of separation of Variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates

MODULE – V **Z –TRANSFORM** 6

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and Final value theorems.

MODULE – VI **DIFFERENCE EQUATIONS AND APPLICATIONS OF Z – TRANSFORM** 6

Formation of difference equation – Solution of difference equation using Z-transform.

LECTURE HOURS: 45	TUTORIAL HOURS: 15	PRACTICE HOURS: 0	TOTAL HOURS: 60

REFERENCES:

1. Grewal, B.S. “Higher Engineering Mathematics”, Khanna Publications (2007)
2. Glyn James, “Advanced Modern Engineering Mathematics, Pearson Education (2007)
3. Rajasekaran.S., Chandrasekaran A., “Engineering Mathematics” Volume II (Revised Edition) Dhanam publishers, Chennai. (2009)
4. Ramana, B.V. “Higher Engineering Mathematics” Tata McGraw Hill (2007).
5. Bali, N.P. and Manish Goyal, “A Text Book of Engineering 7th Edition (2007) Lakshmi Publications (P) Limited, New Delhi

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Be capable of mathematically formulating certain practical problems in terms of partial differential equations, solve them and physically interpret the results.
- Have gained a well founded knowledge of Fourier series, their different possible forms and the frequently needed practical harmonic analysis that an engineer may have to make from discrete data.
- Have obtained capacity to formulate and identify certain boundary value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve them and interpret the results.
- Have grasped the concept of expression of a function, under certain conditions, as a double integral leading to identification of transform pair, and specialization on Fourier transform pair, their

properties, the possible special cases with attention to their applications.

- Have learnt the basics of Z – transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the Z – transform technique bringing out the elegance of the procedure involved.

PTEEB1211 ELECTROMAGNETIC THEORY

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

To impart Knowledge on

- Concepts of electrostatics, electrical potential , energy density and their applications.
- Concepts of magneto statics and its applications.
- Faraday's laws, induced emf and their applications.
- Concepts of electromagnetic waves.

MODULE I VECTOR ANALYSIS 6

Scalars and vectors- Cartesian Coordinate System-Vector components and unit vector- vector field-Other coordinate systems -cylindrical coordinate system, spherical coordinate system.

MODULE II ELECTRIC FIELD 6

Coulomb's Law-Electric field intensity-Electric field due to point charge, line charge, surface charge and volume charge distributions-Electric flux density-Gauss law-Application of Gauss law-Work done in moving a point charge-Electric potential-Potential Gradient-Dipole-Energy density in electrostatic field- Del Operator -Divergence- -Divergence theorem-Maxwell's First equation(electrostatic)- Poission's and Laplace Equations.

MODULE III CONDUCTOR, DIELECTRICS AND CAPACITANCE 7

Charges in motion- current density -Conduction current-Displacement current-Equation of continuity -Conductor properties and boundary conditions –methods of images-nature of dielectric material-Boundary Condition for perfect dielectric –Capacitance-Energy stored in a capacitor-Electrostatic potential energy associated with different charge distributions-Energy density –Force between charges in motion.

MODULE IV MAGNETIC FIELDS 9

Force on current element- Biot-Savart's Law- Ampere's Circuital Law-Curl-Stokes Theorem-Magnetic Flux and Magnetic Flux density-Force between current carrying conductors-Torque on closed conductor-

Boundary conditions at the magnetic surfaces.

MODULE V INDUCTANCE AND MAGNETIC CIRCUIT 9

Faraday's Law of Electromagnetic induction-Inductance of solenoids, toroids, transmission lines and cables- Mutual inductance of series and parallel circuits-Energy stored in magnetic fields-Magnetic circuits.

MODULE VI MAXWELL'S EQUATION AND ELECTROMAGNETIC WAVES 8

Modified Ampere circuital law-Maxwell equation in point and integral forms-Wave equation- Wave equations in phasor form-Electromagnetic wave in perfect dielectric –Electromagnetic wave in good conductor-Skin depth-Reflection of uniform plane waves-Poynting's Theorem.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL: 45 Hours

REFERENCES:

1. William Hayt ,"Engineering Electromagnetics,McGraw Hills,New York,1989.
2. John D.Kraus,"Electromagnetisc, McGraw Hills.
3. Joseph A.Edminister M.S.E,"Schaum's Outline of Theory and Properties of Electromagnetics",McGraw Hill Book Company.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Acquire the knowledge about electrostatics, magneto statics and its applications.
- Understand the concepts of Faraday's laws, induced emf and their applications.
- Understanding the concepts of electromagnetic waves.

PTEEB1212 ELECTRICAL MACHINES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To impart knowledge on operating principles and performance characteristics of DC and AC machines.
- Introduction to solid state DC and AC drives.

MODULE - I DC GENERATORS 8

Construction – EMF Equation – OCC – Types – Losses and Efficiency – Parallel Operation – Simple Problems. Testing: Swinburne's and Hopkinson's

MODULE - II DC MOTORS 10

Construction – Torque equation – Types and their characteristics – Losses and Efficiency – Speed control – Introduction to Solid State DC Drives: Thyristor DC drives and Choppers-Fed DC drives

MODULE – III TRANSFORMERS 7

EMF Equation – Equivalent circuit – voltage regulation and efficiency – 3-phase transformers – Auto transformers – Parallel Operation – Simple problems.

MODULE – IV AC ROTATING MACHINES 8

Alternators: EMF equation – OCC and SCC – Voltage regulation methods – Parallel operation.

Synchronous Motors: Starters – Principle of Operation – V curves

MODULE – V INDUCTION MOTORS 7

Torque production – slip-torque characteristics – Various torques – Starters – Cogging and crawling.

Inverter-Fed induction motor drives – open-loop and closed-loop speed controls – Vector control.

MODULE – VI SPECIAL ELECTRIC MACHINES 5

Operation, characteristics and specific applications of stepper motor, reluctance motor, repulsion motor, universal motor and pole changing motor.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL: 45 HOURS

REFERENCES:

1. Edward Hughes, Electrical Technology
2. H. Cotton, Electrical Technology
3 M.G. Say, Performance and Design of AC machines.
4 Clayton and Hancock, Performance and Design of DC machines

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Ability to understand the electromagnetic energy conversion
- Ability to gain knowledge on solid sate operation of drives

PTMEB1281	FUNDAMENTALS OF FLUID MECHANICS AND THERMODYNAMICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce basic properties of fluids and the laws of fluid mechanics
- To introduce the laws governing the fluid flow
- To introduce the concepts and laws of thermodynamics and their application in analyzing cyclic process
- To Introduce the working of various thermal systems like engines and turbines

MODULE - I BASIC CONCEPTS AND PROPERTIES 7

Fluids-Definition, Units and Dimensions, Properties of fluid - Density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension, Fluid pressure, pressure measurement.

MODULE - II FLUID MECHANICS 8

Fluid flow, classification of flows in terms of variation of flow parameters in time and space, the concepts of streamline and stream tube, the principles of continuity, energy and momentum, Bernoulli's Equation, turbulent flow, flow measurement by orifice, Venturi, Pitot tube, rotameter.

MODULE - III FLUID MACHINES 7

Classification and working principle, basic calculations of head, flow rate and power of hydraulic turbines and pumps.

MODULE - IV BASIC CONCEPTS AND LAWS OF THERMODYNAMICS 8

Concepts of heat and work, properties of pure substances, representation of properties, change of phase, steam and air tables and vapour, equation of state, ideal gases, ideal non-flow and flow processes, laws of thermodynamics, Carnot's principle, Clausius inequality.

MODULE - V POWER GENERATING MACHINES 8

Air standard Cycles for IC engines: Otto cycle; plot on P-V, T-S planes; Thermal efficiency and working of SI engines. Diesel cycle; plot on P-V, T-S planes; Thermal efficiency and working of CI engines.
Rankine cycle of steam h-s chart of steam (Mollier's Chart). Simple Rankine cycle plot on P-V, T-S, h-s planes. Rankine cycle efficiency with & without pump work. Layout of thermal power station.

MODULE - VI COMPRESSORS, REFRIGERATION AND AIR CONDITIONING 8

Working of Reciprocating, rotary, centrifugal and scroll compressors. Simple vapour compression refrigeration systems. Air conditioning systems.

Introduction to Heat Transfer, Introduction to Hydraulic and Pneumatic Systems.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS:	TOTAL: 45 Hours

REFERENCE :

1. White, F.M., Fluid Mechanics", Tata Mc Graw hill, 5th Edition, New Delhi.-2003.
2. Bansal R.K " fluid Mechanics and hydraulics Machines ", (5th edition), Laxmi Publications (P) Ltd, New delhi , 1995.
3. Streeter Wylie and Bedford, "Fluid Mechanics", McGraw- Hill Publishing Company Limited, New York, 1998.
4. Cengel Y Al and Boles M A "Thermodynamics, An Engineering Approach" Tata McGraw Hill, 2003.
5. Nag P K, "Engineering Thermodynamics", Tata McGraw Hill, Delhi, 2004.
6. Holman J P, "Thermodynamics", Tata McGraw Hill, 1998.
7. Holman J P, "Heat Transfer", 9th edition, Tata McGraw Hill Inc., New York, 2008

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Ability to conceptualize the behavior of fluids and fluid flows found in the real time applications
- Exposure to various hydraulic turbines and pumps
- Knowledge on the basic laws of thermodynamics
- Exposure to various thermal systems like IC Engines, Stream turbines, Compressors, Refrigeration and Air Conditioning systems

	L	T	P	C
PTEEB1213 NETWORK ANALYSIS AND SYNTHESIS	3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To impart basic knowledge on s domain analysis using Laplace transforms
- To introduce network transients, network topology and two port networks
- To introduce basic theory about the design of filters and attenuators

MODULE I S-DOMAIN ANALYSIS 6

s - domain network – driving point and transfer impedances and their properties – transform network analysis – poles and zeros of network functions – time response from pole – zero plots.

MODULE II TRANSIENT ANALYSIS 6

Transient response of RL, RC and RLC circuits using Laplace transform using DC input and AC input

MODULE III NETWORK TOPOLOGY 7

Network graphs, tree and cutsets – tie set and cutset schedules – V shift and I shift – primitive impedance and admittance matrices – application to network solutions.

MODULE IV TWO PORT NETWORK 9

Characterization of two port networks in terms of Z, Y, h and ABCD parameters – network equivalents – relation between network parameters – T and π representation - Analysis of Ladder, Bridged T and lattice networks – transfer function of terminated two port networks

MODULE V ELEMENTS OF NETWORK SYNTHESIS 9

Reliability of one port network – Hurwitz polynomials and properties – Positive Real functions and properties – Synthesis of RL, RC and LC one port networks using Foster and Cauer methods.

MODULE VI FILTERS AND ATTENUATORS 8

Classification of filters: Classification of Pass Band and Stop Band – Characteristic impedance in the pass and stop bands- Design of constant K low pass and high pass filters - M derived filters – Band

pass filters – Band elimination filter- Types of Attuenuators

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Kuo F.F., 'Network Analysis and Synthesis', Wiley International Edition, Second Edition, 1966.
2. Paranjothi S.R., 'Electric Circuit Analysis', New age International Publishers, Second Edition, 2000.
3. Van Valkenburg, M.E., 'Network Analysis', Prentice – Hall of India Private Ltd., New Delhi, Third Edition, 1974.
4. Sudhakar. A., and Shyammohan, 'Circuits and Networks Analysis and Synthesis' Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1994.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Capable of analyzing s domain analysis and transient analysis.
- Ability to obtain network solutions through network topology.
- Capable of determining Z,Y, h and ABCD parameters.
- Ability to realize RL,RC and LC networks.
- Better understanding of design of different types of filters and attenuators.

PTEEB1214 ELECTRIC MACHINES LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- To experimentally verify the performance and characteristics of DC machines and 1-phase transformers.
- To experimentally verify the performance and characteristics of Alternator, Synchronous motor and 3-phase induction motor

LIST OF EXPERIMENTS:

1. Open Circuit and load characteristics of DC Shunt generator.
2. Load test on DC shunt motor and DC series motor.
3. Swinburne's Test and Speed control of DC Shunt motor.
4. Load test on single phase transformer.
5. Open circuit and short circuit test on single phase Transformer.
6. Transformer three Phase connections.
7. Parallel operation of single phase transformers.
8. Regulation of three phase alternator by EMF and MMF methods
9. V and Inverted V curves of Three Phase Synchronous Motor.
10. Load test on three-phase induction motor.
11. Computer Controlled DC motor Drive.
12. Computer Controlled AC motor Drive.
13. Parallel operation of two alternators.
14. Load test on single phase Induction motor.

LECTURE HOURS: 0	TUTORIAL HOURS: 0	PRACTICE HOURS: 30	TOTAL: 30 Hours

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Ability to test DC machines and Transformers for suitable applications.
- Ability to troubleshoot DC machines and transformers.
- Ability to test induction and synchronous machines.

PTMEB1282 FLUID AND THERMAL LAB

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- To know the various measuring devices for fluid properties.
- To study the performance characteristics of various kinds of pumps and turbines
- To Study the various performance characteristics of SI and CI engines.
- To study the performance characteristics of Air Compressor, VCRS and convective heat transfer.

LIST OF EXPERIMENTS:

FLUID MECHANIC AND MACHINERY LAB

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Performance Study on Centrifugal Pump
4. Performance Study of Jet Pump
5. Performance Study on Pelton Wheel
6. Performance Study on Reciprocating Pump
7. Performance Study on Francis Turbine

THERMODYNAMICS LAB

1. Valve Timing and Port timing diagram
2. Performance test on 4 stroke petrol / diesel engine
3. Heat balance test on 4 stroke diesel engine
4. Performance test on air compressor
5. Performance test on Vapour Compression Refrigeration system
6. Determination of connective heat transfer coefficient in (a) natural convection and (b) forced convection

LECTURE HOURS: 0	TUTORIAL HOURS: 0	PRACTICE HOURS: 30	TOTAL: 30 Hours

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Students will be having hands on experience in discharge measurement devices and working of pumps and turbines.
- Students will have exposure to various thermal systems like IC Engines, Air Compressors, Refrigeration systems

SEMESTER III

PTMAB2183 NUMERICAL METHODS AND LAPLACE TRANSFORMS L T P C

COURSE OBJECTIVES:

With the present development of the computer technology, it is necessary to develop efficient algorithms for solving problems in science, engineering and technology. This course gives a complete procedure for solving different kinds of problems occur in engineering numerically and it aims at the following

- To have a sound knowledge of Laplace transform and its properties and sufficient exposure to solution of certain linear differential equations using the Laplace transform technique which has applications in other subjects of the current and higher semesters.
- To find the roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations and eigen value problem of a matrix numerically where analytical methods fail to give solution.
- To construct approximate polynomial to represent the data and to find the intermediate values when huge amounts of experimental data are involved.
- To apply the numerical differentiation and integration when the function in the analytical form is too complicated or the huge amounts of data are given such as series of measurements, observations or some other empirical information
- To solve ordinary differential equations and partial differential equations numerically, since many physical laws are couched in terms of rate of change of one/two or more independent variables, most of the engineering problems are characterized in the form of either nonlinear ordinary differential equations or partial differential equations.

MODULE - I **LAPLACE TRANSFORM** 9

Laplace transform – sufficient condition – transforms of elementary functions- basic properties- inverse transforms –derivatives and integral of transforms- transforms of derivatives and integrals- convolution theorem –transform of periodic functions – application to solution of linear ordinary differential equations - second order with constant coefficients, Simultaneous equations.

MODULE - II **SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS** 9

Linear interpolation methods (method of false position) – Newton's method – Statement of Fixed Point Theorem – Fixed point iteration: x=g(x) method – Solution of linear system by Gaussian elimination and

Gauss-Jordon methods- Iterative methods: Gauss Jacobi and Gauss-Seidel methods - Inverse of a matrix by Gauss Jordon method – Eigenvalue of a matrix by power method

MODULE – III **INTERPOLATION AND APPROXIMATION** 6

Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton's forward and backward difference formulae.

MODULE – IV **NUMERICAL DIFFERENTIATION AND INTEGRATION** 7

Derivatives from difference tables – Divided differences and finite differences – Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two and Three point Gaussian quadrature formulas.

MODULE – V **INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS** 7

Single step methods: Taylor series method – Euler and modified Euler methods – Fourth order Runge – Kutta method for solving first order equations – Multistep methods: Milne's and Adam's predictor and corrector methods

MODULE – VI **BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS** **7**

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation.

LECTURE HOURS: 45	TUTORIAL HOURS: 15	PRACTICE HOURS: 0	TOTAL HOURS: 60

REFERENCES:

1. Gerald, C.F, and Wheatley, P.O, "Applied Numerical Analysis", Sixth Edition, Pearson Education Asia, New Delhi, 2002.
2. Burden, R.L and Faires, T.D., "Numerical Analysis", Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.
3. Kandasamy, P., Thilagavathy, K. and Gunavathy, K., "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2003.
4. M.K.Venkataraman, "Numerical Methods" , The National Publishing Co. , Chennai.
5. Veerarajan, T., Engineering Mathematics (For First Year), Tata McGraw-Hill Pub. Pvt Ltd.,

New Delhi (2006).(For Module– I).

6. Rajasekaran.S., Chandrasekaran A., “Engineering Mathematics” Volume II (Revised Edition) Dhanam publishers, Chennai (2009) (For Module– I)

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Have a sound knowledge of Laplace transform and its properties and sufficient exposure to solution of certain linear differential equations using the Laplace transform techniques which have applications in other subjects of the current and higher semesters.
- The roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations and eigen value problem of a matrix can be obtained numerically where analytical methods fail to give solution.
- When huge amount of experimental data are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values.
- The numerical differentiation and integration find application when the function in the analytical form is too complicated or the huge amounts of data are given such as series of measurements, observations or some other empirical information.
- Since many physical laws are couched in terms of rate of change of one/two or more independent variables, most of the engineering problems are characterized in the form of either nonlinear ordinary differential equations or partial differential equations. The methods introduced in the solution of ordinary differential equations and partial differential equations will be useful in attempting any engineering problem.

PTEEB2101 CONTROL SYSTEMS

L	T	P	C
3	0	0	3

Course Objectives:

- To understand the system modeling and to derive their transfer function.
- To provide adequate knowledge of time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of Control systems.

MODULE I BASIC CONCEPTS AND SYSTEM REPRESENTATION 8

Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Block diagram reduction techniques – Signal flow graphs.

MODULE II TIME RESPONSE ANALYSIS AND DESIGN 8

Time response – Time domain specifications – Types of test input – First and Second order system-Response, Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

Module - III FREQUENCY RESPONSE ANALYSIS AND DESIGN 7

Performance specifications-correlation to time domain specifications-bode plots and polar plots –gain and phase margin –constant M and N circles and Nichols chart –all pass and non-minimum phase systems.

Module - IV STABILITY 8

Characteristics equation – Location of roots in s plane for stability – Routh Hurwitz criterion– Root locus construction – Effect of pole, zero addition – Gain margin and phase margin –Nyquist stability criterion.

MODULE - V COMPENSATOR DESIGN 8

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots.

MODULE - VI CONTROL SYSTEM COMPONENTS AND APPLICATION OF CONTROL SYSTEMS 6

Synchros – AC servomotors- DC Servo motors -Stepper motors-AC Tacho generator- DC Tacho generator- -Typical applications of control system in industry.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL: 45 Hours

REFERENCE :

1. K. Ogata, 'Modern Control Engineering', 4th edition, Pearson Education, New Delhi, 2003
2. I.J. Nagrath & M. Gopal, 'Control Systems Engineering', New Age International Publishers,

2003.
3 C.J.Chesmond.'Basic Control System Technology', Viva low priced student edition, 1998.
4 I.J.Nagarath and M.Gopal,'Control System Engineering, 'Wiley Eastern ltd., Reprint 1995
5 R.C.Dorf and R.H.Bishop, 'Modern Control Systems', Addison-Wesley, 1995 (MATLAB Reference)

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Proper understanding of basics of Control Systems.
- Ability and skill to carry-out time domain and frequency domain analysis.
- Capable of determining stability of the system using Routh Hurwitz criterion, Root locus and Nyquist criterion.
- Ability to design lag, lead and lag lead compensator networks.

PTEEB2102	TRANSMISSION AND DISTRIBUTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To derive expressions for the computation of transmission line parameters.
- To model transmission lines for determining voltage regulation and efficiency.
- To analyze the voltage distribution in insulator strings /underground cables
- To understand the operation of the different distribution schemes.

MODULE I INTRODUCTION 6

Structure of electric power system: Generation, transmission and distribution EHV AC and HVDC transmission: comparison of economics of transmission, technical performance and reliability, application of HVDC transmission system. FACTS (qualitative treatment only): TCSC, SVC, STATCOM, UPFC.

MODULE II TRANSMISSION LINE PARAMETERS 8

Parameters of single and three phase transmission lines with single and double circuits: Resistance, inductance and capacitance of solid, stranded and bundled conductors: Symmetrical and unsymmetrical spacing and transposition; application of self and mutual GMD; skin and proximity effects; interference with neighboring communication circuits..

MODULE III MODELLING AND PERFORMANCE OF TRANSMISSION LINES 8

Classification of lines: Short , medium and long lines; equivalent circuits, attenuation constant, phase constant, surge impedance; transmission efficiency and voltage regulation; real and reactive power flow in lines: Power-angle diagram; surge-impedance loading, shunt and series compensation; Ferranti effect and corona loss.

MODULE IV INSULATORS AND CABLES 8

Insulators: Types, voltage distribution in insulator string, improvement of string efficiency. Underground cables: Constructional features of LT and HT cables, capacitance, dielectric stress and grading, thermal characteristics.

Module V MECHANICAL DESIGN OF OVERHEAD LINES 7

Sag in overhead lines- calculation of sag and tension – supports at equal heights-supports at unequal

heights- effect of ice – combined effect of wind and ice loading – Statutory rules and Indian Electricity rules.

Module VI **SUBSTATION, AND DISTRIBUTION SYSTEM** **8**

Types of substations; bus-bar arrangements; substation bus schemes: single bus scheme, double bus with double breaker, double bus with single breaker, main and transfer bus, ring bus, breaker-and-a-half with two main buses, double bus-bar with bypass isolators.

Radial and ring-main distributors; interconnectors; AC distribution: AC distributor with concentrated load; three-phase, four-wire distribution system; sub-mains; stepped and tapered mains.

Case Study:

Students are required to visit an industrial substation (including distribution system) and to submit a report. A presentation is also to be made in front of the department committee.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. B.R.Gupta, 'Power System Analysis and Design', S.Chand, New Delhi, 2003.
2. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, 2002.
3. Luces M.Fualkenberry ,Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 1996.
4. Hadi Saadat, 'Power System Analysis,' Tata McGraw Hill Publishing Company', 2003.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Proper understanding of basics of transmission and distribution.
- Capable of determining voltage regulation and efficiency for short, medium and long lines.
- Ability to determine string efficiency of insulators.
- Better understanding of .different types of substation and distribution systems.

PTEEB2103	MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To impart Knowledge on -

- Various instrument systems and their errors in them.
- Various signal conditioning circuits.
- Principle of various active and passive transducers.
- Various storage and display devices.
- Instruments for measuring the various electrical and electronics quantities.
- Working principles of biomedical instruments that are actually in use at the present day

MODULE I INTRODUCTION 6

Functional elements of an Instrument – Static and Dynamic characteristics –Errors in measurement – statistical evaluation of measurement of data – Standards and Calibration.

MODULE II TRANSDUCERS 9

Classification of transducers – selection of transducer – resistive, capacitive and inductive transducer - piezo- electric transducer – optical and digital transducers. Transducers for measurement of displacement , temperature , Level ,pressure, velocity and acceleration.

MODULE III SIGNAL CONDITIONING CIRCUITS 9

Bridge Circuits – differential and Instrumentation amplifier –filter circuits- V/f and f/V converters – multiplexing and demultiplexing – data acquisition systems - grounding techniques.

MODULE IV STORAGE AND DISPLAYS 7

Digital plotters and printers – CRT Displays – digital CRO – LED,LCD and matrix displays .Single and three phase watt meters and energy meter – magnetic measurements - Instruments for measurement of torque, speed, frequency , phase –viscosity and moisture.

MODULE V ELECTRICAL AND BIOMEDICAL INSTRUMENTS 7

Electrical Instruments: Principle and types of analog and digital ammeters and voltmeters – Single and three phase wattmeters and energymeter.Biomedical Instruments:

Introduction to biomedical instruments – Blood pressure measurement methods – Blood flow measurement methods – CT scanner – MRI scanner.

MODULE VI ASSISTING AND THERAPEUTIC EQUIPMENTS 7

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Audio meters – Dialyzers(Haemodialysis Machine)

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Doebelin E.O., “Measurement Systems – Application and Design “,McGraw Hill Publishing Company , 1990 .
2. Murthy , D.V.S., “ Transducer and Instrumentation “, Prentice Hall of India Pvt. Ltd. , 1995.
3. Stout ,M.B., “Basic Electrical Measurement “, Prentice Hall of India
4. Morris, A.S ,” Principle of Measurement and Instrumentation “, Prentice Hall of India ,1999.
5. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, ‘Bio-Medical Instrumentation and Measurements’, II Edition, Pearson Education, 2002 / PHI.
6. R.S.Khandpur, ‘Handbook of Bio-Medical instrumentation’, Tata McGraw Hill Publishing Co Ltd., 2003.
7. M.Arumugam, ‘Bio-Medical Instrumentation’, Anuradha Agencies, 2003.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Ability to identify various process loops and the appropriate instruments to be used .
- Ability to design and test various transducers.
- Provide awareness on various biomedical instruments

PTSSB2181 SOCIOLOGY, ETHICS AND HUMAN VALUES

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To give an overview of the fundamental of sociology.
- To expose how society developed in India, classes and impact.
- To introduce sociological aspects relating to industry
- To provide some basic concepts on ethics and human rights.
- To stress the role of engineer to the society, environment and sustainability.

MODULE – I FUNDAMENTALS OF SOCIOLOGY **7**

Sociology - definition, evolution – scope – basic concepts – social process, sociological theories, social institutions, culture and social stratification – family – economic – politics – religion – education, state and civil society – social control.

MODULE – II SOCIOLOGY IN INDIAN CONTEXT **7**

Development – Institutions, classes – women and society – impact of social laws, social change in contemporary India – secularism and communalism – social exclusion and inclusion.

MODULE – III INDUSTRIAL SOCIOLOGY **8**

Definition and perspectives – industry in India – social groups in industry, behaviour pattern – group dynamics – focus groups – team – enhancing group behaviour.

MODULE – IV INDUSTRIAL – SOCIETY INTERFACE **8**

Perspectives – social responsibilities – sociological effect on industrialization – urbanization, child labour, psychological impact, Impact of technology, modernization – globalization – challenges – role of engineers.

MODULE – V ETHICS AND HUMAN VALUES **8**

Ethics and values – organizational values – personal worth, ethical behavior, professional ethics, whistle blowing, international ethics, corruption.

MODULE – VI ENGINEERS AND SOCIETY 8

Quality of life and society – engineer in economic development, technology development – invention, innovation and diffusion – appropriate technology – engineer's contribution, ecology and environment – sustainability – role of engineers.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Samir Das Gupta and Paulomi Saha, An Introduction to Sociology, Pearson, Delhi, 2012.
2. Narender Singh, Industrial Sociology, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 201
3. Vidya Bhushan and D.R. Sachdeva, Fundamental of Sociology, Pearson, Delhi, 2012.
4. Deshpande, Satish, Contemporary India : A Sociological view, Viking (2002)
5. Thopar, Romila, Early India, Penguin (2003).
6. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw Hill, New York, 1996.

PTEEB2104 CONTROL AND INSTRUMENTATION LABORATORY	L	T	P	C
	0	0	2	1

COURSE OBJECTIVES:

- To provide a platform for understanding the basic concepts of linear control theory and its application to practical systems.
- To provide practical knowledge on the various Measurement transducers and instruments.

LIST OF EXPERIMENTS:

1. Transfer function of DC Servomotor & AC Servomotor
2. Transfer function of separately excited DC Generator.
3. Transfer function of Armature controlled and field controlled DC Motor.
4. Digital simulation of type-0 and type-1 system.
5. Stability analysis of linear systems using Bode plot, and Root locus/Nyquist plot.
6. Digital control of first order plant (P, PI and PID).
7. Design and implementation of compensators.
8. A/D and D/A converters.
9. Digital oscilloscopes.
10. Data acquisition system.
11. Torque and angle measurement.
12. Study of displacement and pressure transducers (LVDT, I/P and P/I), temperature mea transducer (RTD, Thermocouples and IC590).

LECTURE HOURS: 0	TUTORIAL HOURS: 0	PRACTICE HOURS: 30	**TOTAL: 30 Hours**

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Ability to determine the transfer function of d.c generator, d.c motor, d.c and a.c servomotors.
- Obtain the stability of the system using Bode, Root locus and Nyquist plot.
- Ability to design and implement various instrument systems.
- Ability to calibrate various instruments.

PTEEB2105	MODELING & SIMULATION OF ELECTRICAL APPARATUS	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To impart knowledge in writing programmes to tackle and solve problems in electrical engineering.

LIST OF EXPERIMENTS:

1. C/C++ Programming Exercises- Solution of Differential equations :

MATLAB and SIMULINK-

2. Simulation of Buck, Boost and Buck-boost converters
3. Simulation of 1-Ph and 3-Ph VSI with sine-triangle modulation
4. Solution to RLC circuit and resonance problems
5. Solution to network theorems
6. Pole-zero plots

PSPICE EXERCISES

7. Switched mode power supplies
8. Single phase and Three phase PWM Inverters.
9. Calculation of voltage regulation and efficiency of shorts, medium and long lines
10. Fault analysis in power systems.

LECTURE HOURS: 0	TUTORIAL HOURS: 0	PRACTICE HOURS: 30	TOTAL: 30 Hours

COURSE OUTCOME:

At the end of the course, the Students are expected to possess knowledge and achieve skills on following:

- Ability to write software programme, debug and run the same, for any problem in electrical engineering.

SEMESTER IV

		L	T	P	C
PTEEB2211	**POWER SYSTEM ANALYSIS**	3	1	0	4

COURSE OBJECTIVES:

- To provide the student the knowledge and computational skills required to model and analyze large-scale power system under normal and abnormal operating conditions
- To understand the usage of efficient numerical techniques suitable for computer application which are required for planning and operation of power system

MODULE I INTRODUCTION 8

Overview of power system- balanced three phase system- per phase analysis – per unit system – single line diagram – equivalent circuit of transformers with off-nominal tap ratio – modeling of generator , load, transmission line for power flow and stability

MODULE II FORMATION OF NETWORK MATRICES 7

Basic graph theory – Primitive networks – Formation of network matrices – Bus impedance and admittance Matrix – node elimination by matrix method.

MODULE III SYMMETRICAL COMPONENTS 7

Symmetrical Components – Sequence Impedances of synchronous machines, transformers, transmission lines, loads, formation of sequence networks for unsymmetrical fault analysis.

MODULE IV FAULT ANALYSIS 7

Need for short circuit study - Symmetrical short circuit analysis :short circuit current and MVA calculation – application of series reactors – unsymmetrical fault analysis : LG,LL and LLG faults with and without fault impedence – effect of ground impedance - numerical problems.

Module V POWER FLOW ANALYSIS 7

Problem definition - bus classification - derivation of power flow equation - solution by Gauss-siedel and Newton-Raphson methods -FDPF method-computation of slack bus power, transmission loss and line flows.

Module VI STABILITY ANALYSIS 8

Basic concepts of steady state, transient and dynamic stabilities – steady state stability: stability limits – power angle curve – determination of steady state stability and methods to improve steady state stability-transient stability:swing equation for single machine infinite bus system-Equal area criterion- critical clearing angle calculation - Solution of swing equation by modified Euler and Runge - Kutta methods.

LECTURE HOURS: 45	TUTORIAL HOURS: 15	PRACTICE HOURS: 0	TOTAL: 60 Hours

REFERENCES:

1. John J. Grainger and Stevenson Jr. W.D., 'Power system analysis', McGraw Hill International Edition, 1994.
2. Stagg, G.W. and El-Abiad, A.H., 'Computer methods in Power System Analysis', McGraw Hill International Book Company.
3. Hadi Saadat ‘,Power system analysis’,Tata Mc Graw Hill,2002
4. T.K Nagasarkar and M.S. Sukhija,’ Power system analysis,Oxford University Press, 2007
5. N.V. Ramana, ‘Power System Analysis’,Pearson Education,2011.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Ability to model the power system for steady state and transient studies
- Ability to perform fault studies and design circuit breaker ratings
- Ability to perform power flow studies
- Ability to analyse steady state and transient stability of the power system.

PTEEB2212 MICROPROCESSORS AND MICROCONTROLLERS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Hardware architecture of 8086, 8051 and advanced processors.
- Concept of addressing modes, need and use of interrupts.
- Simple machine language programming using 8086 and 8051.
- Peripheral devices and interfacing with processors and controllers.

MODULE I **9**

INTRODUCTION TO 8086 PROCESSOR

Hardware architecture – Pin outs– Memory interfacing – I/ O ports and data transfer concepts – Timing Diagram – Interrupt structure - 8086 Instruction format and addressing modes – Assembly language format – data transfer, data manipulation and control instructions – Simple programming

MODULE II **8**

PERIPHERAL INTERFACING ICs

Parallel I/ O (8255) - Programmable Interval Timers (8253/ 8254) - Keyboard and Display Controller (8279) - Interrupt Controller (8259) - Interfacing Serial I/ O (8251).

MODULE II **INTRODUCTION TO 8051 MICROCONTROLLER** 6

8051 Microcontroller - General architecture - Memory organization - I/O pins, ports & circuits - Counters and Timers - Serial data input/output - Interrupts.

MODULE IV **8051 PROGRAMMING** 8

Addressing Modes- Instruction set - Data Move Operations - Logical Operations - Arithmetic Operations - Jump and Call Subroutine, - Advanced Instructions - Programming with 8051.

MODULE V **ADVANCED MICROPROCESSORS AND MICROCONTROLLERS** 8

Architecture of AVR, PIC and ARM microcontrollers - JTAG: Concept and Boundary Scan Architecture – core 2 duo processor – i7 core processor. (Qualitative Study).

MODULE VI **APPLICATIONS OF MICROPROCESSORS AND MICROCONTROLLERS** 6

Stepper motor control using 8086 – Temperature control using 8086 – Burglar alarm – Keyboard and Display Interfacing with 8051 – External memory Interfacing with 8051.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL: 45 Hours

REFERENCES:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D.MCKinlay The 8051 Microcontroller and Embedded Systems, Second Edition, Pearson Education 2008.
2. Douglas V.Hall, Microprocessor and Interfacing, Programming and Hardware. Revised second Edition, Indian edition 2007. Tata McGraw Hill
3. Krishna Kant, " Microprocessor and Microcontroller Architecture, programming and system design using 8085, 8086, 8051 and 8096, PHI, 2007
4. Kenneth J.Ayala., "The 8051 Microcontroller, 3rd Edition, Thompson Delmar Learning, 2007, New Delhi.
5. A.K. Ray , K.M .Bhurchandi "Advanced Microprocessor and Peripherals" ,Second edition, Tata McGraw-Hill, 2007.
6. Barry B.Brey, "The Intel Microprocessors Architecture, Programming and Interfacing" Pearson Education, 2007. New Delhi.
7. Zdravko Karakehayov, "Embedded System Design with 8051 Microcontroller hardware and software", Mercel Dekkar, 1999.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Internal organization of some popular microprocessors/microcontrollers.
- Hardware and software interaction and integration.
- Design of microprocessors/microcontrollers-based systems.

PTEEB2213	DESIGN OF ELECTRICAL APPARATUS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To design armature and field systems for D.C. machines.
- To design core, yoke, windings and cooling systems of transformers.
- To design stator and rotor of induction machines.
- To design stator and rotor of synchronous machines and study their thermal behaviour.

MODULE I INTRODUCTION 6

Basic concept of design – standard specifications – classification of materials – electric and magnetic circuits – leakage reactance calculation – thermal rating of electrical apparatus – performance prediction from rating

MODULE II DC MACHINES 8

DC Machines – constructional details – output equation – main dimensions – choice of number of poles – armature and field dimension – design of commutator and brushes – performance prediction.

MODULE III TRANSFORMERS 8

Constructional details – output rating – output equation – design of core windings – single and three-phase transformers – determination of no-load current and equivalent circuit parameters – design of tank and cooling tubes for distribution transformers – performance calculation.

MODULE IV INDUCTION MOTORS 8

Constructional details – output equation – main dimensions – design of stator – design of squirrel cage and slip ring rotor – determination of no-load current and equivalent circuit parameters – performance prediction using circle diagram.

MODULE V SYNCHRONOUS MACHINES 8

Constructional details – output equation – main dimensions – design of stator – design of rotor – design of turbo alternator

MODULE VI **CAD FOR APPARATUS DESIGN** 7

Computer in design, flow-chart, magnetic field calculations using finite difference and finite element methods. Determination of equipotential lines.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL: 45 Hours

REFERENCES:

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 1987.

2. Sen, P.K., 'Principles of Electrical Machine Designs with Computer Programs', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Knowledge and skill to Design DC machines and AC machines.

PTEEB2213 DIGITAL SYSTEMS & INTEGRATED CIRCUITS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the concepts of digital logic systems and its design.
- To study characteristics, design & realization of circuits using Op-amps.
- To study internal functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits, Data Converters.

MODULE - I **BOOLEAN ALGEBRA AND COMBINATIONAL LOGIC DESIGN** 8

Review of number systems - Alphanumeric codes – Boolean Algebra theorems , De-Morgan's law - sum of product and product of sum simplification - canonical forms -minterm and maxterm - Simplification of Boolean expressions: Karnaugh map (upto 4 variables), Quine McCluskey method - Implementation of Boolean expressions using universal gates.

MODULE - II **DESIGN OF DIGITAL SYSTEMS** 8

Internal circuits of basic gates: AND, OR, NOT and XOR using Bipolar, MOS and CMOS families - Combinational logic circuits: adders, subtractors, decoders, encoders, multiplexers, demultiplexers - System design using multiplexer, demultiplexer, encoder, decoder - Memory based design : Design using PAL and PLA.

MODULE III **SEQUENTIAL CIRCUITS** 7

Sequential circuits - Flip-flops : RS, JK, T & D - shift registers – counters : design of asynchronous and synchronous counters – analysis of sequential circuits : state table and diagram.

MODULE – IV **IC FABRICATION AND CHARACTERISTICS** 6

Integrated circuit: fabrication, monolithic IC technology, basic planar processes, fabrication of a typical circuit, active and passive components of ICs, thin and thick film technology, technology trends.

Introduction to Operational amplifier: block diagram representation, analysis of a typical Op Amp circuit, the ideal Op Amp - Op Amp characteristics :Band width, slew rate, CMRR, PSRR ,noise and frequency compensation.

MODULE – V **OP AMP APPLICATIONS** 10

Applications of Op Amp – summer, subtractor, multiplier, divider, integrator, differentiator, comparator, zero crossing detector - Instrumentation amplifier - Precision Diode & Precision rectifier - Square, triangular and sine wave generation - Active Filters: I and II order Butterworth low pass, high pass, band pass and band stop filters.

MODULE – VI **TIMERS AND DATA CONVERTERS** **6**

IC 555 Timer – Block Diagram, Astable and Monostable Multivibrator Configurations - Basic functional internal block diagram IC 565, LM723 voltage regulator.

Data Converters – Basic Principle of Analogue–to- Digital (ADC) and Digital-to-Analogue (DAC) Conversion.

LECTURE HOURS: 45	TUTORIAL HOURS:	PRACTICE HOURS: 0	TOTAL HOURS: 45

REFERENCES:

1 Taub , Schilling, " Digital Integrated Electronics", Tata McGraw Hill , 2008.

2 Tocci, Widmer, Moss Digital Systems: Principles and Applications", Tata McGraw Hill, 2009.

3 Leach and Malvino, "Digital Principles and Application", Tata McGraw Hill, 7th Edition, 2010.

4 Donald D. Givone, "Digital Principles and Design ", Tata McGraw-Hill, 2010.

5 Jacob Millman, Christos C.Halkias, "Integrated Electronics – Analog and Digital circuits system", Tata McGraw Hill, 2010.

6 Jacob Millman, Herbert Taub "Millman's Pulse, Digital and Switching Waveforms", Tata McGraw Hill, 2011

7 R. Gayakwad, Op-Amps and Linear Integrated Circuits, 4th ed., Pearson Education, Delhi, 2000

8 R. Coughlin and F. Driscoll, Operational Amplifiers and Linear Integrated Circuits, 6th ed., Pearson Education, Delhi, 2003

9 D. R. Choudhury and S. Jain, Linear Integrated Circuits, New Age International, New Delhi, 2002

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- The basic tools for the design of digital circuits and fundamental concepts used in design of digital systems.
- An in-depth understanding of fundamentals of Op-amps and its application circuits.
- Knowledge regarding the various signal generator circuits and the linear integrated circuits.

PTCHB2281 ENVIRONMENTAL SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To impart Knowledge on -

- To impart the basic scientific knowledge on the environment and human impacts on various elements of environment and assessment tools.

MODULE I PHYSICAL ENVIRONMENT 8

Earth's surface - the Interior of Earth – Plate Tectonics – Composition of the Crust: Rocks – formation & types, Soils – formation & components – soil profile.

Atmosphere – structure & composition – weather & climate – tropospheric airflow

Hydrosphere – water budget – hydrological cycle – Rainwater & precipitation, River Water & solids, Lake Water & stratification, Seawater & solids, soil moisture & groundwater.

Bioelement cycling – The Oxygen cycles – the carbon cycle – the nitrogen cycle – the phosphorous cycle – the sulfur cycle sodium, potassium & magnesium cycles.

MODULE II BIOLOGICAL ENVIRONMENT 7

Cellular basis of life – prokaryotes & eukaryotes – cell respiration – photosynthesis – DNA & RNA – genetically modified life

Population dynamics – population – population growth – survival & growth curves – population regulation – future of human population

Biological communities - Five major interactions: competition, predation, parasitism, mutualism and commensalism – Concepts of habitat & niche – natural selection – species richness & species diversity – ecological succession & climax.

Ecosystem & Biomes – Food Chains & food webs – biomagnifications – ecological pyramids - Trophic levels – Energy flow in ecosystem – ecosystem stability – Terrestrial & aquatic biomes.

MODULE III IMPACTS ON NATURAL RESOURCES & CONSERVATION 9

Biological resources – nature & importance – direct damage – introduced species – Habitat degradation, loss and fragmentation – Values of biodiversity – hotspots of biodiversity, threats to biodiversity- endangered and endemic species of India- conservation of biodiversity, in-situ and ex-situ conservation

Land Utilization – past patterns of land use – Urban & Industrial development – deforestation, salinisation, soil erosion, and desertification – Modern Agriculture & Impacts

Major extractive industries – metals & ores – building materials – peat – fossil fuels (coal, oil, natural gas)

Waste management – types of solid wastes – disposal options –reduce, recovery & reuse – waste minimization, cleaner production technology.

MODULE IV **IMPACTS ON WATER & AIR AND CONSERVATION** 8

Water pollution – organic oxygen demanding wastes – anthropogenic phosphate & eutrophication - Ground water contamination – Usage of fertilizer and pesticides– acid rain - acid mine discharges – toxic metals – organochlorines – endocrine disrupting substances- treatment process – Rain water harvesting and watershed management- manmade radionuclide's – thermal pollution

Atmospheric pollution - primary & secondary pollutants – anthropogenic, xenobiotic, synergism, sources & sink, residence time, levels & impacts of major pollutants – processes leading to smog, acid rain, global warming, stratospheric ozone depletion. Noise pollution and abatement.

MODULE V **IMPACTS ON ENERGY AND CONSERVATION, ENVIRONMENTAL CRISIS** 8

Energy – Renewable and non renewable energy resources – thermal power plants – nuclear fuels, fossil fuels, solar energy, wind energy, wave energy, tidal energy, ocean thermal energy, hydropower, geothermal energy, biomass energy

Environment crisis – state of environment in developed and developing countries- managing environmental challenges for future – disaster management, floods, earthquake, cyclone and landslides.

MODULE VI **ENVIRONMENTAL IMPACT ASSESSMENT AND SUSTAINABILITY** 5

Environmental Impact Assessment – Impacts: magnitude & significance – steps in EIA – methods – precautionary principle & polluter pays principle – role of NGOs & Public – value education –Environment protection act (air, water, wild life) and forest Conservation act

Concept of Sustainability – Sustainable Development – Gaia Hypothesis - Traditional Knowledge for sustainability.

LECTURE HOURS: 45	**TUTORIAL HOURS: 0**	**PRACTICE HOURS: 0**	**TOTAL: 45 Hours**

REFERENCES:

1. Environmental Science (The Natural Environment and Human Impact), Andrew R. W. Jackson and Julie M. Jackson, Pearson Education Limited, Harlow, Essex, England, 2000.
2. The Revenge of Gaia: Why the Earth is Fighting Back and How We Can Still Save Humanity, James Lovelock, Penguin UK, 2007.
3. Environmental Impact Assessment, Larry W. Canter, McGraw-Hill, 1996.
4. Sustainability: A Philosophy of Adaptive Ecosystem Management, Bryan G. Norton, 2005.
5. Physical Geology, Earth Revealed, David McGeary & Charles C Plummer, WCB McGraw Hill, 1998.
6. Environmental Science (Working with the Earth), G Tyler Miller, Jr., Thomson Brooks/Cole, 2006.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Student should have gained basic scientific knowledge on the environment and human impacts on various elements of environment and assessment tools.

PTEEB2215	DIGITAL SYSTEMS & INTEGRATED CIRCUITS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To provide hands-on experience on design, testing, and analysis of various digital circuits.
- To provide hands-on experience on design, testing, and analysis of Op Amp circuits

LIST OF EXPERIMENTS:

1. Design and implementation of combinational circuits using basic gates and universal gates for arbitrary functions.
2. Design and implementation of multiplexers and Demultiplexers.
3. Design and implementation of Decoders and Encoders.

4. Design and verification of truth table of Code Converter Circuit.
5. Design and implementation of synchronous counters and Asynchronous Counters.
6. Verification of operation of flip- flops - RS, JK, T, D.
7. Measurement of important Op-Amp parameters such as CMRR, slew rate, open loop gain, input and output impedances, GBW product.
8. Inverting, Non inverting amplifiers, Integrator and differentiator using Op Amps.
9. Astable, Monostable Multivibrators and Schmitt Trigger using Op Amp.
10. Application circuits of IC 555.
11. Study of ADCs and DACs: Verification of A/D conversion using dedicated ICs.

LECTURE HOURS: 0	TUTORIAL HOURS: 0	PRACTICE HOURS: 30	**TOTAL: 30 Hours**

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Be trained to design and implement combinational and sequential digital circuits.
- Have acquired skills to design and implement various signal generation circuits using Opamps and ICs.

PTEEB2216 MICROPROCESSOR AND MICROCONTROLLER LAB

L	T	P	C
0	**0**	**2**	**1**

COURSE OBJECTIVES:

- Simple Assembly Language programming using 8086 and 8051 instruction set.
- Framing and implementing of algorithms.
- Subroutines, nesting and interrupts need and usage.

LIST OF EXPERIMENTS

MICROPROCESSOR EXPERIMENTS:

1. Programs on arithmetic operations: addition / division.
2. Programs on logical operations: Largest / Descending
3. Programs on subroutines
4. Programming with Rotate instructions: ASCII code conversions.
5. A/ D, D/ A Interfacing.
6. Traffic light controller interfacing.

MICROCONTROLLER EXPERIMENTS:

1. Demonstration of basic instructions with 8051 Micro controller execution, including:
   a. Conditional jumps, looping
   b. Calling subroutines.
2. Interfacing Keyboard and Display
3. Stepper motor Interfacing
4. D/A Interfacing
5. Traffic light controller Interfacing

LECTURE HOURS: 0	TUTORIAL HOURS: 0	PRACTICE HOURS: 30	**TOTAL: 30 Hours**

COURSE OUTCOME:

At the end of the course the student is expected to possess knowledge and achieve skills on the following.

- Usage of arithmetic, logical branching and control instructions.
- Interfacing of peripheral devices and waveform generation.
- Design and implementation of simple projects using peripheral devices and processors and controllers.

SEMESTER V

		L	T	P	C
PTIT3181	**C++ PROGRAMMING**	**3**	**1**	**0**	**4**

COURSE OBJECTIVES:

- To understand the concepts of object-oriented programming and master OOP using C++.
- To acquire knowledge and skills in OO design and program development
- Certain skills in Internet and windows programming and using graphical user interface.

MODULE I OVERVIEW OF C++ 8

Introduction - Object oriented programming concepts; Object oriented programming languages; Origins of C++; C++ fundamentals; OO concepts; ADT, Classes and objects, Inheritance, abstract classes, Polymorphism; Classes and objects in C++ ; Arrays, Pointers, References.

MODULE II CONSTRUCTOR AND OVERLOADING 8

Constructors-default constructor-parameterized constructor-constructor with dynamic allocation-copy constructor-destructors; Introduction - Function and Operator overloading; Function overloading; Operator overloading- fundamentals, restrictions; operator overloading using a friend function, overloading special operators.

MODULE III TEMPLATES AND EXCEPTION 7

Function and class templates; Exception handling, try-catch-throw paradigm, exception specification, terminate and unexpected functions, Uncaught exception.

MODULE IV INHERITANCE AND POLYMORPHISM 7

Base class, Member accessibility; Multiple Inheritance; Virtual base class; Runtime polymorphism, Virtual functions- pure virtual functions, dynamic binding.

MODULE V INPUT / OUTPUT FUNCTIONS AND FILE PROCESSING 7

Unformatted I/O, Formatted I/O; I/O Manipulators; File handling, Random access, object serialization, standard namespaces; File processing-Opening and closing a file-Reading and writing a file.

MODULE VI RTTI AND STANDARD TEMPLATE LIBRARY 8

RTTI - Application of RTTI; STL - Overview; Container classes: Vector, Lists and Maps; Algorithms: Counting, removing, replacing, reversing and transforming elements.

LECTURE HOURS: 45	TUTORIAL HOURS: 15	PRACTICE HOURS: 0	**TOTAL: 60 Hours**

REFERENCES:

1. Deitel and Deitel, 'C++ HOW TO PROGRAM', Pearson Education, 4th Edition, 2001
2. Herbert Schildt, 'The Complete Reference C++', TataMcgraw Hill, 2001, 3rd Edition
3. Balaguruswamy E., 'Programming in C++', Tata McGraw Hill, Second Edition, 2001
4. Bruce Eckel, 'THINKING IN C++', Pearson Education, Second Edition, 2001.
5. James P. Cohoon, Jack W. Davidson, 'C++ PROGRAM DESIGN', An Introduction to Programming & Object Oriented Design, TataMcgrawHill, 2nd Edition, 2000.
6. Yashwant Kanetkar, 'LET US C++', BPB Publication, First Edition, 1999

COURSE OUTCOME:

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

- Experience in basic concepts of object oriented programming
- Know practical knowledge in OO design concepts
- Design a small-scale object-oriented program.

		L	T	P	C
PTEEB3101	**POWER SYSTEM OPERATION & CONTOL**	3	0	0	3

COURSE OBJECTIVES:

- To provide knowledge about economics of power generation.
- To provide knowledge about real power frequency control and voltage control.
- To acquire knowledge about excitation system.
- To provide basic knowledge about the economic dispatch and unit commitment**.**

MODULE - I **INTRODUCTION** 7

Types of load – load Characteristics – load curves and load duration curves – economics of generation - generation reserves – overview of system operation and control

MODULE - II **REAL POWER FREQUENCY CONTROL** 8

Fundamentals of Speed Governing mechanism and its modeling – Speed load characteristics – Load sharing between two synchronous generators in parallel – concept of control area

Need for frequency control -Load frequency control of single area power system – modeling- static and dynamic analysis of uncontrolled and controlled cases –Two area power system-modeling, static and dynamic analyze controlled and uncontrolled cases.

MODULE III **EXCITATION SYSTEM** 7

Types of excitation system : Modeling – static and dynamic analysis root loci of AVR – Stability compensation

MODULE – IV **REACTIVE POWER AND VOLTAGE CONTROL** 8

Requirements of voltage and reactive power control – relation between node voltage, power and reactive power at a nodes – generation and absorption of reactive power – analysis of reactive power absorbed and generated by the transmission line – methods of voltage control-reactive power compensation-tap changing transformers.

MODULE – V **UNIT COMMITMENT AND ECONOMIC DISPATCH** 8

Unit commitment: need – constraints,solution methods , priority listing scheme – numerical problems . Incremental cost curve – co- ordination equation without and with losses – analytical solution for λ- computer approach to λ iteration method-flow chart –transmission loss formula by B coefficient method.

.

MODULE – VI **COMPUTER CONTROL OF POWER SYSTEMS** **7**

Energy control centre – functions – monitoring, data acquisition and control-system hardware configuration – SCADA and EMS functions – power system security –various operation states

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL: 45 HOURS

REFERENCES:

1. .Olle. I. Elgerd,"Electric Energy Systems Theory – An Introduction ",Tata Mc Graw Hill Publishing company Ltd,New Delhi,Second Edition,2003.
2. .Allen J.Green Wood and Bruce F.Wollenberg, " Power Generation, operation and control",John Wiley and spons,Inc.,2003.
3. P.Kundur,"Power System Stability and Control",Mc.Graw Hill Publications,USA,1994.34.D.P.Kothari and I.J.Nagrath,"Modern Power System Analysis",Third edition,Tata Mc Graw Hill Publishing company limited,New Delhi,2003.
4. N.V.Ramana,"Power System Operation and control",Pearson Education India,2010.
5. Abhijit chakrabarti and Sunita Halder, "Power System analysis –Operation and control" Prentice Hall of India Learning private limited,2010.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Ability to understand the basic economic concepts of power system operation
- Ability to use his knowledge to operate the power system under most economic conditions.
- Work with power system planning, design and operation companies

	L	T	P	C
PTEEB3102 POWER ELECTRONICS AND DRIVES	3	0	0	3

COURSE OBJECTIVES:

- To make the students learn the fundamentals of power electronic components, circuit analysis techniques and design skills.
- To acquire basic understanding of various power converter modules.
- To acquire the knowledge and applications of modern devices.

MODULE - I POWER SEMI CONDUCTOR DEVICES 8

Study of Switching devices: Construction, Theory of operation and switching characteristics of SCR,TRIAC,MOSFET and IGBT- snubbers-Gate Drive Circuitry for Power Converters –Case study :IR 21XX series MOSFET / IGBT drivers and MOC 30XX series SCR /TRIAC drivers.

MODULE - II PHASE CONTROLLED CONVERTERS 8

AC–DC Converters: Single phase and Three phase controlled converters -Inverter operation -Effect of source impedance on Current Commutation Dual Converters- AC-AC Converters: AC–AC Voltage Controller Cycloconverters - Matrix Converters.

MODULE III INVERTERS 7

Single phase and Three phase (both 120˚and 180˚Modes) Inverters - synthesizing sinusoidal output: Sine-PWM - Space Vector PWM -Multilevel inverters - Matrix converters (Direct Link System)- Uninterruptible power supplies

MODULE – IV DC-DC CONVERTERS 6

Switching Analysis in steady state: Buck, Boost and Buck- Boost converters-Voltage Regulation by PWM-Bi-directional Switching - Feedback controller design using Bode plot- Flyback converters - Forward converters-soft-switching: ZVS – ZCS- Synchronous Buck Converter- PWM and Phase-Shift Modulated converters

MODULE – V SOLID STATE DC DRIVES 10

Drive Classifications-Load Profiles - Characteristics- DC Moto representation Four Quadrant Operation

- Thyristor Converter Drive – Buck Converter fed DC Motor– Closed – loop Systems –Steady state analysis-Importance of loop gain- Integral controller- Stability-Disturbance Rejection.

MODULE – VI SOLID STATE AC DRIVES 6

Inverter - fed induction motor drive - general arrangement - Importance of Achieving full flux -Torque–speed characteristics with constant–v/f operation - open loop and closed loop Speed control – vector control - synchronous motor drives - open loop and self - synchronous operation - Electric and Hybrid Electric Vehicles .

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL HOURS: 45

REFERENCES:

1 Ned Mohan,Undeland and Robbin, "Power Electronics: converters, Application and design" John Wiley and sons.Inc,New York,1995.

2 Rashid M.H., " Power Electronics Circuits, Devices and Applications ", Prentice Hall India, New Delhi, 1995.

3 Austin Hughes," Electric Motors and Drives- Fundamentals, Types and Applications" Newnes 2006.

4 Rashid M.H., " Power Electronics Hand Book ", Academic Pressi, USA 2007

5 Ned Mohan, "Power Electronics: A First Course" John Wiley and sons.Inc,New York,2012.

6 P.C Sen., "Modern Power Electronics", Wheeler publishing Co, First Edition, New Delhi-1998

7 P.S.Bimbra, "Power Electronics", Khanna Publishers, Eleventh Edition, 2003.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Technical information on the design of Circuits and Converters based on modern Power Electronics devices.
- Analysis and design of efficient Electrical Drives.

PTMSB3181 MANAGEMENT OF BUSINESS ORGANIZATION

L	T	P	C
3	0	0	3

The Syllabus will be provided to the students

POWER ELECTRONICS & DRIVES LABORATORY

L	T	P	C
0	0	2	1

PTEEB3103

COURSE OBJECTIVES:

- To acquire knowledge on design and operation of several common circuits relevant to the field of power electronics.
- To expose the students to the Micro Controller based controlling techniques

LIST OF EXPERIMENTS:

1. Designing and fabrication of zero crossing detector circuit for SCR and TRIAC triggering.
2. Designing and fabrication of SCR and TRIAC triggering circuits using MOC 30XX series
3. Designing and fabrication of gate driver circuits for MOSFETs and IGBTs using self oscillating driver ICs (IR 215X series)
4. Designing and fabrication of gate driver circuits for MOSFETs and IGBTs using high voltage driver ICs (IR 21XX series)
5. Study of interfacing PIC microcontrollers with PC.
6. Gate pulse generation using PIC Controllers (Frequency modulation and Pulse Width Modulation techniques).
7. Fabrication of TRIAC based lighting control using PIC microcontroller.
8. Fabrication of SCR based converters (open loop).
9. Fabrication of converter with closed loop using PIC microcontroller based PI and PID controllers.
10. Fabrication of inverters using MOSFET and IGBT (open loop).
11. Fabrication of inverters with closed loop using PIC microcontroller based PI and PID controllers.
12. Fabrication of Chopper with closed loop using PIC microcontroller based PI and PID controllers.

LECTURE HOURS: 0	TUTORIAL HOURS: 0	PRACTICE HOURS: 30	TOTAL: 30Hours

COURSE OUTCOME:

At the end of the course the student is expected to possess knowledge and achieve skills on the following:

- Ability to design switching power converters and inverters.
- This course gives a "running start," that can lead to a useful understanding of the PIC Controller based Converters.

PTEEB3104	POWER SYSTEM SIMULATION LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To study steady state analysis of Power systems using Gauss seidal, Newton-Raphson and Fast decoupled power flow methods.
- To study and analyze transient stability of power systems
- To study and analyze electromagnetic transients in power systems.

LIST OF EXPERIMENTS:

1. Computation of Parameters and Modeling of Transmission Lines
2. Formation of Network Matrices and Solution of Networks.
3. Power Flow Analysis - I: Solution of Power Flow using Gauss-Seidel Method.
4. Power Flow Analysis II: Solution of Power Flow using Newton-Raphson and Fast-Decoupled Methods.
5. Short Circuit Analysis.
6. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System.
7. Transient Stability Analysis of Multi machine Power Systems.
8. Electromagnetic Transients in Power Systems.
9. Load - Frequency Dynamics of Single and Two-Area Power Systems.
10. Unit Commitment and Economic Dispatch in Power Systems.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Perform load flow studies using Gauss seidal , Newton Raphson and fast decoupled method.
- Short circuit studies for singe phase to ground fault and three phase fault.
- Perform transient and small signal stability study
- Perform load frequency dynamics of single area and two area power systems.
- Find optimal scheduling using economic dispatch programme.

LECTURE HOURS: 0	TUTORIAL HOURS: 0	PRACTICE HOURS: 30	TOTAL: 30 Hours

SEMESTER VI

		L	T	P	C
EIB3281	**PLC, SCADA & DCS** **(Programmable Logic Controllers (PLC), Supervisory Control and Data Acquisition System (SCADA) and Distributed Control System (DCS))**	3	**0**	**0**	**3**

COURSE OBJECTIVES

- To provide fundamental knowledge about the computer networks.
- To give an introductory knowledge about PLC and the programming languages.
- To give adequate knowledge about the applications of PLC and SCADA.
- To give basic knowledge in the architecture and local control unit of distributed control system.
- To give adequate information in the interfaces used in DCS.

MODULE I **PROGRAMMABLE LOGIC CONTROLLER** **8**

Evolution of PLCs — Sequential and programmable controllers — PLC Architecture - Programming of PLC — relay logic — Ladder logic — Functional blocks programming, sequential function chart.

MODULE II **COMMUNICATION IN PLCS** **8**

Requirement of communication networks for PLC — connecting PLC to computer — Use of Embedded PC as PLC - PLC applications in Industrial Automation.

MODULE III **INTRODUCTION TO SCADA** 7

SCADA: Data acquisition system, evaluation of SCADA, communication technologies, monitoring and supervisory functions. Interfacing of PLC with SCADA. SCADA system components

MODULE IV **SCADA ARCHITECTURE** 7

Various SCADA Architectures, advantages and disadvantages of each system, SCADA Communication - wired and wireless methods and fiber optics, open standard communication protocols.

MODULE V DISTRIBUTED CONTROL SYSTEM 8

Introduction to DCS-Evolution, Architectures-Hybrid, centralized computer control, Generalized DCS. Architectures-Comparison, Local control unit, LCU-Configurations, Comparison, Process interfacing issues, Communication facilities.

MODULE VI INTERFACES IN DCS 7

Operator interfaces-Low level and High level operator interfaces, Operator displays, Engineering interfacing- Low level and High level engineering interfaces,Factors to be considered in selecting DCS

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. G.K.Mc-Millan, Process/Industrial Instrument and controls and handbook, Mc Graw Hill, New York, 1999.
2. Hughes T, Programmable Logic Controllers, ISA Press, 1989.
3. W. Bolton, “PLC”, Elsevier Newnes
4 John W. Webb Ronald & Areis “PLC”
5 Clarke, G., Reynders, D. and Wright, E., “Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems”, Newnes, 1st Edition, 2004.
6 Petrezeulla, Programmable Controllers, Mc-Graw Hill, 1989.
7 Michael P.Lucas, Distributed Control System, Van Nastrand Reinhold Company, New York,1986.

COURSE OUTCOME

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Basics of Computer networks, Ladder logic programming and SCADA.

L	T	P	C
3	0	0	3

PTEEB3212 POWER SYSTEM PROTECTION AND SWITCHGEAR

COURSE OBJECTIVES:

- To discuss the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system
- To understand the characteristics and functions of relays and protection schemes
- To understand the problems associated with circuit interruption by a circuit breaker**.**

MODULE I INTRODUCTION 8

Importance of Protective schemes for electrical apparatus and power system-Qualitative review of faults and fault currents – relay terminology - definitions – essential qualities of protection - CT's and PT's and their applications in protective schemes

MODULE II PROTECTION AGAINST OVER VOLTAGES AND NEUTRAL GROUNDING 8

Generation of Over Voltages in Power Systems.-Protection against Lightning Over Voltages –Shielding – Non metallic shielding methods : Valve type and Zinc-Oxide Lighting Arresters –– Impulse Ratio - Standard Impulse Test Wave - Volt-Time Characteristics - BIL - Insulation Coordination.

MODULE III OPERATING PRINCIPLES AND RELAY CHARACTERISTICS 8

Electromagnetic relays – overcurrent,directional and non-directional, distance, negative sequence, differential and under frequency relays – Introduction to static relays.

MODULE IV APPARATUS PROTECTION 8

Main considerations in apparatus protection – transformer, generator and motor protection – protection of bus bars. Transmission line protection – zones of protection.

Module V THEORY OF CIRCUIT INTERRUPTION 8

Physics of arc phenomena and arc interruption – DC and AC circuit breaking – restriking voltage and

recovery voltage – rate of rise of recovery voltage – resistance switching – current chopping – interruption of capacitive current

Module VI CIRCUIT BREAKERS 8

Types of circuit breakers – air blast, air break, oil, SF_6 and vacuum circuit breakers – comparative merits of different circuit breakers – testing of circuit breakers**.**

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL: 45 Hours

REFERENCES:

1. Ravinranath.B and Chander.N, " PowerSystem Protection and Switchgear", New Age International (P) Publishers,1977 (2005 Reprint).
2. Chakrabarti.A.Soni.M.L Gupta,P.V."A Text book on Power System Engineering",Dhanpat Co. Pvt. Ltd.,2008.
3. C.L.Wadhwa,;Electrical Power Systems:,New Age International Pvt. Ltd. Publishers,2006
4. Patra S.Basu S.K & Choudary.S,"Power System Protection",Oxford and IBH Publishing Co. Ltd.,1983.
5. Sunil S.Rao,"Switch Gear and Protection", Khanna Publishers,New Delhi,1986.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Analyse the fault level and accordingly design the protective devices in a power system for power frequency voltages and currents.
- Ability to design insulation co – ordination between protected equipments and protective devices so that major equipment are protected against surges.

		L	T	P	C
PTEEB3213	**EVOLUTIONARY COMPUTING**	3	**0**	**0**	**3**

COURSE OBJECTIVES

- To expose the students to the concepts of feed forward neural networks.
- To provide adequate knowledge about feedback neural networks.
- To teach about the concept of fuzziness involved in various systems. To provide adequate knowledge about fuzzy set theory.
- To provide comprehensive knowledge of fuzzy logic control and its application to real time systems.
- To expose the ideas of GA and EP in optimization and control.

MODULE I FUNDAMENTALS OF ARTIFICIAL NEURAL NETWORKS 9

Objectives , history, biological inspiration, neuron model, McCulloch-Pitts neuron model, single-input neuron, multi-input neuron, network architectures, perceptron architecture, single-neuron perceptron, multi-neuron perceptron, perceptron learning rule, constructing learning rules, training multiple-neuron perceptrons.

MODULE II ASSOCIATIVE NETWORKS 9

Simple associative networks, auto-associative and hetero-associative nets, learning in neural nets, supervised and unsupervised learning, unsupervised hebb rule, kohonen rule, ADALINE and MADALINE network , back propagation neural networks , hopfield networks, adaptive networks, applications.

MODULE III FUZZY SET THEORY 6

Fuzzy versus crisp, crisp sets, fuzzy sets, operations and properties , membership function , crisp relations ,fuzzy relations .

MODULE IV FUZZY SYSTEMS 6

Crisp logic – fuzzy logic – fuzzy rule based system- defuzzification methods – applications – Greg Viot's fuzzy cruise controller - fuzzy logic control for LFC.

MODULE V FUNDAMENTALS OF GENETIC ALGORITHMS 7

Genetic algorithms, history, basic concepts, working principle, encoding ,fitness function, reproduction .

MODULE VI GENETIC MODELING AND APPLICATIONS 8

Genetic operators, cross over types, mutation operator, coding steps of GA, convergence characteristics, applications of AI techniques, load forecasting , load flow studies.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Laurance Fausett, Englewood cliffs, N.J., 'Fundamentals of Neural Networks',Pearson Education, 1992.
2. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Tata McGraw Hill,1997.
3. David Goldberg, "Genetic Algorithms and Machine learning", PHI
4 Wassermann, P. D. "Neural Computing" Van Reinhold, 1988.
5 Zimmermann, H. J., 'Fuzzy Set Theory and Its Applications', 2nd Edition,Kluwer Academic Publishers.
6 Martin T. Hogan , Howard B.Demuth. M,'Neural network design'4th edition
7 Zureda, J.M.,'Introduction to Artificial Neural Systems', Jaico publishing house Bombay, 1994.
8. Bose N.K, Liang P. 'Neural Network Fundamentals with graphs, Algorithms and applications', TMH Pub. Co. Ltd, 2001.
9. Neural Networks, Fuzzy logic and Genetic algorithms Synthesis and Applications by S.Rajasekaran, G.A.Vijayalaksmi Pai, PHI private learning ltd.New Delhi, 2011.

COURSE OUTCOME

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Design suitable neural networks, fuzzy systems, genetic representations with appropriate fitness functions for simple problems
- Know the key issues in using these techniques for search of difficult search-spaces
- Be aware of the different approaches and different applications in the field.

PTSSB3282 LAW FOR ENGINEERS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To familiarize with Indian Constitution and Governance of our country.
- To apprise on human rights, local and International and redressal mechanism.
- To provide important aspect of corporate laws
- To give an introduction of important industrial and labour laws of our country.
- To provide an exposure on laws on contracting and arbitration.
- To give an overview on intellectual property related laws.

MODULE I INDIAN CONSTITUTION 7

Constitution – meaning and history – making of constitution – salient features, preamble, Citizenship, Fundamental rights, Fundamental duties, Equality and social justice, Directive principles, Constitutional amendments.

MODULE II GOVERNANCE AND POWERS VESTED 7

Union executive, Legislature – Union – State and union territories, Union and state relations, powers vested with parliament and state legislature, emergency provisions - People's Representations Act – Election Commission – Election for parliament and state legislature, Judiciary.

MODULE III HUMAN RIGHTS 7

Human rights – meaning and significance, International law on human rights, Covenant on civil and political rights; Covenant on Economic, social and cultural rights – protocol, UN mechanism and agencies, watch on human rights and enforcement – role of judiciary and commission, Right to information Act 2005 – evolution – concept – practice.

MODULE IV CORPORATE AND LABOUR LAWS 7

Corporate laws – meaning and scope – laws relating to companies, Companies Act 1956 – collaboration agreement for Technology transfer, Corporate liability – Civil and criminal – Industrial employment (standing orders) Act 1946, Industrial Disputes Act, 1947, Workmen's Compensation Act 1923, The

Factories Act, 1948 – Industry related other specific laws.

MODULE V CONTRACTS AND ARBITRATION 9

Types of contract – standard form of contracts - General principles under Indian Contract Act, 1872 – protection against exploitation – judicial approach to contracts, Arbitration and conciliation – meaning, scope and types, model law, judicial intervention, international commercial arbitration – arbitration agreement, arbitration tribunal – powers and jurisdiction, enforcement and revision, Geneva Convention, Awards, Confidentiality.

MODULEVI LAWS RELATED TO IPR 8

IPR – Meaning and scope, International Convention – Berne and Parrys Conventions, International organization – WIPO – TRIPS, Major Indian IPR Acts – Copyright laws, Patent and Design Act, Trademarks Act, Trade Secret Act, Geographical Indicator, Securing of International patents.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Jain M.P, Indian Constitutional Law, Wadhwa & Co., (2005)
2. Subhash G. & Kashyap, Our Constitution : An introduction to India's Constitution and Constitutional Law, National Book Trust, 3rd edn., India (2001)
3. Agarwal H.D., International Law and Human Rights, Central Law Publications, (2008).
4. Meena Rao, Fundamental Concepts in Law of Contract, 3rd edn., Professional offset, (2006).
5. Ramappa, Intellectual Property Rights Law in India, Asia Law House (2010)
6. Avtar Singh, Company Law, Eastern Book Co., (2007).
7. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House.
8. Acts : Right to Information Act, Industrial Employees (standing order) Act, Factories Act, Workmen Compensate Act.

PTEI3282 PLC, SCADA & DCS LAB

L	T	P	C
0	**0**	**2**	**1**

COURSE OBJECTIVES:

- To know fundamentals of PLC and DCS and its Programming.
- To provide hands on experience with industrial PLC and DCS.
- To know Hardware structure of PLC and DCS.
- To have an exposure to basics concepts of SCADA.

LIST OF EXPERIMENTS

1. Development of Ladder program for simple on-off applications.
2. Development of Ladder program for Timing and counting applications.
3. Configuring Screens and Graphics (DCS).
4. Programming of HMI interfacing with PLC.
5. Develop simulate programming using FBD in Delta –V.
6. Tag Assignments to Field Devices in DCS.
7. DCS based PID control for temperature loop.
8. DCS based PID control for level loop.
9. DCS based PID control for pressure loop.
10. Communicate PLC with SCADA & DCS.

LECTURE HOURS: 0	TUTORIAL HOURS: 0	PRACTICE HOURS: 30	**TOTAL: 30Hours**

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Appropriate knowledge and skills in Industrial automation systems with the use of DCS, PLCs, and SCADA.
- An appropriate mastery of knowledge, techniques, skills and modern tools of their disciplines.
- an ability to apply current knowledge and adapt to engineering applications of mathematics, science, engineering and technology.
- an ability to conduct, analyze and interpret experiments and apply experimental results to improve processes,
- an ability to apply creativity in design of systems, components or processes appropriate to program objectives.

PTEEB3214 MINI PROJECT

L	T	P	C
0	0	8	4

- The objective of project work is to enable the students, to work in convenient groups,on a project involving some design and fabrication work or theoretical and experimental studies related to the respective engineering discipline. Every project work shall have a supervisor who is a member of the faculty.
- The mini project work will be carried out in the sixth semester and the main project work will be carried out in the seventh semester.
- For this important activity time shall be utilized by the students to receive directions from the supervisor, on library reading, laboratory work, computer analysis, or field work as assigned by the guide and also to present in periodical seminars or viva to review the progress made in the project.
- Each student shall finally produce a comprehensive report covering, background information, Literature – Survey, problem statement, project work details, estimation of cost and conclusions. This final report shall be in typewritten form as specified in the guidelines.
- The continuous assessment and semester evaluation is to be carried out as specified in the guidelines to be issued from time to time.
- A total of eight periods per week shall be allotted for this activity in Mini Project. Project work/ thesis / dissertation shall be carried out under the supervision of a qualified faculty in the Department. A project report regarding the progress of the work shall be submitted to the Head of the Department at the end of the semester. Evaluation of the project progress shall be done by an internal panel of faculty members.

SEMESTER VII

		L	T	P	C
PTEEB4101	**GENERATION, QUALITY & CONSERVATION OF ELECTRICAL ENERGY**	3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To have a general discussion on various types of conventional & non-conventional power generating stations and its various economic aspects.
- To impart knowledge on electrical energy conservation, energy auditing and power quality.
- To study about the principle and design of illumination systems and methods of heating.
- To expose students to the main aspects of Electric traction systems and their performance.

MODULE I POWER GENERATION 7

Generating Station: Schematic arrangement: Thermal Power Station - Hydroelectric power station - Nuclear power station - Comparison of the various power stations.

MODULE II RENEWABLE & NEW ENERGY SOURCES 7

Solar power plant - Hydrogen energy cycle - Principle of MHD generation, open and closed cycle MHD system - Wind energy system - Tidal power schemes - Energy from bio-mass – Ocean thermal energy.

MODULE III ECONOMICS OF POWER GENERATION 7

Load curve: Important terms and factors - Load duration curve - Base load and peak load - Cost of electrical energy – Tariff: Types of Tariff, Desirable Characteristics of Tariff- Importance of electrical energy: Conservation methods, Energy efficient equipments - Introduction to energy auditing.

MODULE IV ILLUMINATION & HEATING 8

Photometry, Definitions – Design of illumination systems (for residential, industrial, commercial, residential) – Types of lamps – Role electric heating for industrial applications - Methods of heating - Requirement and design of heating material.

MODULE V ELECTRIC TRACTION 8

Introduction – Requirements of ideal traction systems – Classification - Mechanics of train movement – Traction motors and control - Energy efficiency drives - Advanced speed control measures - Recent trends in electrical traction.

MODULE VI INTRODUCTION TO POWER QUALITY 7

Terms and definitions: Under voltage – Interruptions - Sags and swells - Waveform distortion - Total Harmonic Distortion (THD) - Computer Business Equipment Manufacturers Associations (CBEMA) curve - Voltage and current distortion - Locating harmonic sources - Devices for controlling harmonic distortion - Passive filters - Active filters - IEEE and IEC standards.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL: 45 Hours

REFERENCES:

1. Philip Kiameh, 'Power Generation Handbook' Second Edition, Tata McGraw Hill Publishing Company Ltd. New Delhi, March 2013.

2 Ramesh C. Bansal & Ahmed Faheem Zobaa, 'Handbook of Renewable Energy Technology', World Scientific, 2011.

3 S. Sukhatme, J Nayak, 'Solar Energy: Principles of Thermal Collection and Storage' Third edition, McGraw Hill Publishing Company Ltd. New Delhi, June 2008.

4 Roger C. Dugan, Mark F. McGranaghan, Surya Santoso, H. Wayne Beaty, 'Electrical Power Systems Quality', Third Edition, McGraw Hill Publishing Company Ltd. New Delhi, June 2012.

5 AT Dover, "Electric Traction", Pitman

6 L. W. Gant, 'Elements of Electric Traction', BiblioLife , 15-May-2009 .

COURSE OUTCOME :

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

- Various power generation techniques in India and the economic aspects of power generation.
- Methods of electrical energy conservation, energy auditing and power quality.
- Principle and design of illumination systems and heating methods.
- Performance and application of electric traction.

L	T	P	C
3	0	0	3

PTEEB4102 HIGH VOLTAGE ENGINEERING

COURSE OBJECTIVES:

This course Imparts a detailed knowledge on:

- Breakdown in gaseous, liquids and solid dielectrics.
- Generation and measurement of High voltages and currents.
- Different High voltage testing methods.

MODULE I **OVER VOLTAGE PHENOMENON AND INSULATION CO-ORDINATION** 8

Natural causes for over voltages – Lightning phenomenon, Overvoltage due to switching surges, system faults and other abnormal conditions, Principles of Insulation Coordination on High voltage and Extra High Voltage power systems.

MODULE II **BREAK DOWN IN GASEOUS AND LIQUID DIELECTRICS** 7

Gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law - Streamer theory-Breakdown in non uniform fields and corona discharges. Liquid as Insulator, pure and commercial liquids, breakdown in pure and commercial liquids.

MODULE III **BREAK DOWN IN SOLID DIELECTRICS** 8

Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, Breakdown in composite dielectrics, Solid dielectrics used in practice.

MODULE IV **GENERATION OF HIGH VOLTAGES AND CURRENTS** 8

Generation of High Direct Current Voltages, Generation of High alternating voltages, Generation of Impulse Voltages, Generation of Impulse currents, Triggering and control of impulse generators.

Module V **MEASUREMENT OF HIGH VOLTAGES AND CURRENTS** 7

Measurement of High DC,AC and impulse voltages, Measurement of High DC,AC and impulse currents, Digital techniques in high voltage measurements.

Module VI **HIGH VOLTAGE TESTING** 8

High voltage testing of Transformers, Insulators and bushings, cables ,Isolators and circuit breakers, surge Arresters- Radio Interference measurements.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL: 45 Hours

REFERENCES:

1. High Voltage Engineering by C.L.Wadhwa, New Age Internationals (P) Limited, 1997.
2. High Voltage Insulation Engineering by Ravindra Arora, Wolfgang Mosch, New Age International (P) Limited, 1995.
3. High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications, 3rd Edition
4. High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl, J.Kuffel by Elsevier, 2nd Edition.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Knowledge of the electrical properties of various gaseous,liquid and solid insulating materials.
- Generation of high DC,AC and impulse voltage measurement.
- High voltage testing of various equipments used in power systems.

PTEEB4103 **PROJECT WORK**

L	T	P	C
0	0	16	8

- The objective of project work is to enable the students, to work in convenient groups,on a project involving some design and fabrication work or theoretical and experimental studies related to the respective engineering discipline. Every project work shall have a supervisor who is a member of the faculty.
- The mini project work will be carried out in the sixth semester and the main project work will be carried out in the seventh semester.
- For this important activity time shall be utilized by the students to receive directions from the supervisor, on library reading, laboratory work, computer analysis, or field work as assigned by the guide and also to present in periodical seminars or viva to review the progress made in the project.
- Each student shall finally produce a comprehensive report covering, background information, Literature – Survey, problem statement, project work details, estimation of cost and conclusions. This final report shall be in typewritten form as specified in the guidelines.
- The continuous assessment and semester evaluation is to be carried out as specified in the guidelines to be issued from time to time.
- A total of eight periods per week shall be allotted for this activity in Mini Project. Project work/ thesis / dissertation shall be carried out under the supervision of a qualified faculty in the Department. A project report regarding the progress of the work shall be submitted to the Head of the Department at the end of the semester. Evaluation of the project progress shall be done by an internal panel of faculty members.

PROFESSIONAL ELECTIVES (PE)

Professional Electives Category

1. Power System
2. Power Electronics & Drives
3. High Voltage Engineering
4. Electronics, Communication & Instrumentation
5. Computer Science & Information Technology

POWER SYSTEM

		L	T	P	C
PTEEBX01	**POWER DISTRIBUTION SYSTEM**	3	0	0	3

COURSE OBJECTIVES:

To impart knowledge on

- The importance of the design of distribution systems
- Various components of the distribution systems
- The methods of analysis of distribution systems
- Protection of the distribution systems
- Concepts of demand side management

MODULE - I **INTRODUCTION TO DISTRIBUTION SYSTEMS** 7

General: Introduction to distribution system, an overview of the role of computers in distribution system planning. Load modeling 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.

MODULE - II **DISTRIBUTION FEEDERS** 7

Design consideration of Distribution feeders: Radial and loop types of primary feeders - voltage levels - feeder loading.

MODULE III **Substations and Grounding System** 8

Types of substations - Design considerations of the secondary distribution system: Bus-bar arrangements - Substation bus schemes - Location of substations - Rating of a distribution substation - Service area with primary feeder - Benefits derived through optimal location of substations. Resistance of grounding systems: Resistance of driven rods, resistance of grounding point electrode - Grounding grids - Design principles of substation grounding system - Neutral grounding.

MODULE – IV **DISTRIBUTION SYSTEM ANALYSIS** 8

Voltage drop and power loss calculations: Derivation for volt-drop and power loss in lines - Manual methods of solution for radial networks - Three-phase balanced primary lines - Non-three-phase primary lines.

MODULE – V **PROTECTIVE DEVICES AND COORDINATION** 8

Objectives of distribution system protection - Types of common faults and procedure for fault calculation. Protective devices: Principle of operation of fuses, circuit reclosers, line sectionalizer and circuit breakers. Coordination of protective devices: General coordination procedure

MODULE – VI **CONCEPTS AND METHODS OF DSM, LOAD CONTROL** **7**

Load control - Energy efficiency - Load management - DSM planning, design, marketing, impact assessment - Direct, distributed and local control – Interruptible load - Configuration of control system for load control - Assessment of impact on load shape.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL:45 HOURS

REFERENCES:

1 Turan Gonen, 'Electric Power Distribution System Engineering', Mc.Graw-Hill Book Company,1986.

2 A.S.Pabla, 'Electric Power Distribution', Tata Mc Graw-Hill Publishing Company, 5th edition, 2003.

3 V.Kamaraju, 'Electrical Power Distribution Systems', Tata Mc Graw Hill publication, 2009.

4 S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, 2002.

5 Luces M.Fualkenberry ,Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 1996.

6 Hadi Saadat, 'Power System Analysis,' Tata McGraw Hill Publishing Company', 2003

7 Gellings, C.W. and Chamberlin, J. H., 'Demand-Side Management: Concepts & Methods', Firmont Press, 1993.

8 Gellings, C.W. and Chamberlin, J. H., 'Demand-Side Management Planning', Firmont Press, 1993.

9 B.R.Gupta, 'Power System Analysis and Design', S.Chand, New Delhi, 2003.

COURSE OUTCOME:

At the end of the course, the Students are expected to possess knowledge and achieve skills on following:

- Various components of the distribution systems
- The parameters to be analyzed for an effective distribution system design
- The importance of Demand side management

L	T	P	C
3	0	0	3

PTEEBX02 POWER SYSTEM PLANNING AND RELIABILITY

COURSE OBJECTIVES:

To impart knowledge on:

- Load forecasting in power systems
- Basic probability theory and concepts of reliability analysis
- Factors influencing the reliability of generation systems, transmission systems and distribution systems
- Expansion planning

MODULE I INTRODUCTION TO POWER SYSTEMS AND LOAD FORECASTING 8

A perspective: brief introduction to structure of power systems, growth of power system in India, present Indian power industry, GRID formation, concept of National GRID.

Objectives of forecasting - Load growth patterns and their importance in planning - Load forecasting based on discounted multiple regression technique - Weather sensitive load forecasting - Determination of annual forecasting - Use of AI in load forecasting

MODULE II INTRODUCTION TO RELIABILITY ANALYSIS 7

Review of probability distribution, binomial distribution and exponential distribution – Network modeling and evaluation of simple and complex systems – System reliability evaluation using probability distributions – Frequency and duration techniques. Reliability concepts: Meantime to failure – Series and parallel systems – MARKOV process – Recursive technique.

MODULE III GENERATION SYSTEM RELIABILITY ANALYSIS 8

Probabilistic generation and load models - Determination of reliability of isolated and interconnected generation systems – Energy transfer and off peak loading.

MODULE IV TRANSMISSION SYSTEM RELIABILITY ANALYSIS 8

Deterministic contingency analysis - Probabilistic load flow - Fuzzy load flow - Probabilistic transmission system reliability analysis - Determination of reliability indices like LOLP and expected value of demand not served.

Module V EXPANSION PLANNING 7

Basic concepts on expansion planning - Procedure followed to integrate transmission system planning, current practice in India - Capacitor placement problems in transmission systems and radial distribution systems.

Module VI DISTRIBUTION SYSTEM PLANNING AND RELIABILITY 8

Introduction, sub transmission lines and distribution substations - Design primary and secondary systems - Distribution system protection and coordination of protective devices. Distribution system reliability evaluation: Reliability analysis of radial systems with perfect and imperfect switching.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1 R.L .Sullivan, "Power System Planning", Heber Hill, 1987.

2 Roy Billington, 'Power System Reliability Evaluation', Gordan & Breach Scain Publishers, 1990.

3 A.S.Pabla, 'Electric Power Distribution', Tata Mc Graw-Hill Publishing Company, 5th edition, 2003.

4 Turen Gonen, "Electric Power Distribution System Engineering", McGraw Hill, 1986.

5 Turen Gonen, "Electric Power Transmission System Engineering Analysis and Design", McGraw Hill, 2nd Edition, 2010.

6 Eodrenyi, J., 'Reliability Modelling in Electric Power System', John Wiley, 1980.

7 B.R. Gupta, "Power Sytem Analysis and Design", S.Chand, New Delhi, 2003.

COURSE OUTCOME:

At the end of the course, the Students are expected to possess knowledge and achieve skills on following:

- Familiarity with load forecasting techniques
- Familiarity with reliability analysis techniques
- Expansion planning of power systems.

PTEEBX03 EHV AC AND DC TRANSMISSION ENGINEERING

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES

- To provide an in depth understanding of the different aspects of Extra High Voltage AC and DC transmission system analysis and design

MODULE I INTRODUCTION 8

Need of EHV transmission-standard transmission voltages-comparison of EHV AC and HVDC transmission systems and their applications & limitations- surface voltage gradients in conductor-distribution of voltage gradients on sub-conductors- mechanical considerations of transmission lines-modern trends in EHV AC and HVDC transmission

MODULE II PARAMETERS OF EHV LINES 8

Resistance of conductors- bundle conductors-inductance of EHV Line configurations line capacitance-sequence inductance and capacitance- line parameters for modes of propagation- resistance and Inductance of ground returns.

MODULE III EHV AC TRANSMISSION 7

Corona loss formulas- corona current- audible noise – generation and characteristics corona pulses their generation and properties- radio interference (RI) effects- over voltage due to switching- ferroresonance-reduction of switching surges on EHV system.

MODULE IV EXTRA HIGH VOLTAGE TESTING AND DESIGN OF EHV LINES 6

Characteristics and generation of impulse voltage -generation of high AC and DC voltages- measurement of high voltages by sphere gaps and potential dividers- Consideration for Design of EHV Lines: Design factors under steady state limits- EHV line insulation design based upon transient over voltages-Effects of pollution on performance of EHV lines.

MODULE V HVDC TRANSMISSION 7

Types of dc links- converter station-choice of converter configuration and pulse number- effect of source inductance on operation of converters- Principle of dc link control- converter controls characteristics- firing angle control- current and excitation angle control- power control-starting and stopping of dc link.

MODULE VI CONTROL AND PROTECTION OF HVDC LINE 8

Converter faults- protection against over currents and over voltages-smoothing reactors-generation of harmonics-ac and dc filters- Multi Terminal DC systems (MTDC): Types, control- protection and applications-control of HVDC system desired features of control-control characteristics

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering" Revised Second Edition, John Wiley.
2. K.R. Padiyar, "HVDC Power Transmission System", Second revised Edition, New Age Int. 2012
3. S. Rao, "EHV-AC and HV DC Transmission Engineering Practice", Khanna Publishers.
4. Arrillaga J "High Voltage Direct current Transmission" 2nd Edition (London) Peter Peregrinus, IEEE.
5. Hingorani HG and Gyugyi L "Understanding FACTS-concepts and Technology of Flexible AC Transmissions Systems" New York, IEEE Press,2010
6. Padiyar K R "FACTS controllers in Power Transmission and distribution" New Delhi, New Age Int. publishers.
7. Clayton R.Paul," Analysis of multi-conductor transmission lines", Wiley publication.

COURSE OUTCOME

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Design commercial transmission systems.

PTEEBX04 POWER SYSTEM DYNAMICS

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES

- To model and analyze the dynamics of power system with synchronous machines, turbines and various controllers.
- To analyze the small signal and large signal disturbances and to design the system with enhanced stability.

MODULE I INTRODUCTION 3

Concepts and importance of stability in power system operation and design-Basic concepts and definition-Classification of power system stability-complexity of stability problem in large system-Need for reduced models-stability of interconnected systems.

MODULE II SYNCHRONOUS MACHINE MODELLING 8

Physical description-Park's transformation :flux linkage equations ,voltage equation and torque equation-per unit conversion-normalizing the equation-equivalent circuit-flux linkage state space model with transient and sub transient inductances and time constants- Simplified models(one axis and constant flux linkage),steady state equations and pharsor equation.

MODULE III MODELLING OF EXCITATION AND SPEED GOVERNING SYSTEMS 8

Excitation system requirements-Elements of Excitation system-Types of Excitation system-Typical excitation system configuration-block diagram and state space representation of IEEE type 1 excitation system-saturation function-stabilizing circuit. Function of speed governing systems-block diagram and state space representation of IEEE steam turbine and hydraulic governor**.**

MODULE IV TRANSIENT STABILTY 8

State equation for multimachine –transient stability simulation of multimachine power system with one axis machine model including excitation system and speed governing system using R-K method of fourth order(Gill's Technique),Power system stabilizer**.**

MODULE V SMALL SIGNAL STABILTY 8

System response to small disturbance –Linear model of the synchronous machine and load -modes of oscillation-effect of excitation on dynamic stability-approximation system representation-supplementary stabilizing signals-small signal performance measures**.**

MODULE VI ENHANCEMENT OF SMALL SIGNAL STABILITY AND TRANSIENT STABILITY 5

Methods of enhancing transient stability –methods based on reduction of disturbance severity-methods by increasing synchronizing forces-methods of enhancing small signal stability-Power system stabilizers-delta-omega stabilizer.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. P.Kundur," Power System Stability and Control",Mc Graw-Hill ,1993.
2. IEEE Committee Report, "Dynamic Models for steam and Hydro turbines in power system studies,"IEEE trans.Vol PAS -92,pp 1904-1915,Nov/Dec 1973 on turbine Governor Model.
3. P.M.Anderson and A.A Fouad,"Power System Control and stability,"Lowa State university Press, Ames,lowa,1978.
4. R.Ramanujam,Power system dynamics , Analysis and simulation, Prentice Hall India Learning Pvt.Ltd.,New Delhi,2009.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Ability to model a synchronous machine and its controllers for dynamics studies.
- Ability to analyze small signal and transient stability of power system.
- Understanding the methods to enhance the small signal stability and transient stability.

PTEEBX05 POWER SYSTEM TRANSIENTS

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES

- To identify and analyze the cause of surges and their propagation and their effect on power system components.
- To understand & distinguish between power frequency and surge voltages and currents and accordingly model the power system components for analysis.

MODULE I 3

Types of power system transients – modeling of lines for surges and power frequency over voltages – effect of transients & power system components – importance of study of transients in planning.

MODULE II 8

Lightning phenomenon: charge formation in clouds, rate of charging of thunder clouds, mechanism of lightning strokes, characteristic of lightning strokes - protection against lightning over voltage by shielding &non shielding methods

MODULE III 8

Circuit closing transients in RL and RLC circuits with sinusoidal excitation to simulate faults – circuit breaker restriking and recovery voltage – double frequency transients.

MODULE IV 8

Generation of system over voltages - current chopping – reclosing circuit breaker and compound transients – control of switching over voltages

MODULE V 8

Wave equations and its solution- travelling voltage and current waves: velocity, attenuation and distortion- reflection,refraction of travelling waves – behaviour at line termination multiple reflections – Lattice diagram.

MODULE VI 5

Over voltage on integrated power system and its simulation and analysis using EMTP.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Interscience, NewYork, 2nd edition,1991
2. R.D. Begamudre,'Extra High Voltage AC Transmission Engineering',Wiley Eastern Limited,1986
3. Pritidra Choudary, 'Electromagnetic Transients in Power System',John Wiley and sons Inc,1996.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Familiarity with transient disturbance on power system
- Ability to design protection schemes for power frequency, lightning and surges

PTEEBX06 SMART POWER GRID

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES

- To introduce the fundamentals of smart grid and associated Information Technology services.
- To introduce the modeling of devices associated with smart grid.
- To familiarize about the concept of wide area measuring systems (WAMS) and Phasor Measurement units.

MODULE I RECENT TRENDS IN INFORMATION AND COMMUNICATION TECHNOLOGIES 9

Distributed services - Web services – Creation and deployment – Application development frameworks – XML – RPC-AXIS- SOAP - Communication models - Service oriented architecture fundamentals.

MODULE II SMART GRID FUNDAMENTALS 8

Smart grid structure – Interactive grid – Micro grid – Distributed resources modeling – Communication Infrastructure – Sensing and control devices – Smart grid characteristics.

MODULE III COMPONENTS AND STANDARDS 8

Smart grid components – Metering - Virtual power plants – Benefits and cost elements - Pricing regulations – Networking Standards and integration – Analytics .

MODULE IV AUTOMATION TECHNOLOGIES 8

Control centre systems – Data management principles – Smart Grid implementation standards and procedure – Operational Issues – Modelling and control – Advanced metering infrastructure – Outage management – Distribution and substation automation – Customer interactions.

MODULE V CASE STUDY I 8

Smart meters – Smart grid experimentation plan for load forecasting – Optimal placement of Phasor Measurement Units (PMU) .

MODULE VI CASE STUDY II 5

Coordination between cloud computing and smart power grids- Development of power system models and control and communication software.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Tony Flick and Justin Morehouse , " Securing the Smart Grid – Next Generation Power Grid Security" , Elsevier Publications , 2011.
2. Ali Keyhani- "Design of Smart Power Grid Renewable Energy Systems ", First Edition **,** John Wiley Inc. , 2011.

COURSE OUTCOME:

At the end of the course the student is expected to possess knowledge and achieve skills on the following :

- Ability to design and implement Smart Grid Power Systems independently .
- Ability to use Software for Load Forecasting with special reference to Smart Grids .

PTEEBX07 WIND ENERGY CONVERSION SYSTEMS

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES

- To understand the demand for electrical power generation from the renewable wind energy and fundamentals of wind power.
- To study and understand about the wind turbine components, power generation machinery, control systems.

MODULE I INTRODUCTION 9

Historical development and current status of Wind power-Generators and power electronics for wind turbines - Impacts of wind power-Wind speed estimation-Wind speed measurements-Rayleigh distribution-Maximum Power obtainable-Bertz limit-Power coefficient –Aerodynamics of wind rotor-Blade element theory-Aerodynamic efficiency-Wind energy conversion system components.

MODULE II WIND TURBINE 8

Types of Wind Turbine-Rotor design considerations-Tip speed ratio-Blade profile-Power regulation-Yaw control –Pitch angle control-Stall control-Schemes for maximum power extraction.

MODULE III FIXED SPEED AND VARIABLE SPEED SYSTEMS 8

Fixed speed and variable speed wind turbine- Need of variable speed systems-Power-wind speed characteristics-Generation schemes with fixed and variable speed turbines-Comparison of different schemes.

MODULE IV MODELING AND SIMULATION OF FIXED SPEED AND VARIABLE SPEED WIND GENERATORS 8

Modeling of fixed speed Induction generator-axes transformation-flux linkage equations-voltage equations-state equations-modeling of variable speed DFIG for wind energy conversion systems-converter control system- transient stability simulation of fixed speed induction generator using EUROSTAG -Doubly Fed Induction Generator(DFIG) modeling - controller modelling - Modelling of DFIG in EUROSTAG - Transient stability simulation of power systems with induction generators using EUROSTAG.

MODULE V POWER ELECTRONICS IN WIND ENERGY CONVERSION SYSTEM 8

Induction generator-Controlled firing angle scheme with AC and DC side Capacitor-Scalar method-flux vector scheme-Control scheme for synchronous generator with variable speed drive**-**Variable speed synchronous generator control with boost converter.

MODULE VI GRID CONNECTED SYSTEMS 5

Stand alone and grid connected WECS system-Grid connection Issues- -Impacts of wind power on power system stability-wind plant reactive power capability and its requirements-voltage control and active power control -Storage technologies.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. S.N.Bhadra,D.Kasthra,S.Banerjee,"Wind Electrical Systems,"Oxford HigherEduction,2005.
2. Thomas Ackermann,"Wind Power in Power system,"Wiley 2012.
3 L.L.Freris "Wind Energy conversion Systems", Prentice Hall, 1990.
4 Jian Zhang, Adam Dysko, John O'Reilly, William E. Leithead," Modeling and performance of fixed-speed induction generators in power system oscillation stability studies", Electric Power System Research Vol. 78 (2008) 1416-1424.
5 Andre´s Feijoo, Jose Cidras, Camilo Carrillo, "A third order model for the doubly-fed induction machine", Electric Power Systems Research 56 (2000) 121-127.
6 Eurostag 4.3 Theory Manual Part I.
7 Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.
8 E.W.Golding "The generation of Electricity by wind power", Redwood burn Ltd., Trowbridge, 1976.
9 S.Heir "Grid Integration of WECS", Wiley 1998.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Understanding the fundamental concepts of wind power ,detailed model of the Wind Energy components and its control systems.
- Knowledge about the modeling of various wind generator and its dynamic behavior when integrate with grid.

PTEEBX08	FLEXIBLE AC TRANSMISSION SYSTEMS (FACTS)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the need for reactive power compensation in AC transmission system.
- To become familiar with modeling and operation of thyristor and voltage source inverter based FACTS controllers.
- To study the effect of FACTS controllers on AC transmission system.

MODULE I REACTIVE POWER CONTROL IN TRANSMISSION SYSTEM 9

Reactive power - uncompensated transmission lines - load compensation - system compensation - lossless distributed parameter lines -symmetrical lines - midpoint conditions of a symmetrical line case study - passive compensation - shunt compensation -series compensation effect on power-transfer capacity.

MODULE II CONVENTIONAL FACTS DEVICES 8

Types , definitions and representation of various FACTS controllers - synchronous Condensers - saturated Reactor (SR) - thyristor-controlled reactor (TCR) - operating characteristics of a TCR- fixed Capacitor–thyristor-controlled reactor (FC–TCR)- thyristor-switched capacitor (TSC)- thyristor-switched capacitor–thyristor-controlled reactor (TSC–TCR).

MODULE III STATIC VAR COMPENSATOR 8

Voltage Control - V-I characteristics of the SVC - dynamic Characteristics- steady-State characteristic advantages of the slope in the SVC dynamic characteristic influence of the SVC on system voltage.

MODULE IV THYRISTOR-CONTROLLED SERIES CAPACITOR (TCSC) 8

Fixed-series compensation - need for variable series compensation- advantages of the TCSC - TCSC controller- operation of the TCSC - modes of TCSC operation - capability characteristics - single-module TCSC- multi - module TCSC - variable-reactance model of TCSC.

MODULE V EMERGING FACTS CONTROLLERS 8

STATCOM : principle of operation - *V-I* characteristic - SSSC : principle of operation - UPFC : principle of operation

MODULE VI APPLICATIONS OF FACTS DEVICES 5

Increase in steady-state power-transfer capacity - enhancement of transient stability. -TCSC applications - applications of STATCOM , SSSC and UPFC

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Mohan Mathur.R., Rajiv. K.Varma, "Thyristor – Based Facts Controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons, Inc 2000.
2. Narain G. Hingorani, "Understanding FACTS -Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers Distributors, Delhi, 2001
3 A.T.John, "Flexible A.C. Transmission Systems", Institution of Electrical and Electronic Engineers (IEEE), 1999.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Derive basic mathematical models for FACTS components
- Design and analyze FACTS
- Analyze the impact of these components on power system stability
- Perform calculations on different control strategies for these devices

PTEEBX09 INDUSTRIAL POWER SYSTEM ANALYSIS AND DESIGN	L	T	P	C
	3	0	0	3

COURSE OBJECTIVES

- To provides practical knowledge in the field of power system analysis and design for industrial applications.

MODULE I ELECTRICAL POWER SYSTEM BACKGROUND 7

Overview of power systems generation, transmission and distribution- utility-scale systems versus industrial power systems; utility restructuring and deregulation- smart grid.

MODULE II POWER SYSTEM STUDIES 9

Load flow – short circuits – protective coordination – arc flash hazard calculation – harmonic analysis – power system stability – simple calculation.

MODULE III TRANSMISSION LINE MODELING AND TRANSFORMER 8

Line configurations and physical parameters- lumped circuit equivalent models- Power flow formulation-solution techniques-decoupling- applications- Transformer – types – transformer for non linear loads – instrument transformers.

MODULE IV FAULTS AND SYSTEM PROTECTION 7

Symmetrical components- symmetrical and unsymmetrical faults- protection devices

MODULE V SWITCHGEAR CIRCUIT BREAKER- MOTOR CONTROL CENTRE 7

Switchgear : low voltage medium voltage – load interrupt switchgear – power fuse – medium and high voltage circuit breaker – SF_6 gas insulated switchgear – low and medium voltage motor control centre.

MODULE VI APPLICATION & PROTECTION OF MEDIUM VOLTAGE MOTORS 7

Introduction overview – load characteristics – squirrel cage induction motor – wound rotor induction motor – synchronous motor – electric motor for variable frequency drives – motor controllers and starting methods.

LECTURE TUTORIAL PRACTICE TOTAL: 45 Hours

HOURS: 45 HOURS: 0 HOURS: 0

REFERENCES:

1. J Duncan Glover, Power system analysis and design, Fouth edition, Thompson, USA
2. Arnold, C.P., Arrillaga, J. &Harker, B. J., Computer Modelling of Electrical Power Systems, John Wiley & Sons, 1983.
3 Davies, T., Protection of Industrial Power Systems, 2nd Ed., 1998.
4 Shoaib khan, Industrial Power Systems, CRC publication.
5 Elgerd, O. I., Electric Energy Systems Theory, 2nd Ed., McGraw-Hill, 1983.
6 Kusic, G., Computer-Aided Power Systems Analysis, 2nd Ed., CRC, 2008.
7 John J. Grainger andWilliam D. Stevenson, Jr., Power system analysis, McGraw-Hill, Inc,.
8 T. K. Nagsarkar and M.S.Sukhija, Power system analysis, Oxford University press.
9 PrabhaKundur, Power system stability and control, McGraw-Hill, Inc,.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Ability to model and predict the operation of power system components.
- Understand the environmental impacts of engineering design.

POWER ELECTRONICS & DRIVES

PTEEBX10 SPECIAL ELECTRICAL MACHINES

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES

To impart knowledge on

- Construction, principle of operation and performance of AC commutator motors.
- Construction, principle of operation, control and performance of Synchronous Reluctance, stepping and switched motors.
- Construction, principle of operation, emf and Torque speed characteristics of PM brushless and PM synchronous motors.

MODULE I **AC COMMUTATOR MOTORS** 6

Principle of operation - Equivalent circuit - Phasor diagram - Performance of Repulsion motor and Universal motor.

MODULE II **SWITCHED RELUCTANCE MOTORS** 8

Constructional features – Principle of operation – Torque prediction – Power controllers – Non-linear analysis – Microprocessor based control - Characteristics

MODULE III **STEPPING MOTORS** 8

Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Theory of torque predictions – Linear and non-linear analysis – Characteristics.

MODULE IV **PERMANENT MAGNET BRUSHLESS D.C. MOTORS** 8

Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations – Power controllers – Motor characteristics and control.

MODULE V **PERMANENT MAGNET SYNCHRONOUS MOTORS** 8

Principle of operation – EMF and torque equations – Reactance – Phasor diagram – Power controllers - Volt-ampere requirements – Torque speed characteristics - Microprocessor based control.

MODULE VI **SYNCHRONOUS RELUCTANCE MOTORS** 7

Constructional features – Types – Axial and radial air gap motors – Operating principle – Reluctance –

Phasor diagram - Characteristics – Vernier motor.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL: 45 Hours

REFERENCES:

1. Miller, T. J. E., 'Brushless Permanent Magnet and Reluctance Motor Drives´, ClarendonPress, 1989..
2. Taylor, E.O., 'The Performance and Design of AC Commutator Motors´, Sir Issac Pitmanand Sons, 1998.
3. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.
4. Kenjo, T., 'Stepping Motors and their Microprocessor Controls´, Clarendon Press, 19842. Naser, A. and Boldea. L., 'Linear Electric Motors: Theory Design and PracticalApplications´, Prentice Hall of India, 1987.
5. Murphy, J.M.D., 'Power Electronics Control of AC Drives´, Pergamon Press, 1988.4. Bose, B.K., 'Power Electronics and Variable Frequency Drives´, Prentice.
6. P.P. Aearnley, 'Stepping Motors – A Guide to Motor Theory and Practice', Peter Perengrinus, London, 1982.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following

- Ability to understand the operating principle and performance of AC commutator motors.
- Ability to understand the operating principle, control and performance of Synchronous Reluctance, stepping motors and switched reluctance motors.
- Understanding the problems associated with Emf and torque equations of PM Brushless and synchronous Motors.

PTEEBX11 COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES

To impart knowledge on

- Using electromagnetic field theory in understanding the modeling concepts of Electrical Apparatus.
- Applying Maxwell's equation to model Electrical Apparatus.
- Providing numerical solutions for the analysis of Electrical Apparatus, using finite element approach.

MODULE I INTRODUCTION 5

Conventional design methodology – computer aided design aspects – Advantages

MODULE II ELECTROMAGNETICS AND ELECTROSTATICS 5

Basic field equations – calculation of field distribution – flux linkages – voltage induced – inductance – capacitance - force / torque.

MODULE III CAD PACKAGES 8

Recent developments – preprocessing – modeling – boundary conditions – material characteristics – problem formulation – solution – post processing.

MODULE IV FINITE ELEMENT ANALYSIS 9

Mathematical formulation – discretisation – shape functions – stiffness matrix – solution techniques – post processing.

MODULE V DESIGN PRACTICALS - FUNDAMENTAL 8

Design of actuator – solenoid –Inductance - transformer

MODULE VI DESIGN PRACTICALS - MOTORS 10

Induction motor switched reluctance motor – stepper motor – P.M. machines

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Sheppard J.Salon ,'Finite Element Analysis of Electrical Machines' , Springer Edition 2009.
2. Nicola Bianchi , ' Electrical Machines Analysis Using Finite Elements ' Taylor & Francis group 2009.
3 P.P. Silvester and Ferrari, 'Finite Element for Electrical Engineers', Cambridge University Press, 1984.
4 D.A. Lowther and P.P. Silvester, 'Computer Aided Design in Magnetics',Springer Verlag, Newyork, 1986.
5 M.V.K. Chari and P.P. Silvester, "Finite Elements in Electric and Magnetic Field Problems", John Wiley, 1980.

COURSE OUTCOME:

At the end of the course, the Students are expected to possess knowledge and achieve skills on following:

- Ability to Model Electrical Apparatus
- To Provide Numerical solutions for FEA.

PTEEBX12 SOFTWARE FOR CIRCUIT SIMULATION

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES

- To gain the hands-on experience to simulate, verify, examine, and design electrical, mechanical and electronic circuits using electrical software such as PSPICE, MATLAB, MagNet and Lab View
- To possess the intuitive analysis skill to forecast / illustrate the circuit simulation results.

MODULE I INTRODUCTION 7

Importance of simulation – General purpose circuit analysis – programs – Method of analysis of power electronic systems – Review of modeling of power electronic components and systems - Future trends in computer simulation.

MODULE II PSPICE 8

Introduction – PSpice overview – DC circuit Analysis –AC circuit analysis – Transient and the time domain analysis – Fourier Series and Harmonic components – Modelling of devices like BJT, FET and MOSFET as amplifiers and oscillators and their analysis.

MODULE III MATLAB 7

Introduction - function description – Data types – Tool boxes – Graphical Display - Import and Export of data - programs for the solution of state equations.

MODULE IV MagNet 7

Introduction - 2D mesh adaption tools - 2D boundary conditions – Modelling and predicting the performance of any electromagnetic or electromechanical device such as Electric Motors / Generators and Transformers.

MODULE V LABVIEW 8

Introduction – Lab view concepts - Environment basics - Graphical programming basics - Common tools - Debugging tools.

MODULE VI DESIGN 7

Solve electrical and electronics circuits and systems by modeling in PSpice, Matlab, MagNet and labview.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Rajagopalan.V 'Computer aided analysis of power electronic systems' Marcell Dekker 1987.
2. Pspice for Circuit Theory and Electronic Devices Paul Tobin Morgan & Claypool publishers2007
3. John Keown 'Microsim Pspice and circuit analysis" Prentice hall Inc, 1998
4. Matlab / Simulink manual, Maths Work 2010.
5. http://www.infolytica.com/en/products/magnet/features.aspx#
6. Learning with lab view 2009 robert h. Bishop prentice hall, 14-dec-2009

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Basic concepts of simulation software tools and its applications
- Describe the techniques to model and solve the application problems.
- Apply modern simulation tools such as PSPICE – MATLAB – MagNet - Labview for the design, analyses, and performance evaluations of electrical and electronics circuits and systems.

PTEEBX13	FEA FOR ELECTRICAL ENGINEERS (Electromagnetic Field Computation and Modeling)	L 3	T 0	P 0	C 3

MODULE I **INTRODUCTION** 9

Review of basic field theory – electric and magnetic fields – Maxwell's equations – Laplace, Poisson and Helmoltz equations – principle of energy conversion – force/torque calculation – Electro thermal formulation.

MODULE II **SOLUTION OF FIELD EQUATIONS I** 8

Limitations of the conventional design procedure, need for the field analysis based design, problem definition , solution by analytical methods-direct integration method – variable separable method – method of images, solution by numerical methods- Finite Difference Method.

MODULE III **SOLUTION OF FIELD EQUATIONS II** 9

Finite element method (FEM) – Differential/ integral functions – Variational method – Energy minimization – Discretisation – Shape functions –Stiffness matrix –1D and 2D planar and axial symmetry problem

MODULE IV **FIELD COMPUTATION FOR BASIC CONFIGURATIONS** 7

Computation of electric and magnetic field intensities– Capacitance and Inductance – Force, Torque, Energy for basic configurations

MODULE V **BASIC EXERCISES IN FEA PACKAGES** 6

Modeling – Pre-processing – A vector and flux plot calculations – deriving pther quantities in Post-processing

MODULE VI **DESIGN APPLICATIONS** 6

Insulators- Bushings – Cylindrical magnetic actuators – Transformers – Rotating machines.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. K.J.Binns, P.J.Lawrenson, C.W Trowbridge, “The analytical and numerical solution of Electric and magnetic fields”, John Wiley & Sons, 1993.
2. Nathan Ida, Joao P.A.Bastos , “Electromagnetics and calculation of fields”, Springer- Verlage, 1992.
3 Nicola Biyanchi , “Electrical Machine analysis using Finite Elements”, Taylor and Francis Group, CRC Publishers, 2005.
4 S.J Salon, “Finite Element Analysis of Electrical Machines.” Kluwer Academic Publishers, Lor 1995, distributed by TBH Publishers & Distributors, Chennai, India
5 User manuals of MAGNET, MAXWELL & ANSYS software.
6 Silvester and Ferrari, “Finite Elements for Electrical Engineers” Cambridge University press, 1983.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

1. Ability to model electric systems in finite element analysis scenario.
2. Ability to calculate any electrical or magnetic parameter from the analysis and co-relate it.

PTEEBX14 CHOPPER CONTROLLED DC DRIVES

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To study and understand the operation of chopper controller from open loop and closed loop modules
- To introduce the design concepts of chopper drives
- To study and analyze the operation of the chopper fed DC drives
- To study of closed loop control of DC drives

MODULE I THYRISTOR FAMILY 7

SCR-symbol, working , characteristic, holding current, latching current, dv/dt, di/dt ratings, gate protection- Insulated gate bipolar transistor (IGBT) – MOSFET - Symbol, working and characteristics of DIAC, TRIAC, SUS, SCS, SBS, LASCR, and GTO – symbol, working and characteristics - specifications of the above power devices.

MODULE II BASICS OF CHOPPER 8

Introduction – applications – principle of chopper – control strategies (time ratio and current limit control)– Step down choppers Derivation of load voltage and currents with R, RL and RLE loads- Step up Chopper – load voltage expression Morgan' s chopper – Jones chopper and Oscillation chopper (Principle of operation only) Waveforms.

MODULE III CHOPPER TYPES 8

Types of chopper - type A, B, C, D, and E -step up chopper - Jones chopper - Morgan chopper Chopper using MOSFET - PWM Control circuit for driving MOSFET in chopper

MODULE IV CLOSED LOOP CONTROL -CHOPPER 8

Introduction Closed loop speed control - current and speed loops, P, PI and PID controllers - response comparison. Simulation of chopper fed D.C drive.

MODULE V DIGITAL CONTROL OF DC DRIVE 7

Closed loop control of dc drives – basic block diagram – Phase locked loop (PLL) control of dc drives – block diagram – microprocessor based closed loop control of DC drive – block diagram and working.

MODULE VI **CASE STUDY** 7

Simulation of chopper – open loop –closed loop – DC drives –Matlab- pspice Software

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Power Electronics – by Vedam Subramanyam, New Age International (P) Limited, Publishers 2000
2. Power Electronics - by V.R.Murthy , 1 edition -2005, OXFORD University Press
3 Power Electronics-by P.C.Sen,Tata Mc Graw-Hill Publishing.2006
4 Thyristorised Power Controllers – by G. K. Dubey, S. R. Doradra, A. Joshi and R. M. K. Sinha, New Age International (P) Limited Publishers, 1996.

COURSE OUTCOME:

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

- Ability to design a chopper controller for electrical application
- Knowledge in MATLAB tool box.
- Talent to improve the performance of power electronics application.

PTEEBX15	SOLID STATE AC & DC DRIVES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To study and understand the operation of electrical drives - D.C. motor drives, Induction motor drives, Synchronous motor drives.

To analyze the closed-loop control of both DC and AC drives.

To understand the differences between induction motor drives and synchronous motor drives.

MODULE I ELECTRIC MOTOR CHARACTERISTICS 7

Characteristics of DC motors, Induction motors, synchronous motors - Constant torque and constant HP operations – Four quadrant operations – Rating of motors- Selection of drives.

MODULE II CONVERTER FED DC DRIVES 8

Single phase semi and full converter fed drives – three phase semi and full converter fed drives – continuous and discontinuous modes – closed loop converter fed drives

MODULE III CHOPPER FED DC DRIVES 7

Operation of Class A, B, C, D, E chopper fed DC drives - four quadrant operations – closed loop chopper fed drives

MODULE IV STATOR CONTROLLED INDUCTION MOTOR DRIVES 7

AC voltage controller fed induction motor drive – VSI and CSI fed drives – closed loop stator controlled induction motor drives - Braking methods for induction motors

MODULE V ROTOR CONTROLLED INDUCTION MOTOR DRIVES 8

Rotor resistance control – slip power recovery scheme, Scherbius drive- sub synchronous operation, Kramers drive– super synchronous operation – closed loop rotor controlled drives

MODULE VI SYNCHRONOUS MOTOR DRIVES 8

Operation of wound field cylindrical and salient pole synchronous motor for constant voltage and constant frequency source – brushless excitation – closed loop self controlled synchronous motor drives

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Gopal K.Dubey : Power semiconductor controlled drives, Prentice Hall international 1989.
2. Vedam subramanyan, Thyristor Control of Electrical Drives, Tata McGraw-Hill Co.Ltd., (1988).
3 Murphy, J.M.D and Turnbull.F.G., 'Thyristor control of AC Motors', Pergamon Press, 1988.
4 B.K. Bose, 'Power Electronics and AC Drives', Prentice Hall Onglewood cliffs, New Jersey, 1986.
S.B. Dewan, Gordon R. Slemon and A. Straughen: Power Semiconductor Drives, John Wiley Pub.,1996

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Select the suitable drive for the required load characteristics.
- Understand the concept of Converter / Chopper control of DC motor drive.
- Gain adequate knowledge about induction motor and synchronous motor drives and various speed control methods.
- Design controllers for drives

PTEEBX16 CONVERTERS, APPLICATIONS & DESIGN

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To get an overview of different types of power semi-conductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers.
- To design & implement real time industrial application of Power Electronic equipments.
- To know the practical application for power electronics converters in conditioning the power supply.

MODULE I PROTECTION OF POWER ELECTRONIC DEVICES 7

SCR, Triac, MOSFET, IGBT - Protection Circuits - Snubber Circuits – Ratings - safe operating Area - Heat sink Design.

MODULE II DESIGN OF CONTROLLED CONVERTERS 8

Gate pulse generating circuits - conventional methods, gate pulse generation using microcontroller, gate drive circuits - Pulse Transformers - Opto Triacs, Synchronisation Circuits, fully controlled fed DC motor - Open loop, closed loop.

MODULE III DC-DC CONVERTERS 7

Half Bridge and Full Bridge Driver ICs for MOSFET and IGBT - Phase shifted series Resonant Converters - ZCS - ZVS, DC - DC Converter for Electric Vehicle.

MODULE IV PHASE CONTROLLERS 8

Photosensors, Temperature sensors, Micro controller Programming for phase angle control, Implementation of phase controller for illuminating lights & Electric furnace control using micro controller. Maximum power point trackers, Grid connected inverter, Implementation of converters for solar panel.

MODULE V SWITCHING POWER SUPPLIES 8

Design of PWM inverters, SPPWM inverters, Design and implementation of UPS and SMPS, Harmonic

analysis of inverters using Harmonic Analyser.

MODULE VI CASE STEADY 7

Mini Project Model – Hardware Fabrication –converter –DC-DC Converter - DC Drives

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. M.H. Rashid, "Power Electronics Handbook", Elsevier Press, 2003. Micro C Manual.
2. Power Electronics Design Handbook "Low-Power Components and Applications" By Nihal Kularatna.
3 Power Electronics Design : A Practitioner's Guide Keith H. Sueker.
4 International Rectifiers, Application note – Catlogue

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Practical exposure in DC-DC converter and control
- Knowledge in power control devises
- Experience to selection of converter for various application.
- Design controllers for drives

PTEEBX17	POWER ELECTRONICS APPLICATION TO RENEWABLE ENERGY SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide basic understanding of the emerging power electronics technologies to Renewable systems
- To enable students to design power electronics circuit that can control active and reactive power flow in grids
- To integrate theory and practical knowledge of power system protection

MODULE I OVERVIEW OF ENERGY CONVERSION AND RENEWABLE ENERGY SYSTEMS 7

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems- Block diagram.

MODULE II ELECTRICAL ENERGY CONVERSION SYSTEMS 8

Review of reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG - different conversion schemes- fixed and variable speed operation -drive selection-power control - braking systems - grid integration issues.

MODULE III POWER CONVERSION IN RENEWABLE SYSTEMS 8

Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- Inverters for high power applications: Multi-level Inverters, Analysis of their performance,Selection of inverter, Battery sizing, Array sizing,AC and DC harmonics, Interaction with power grid

MODULE IV ANALYSIS OF WIND SYSTEMS 8

Stand alone operation of fixed and variable speed wind energy conversion systems -electrical design - power collection systems - earthing- electrical protection - reactive VAR isues - compensators -remote monitoring and control - economic aspects.

MODULE V ANALYSIS OF PV SYSTEMS 8

Technical and non-technical considerations - system size and module choice - mounting systems and building integration- power conditioning system - lightning protection - earthing - metering Stand-alone systems: Modules-Batteries - charge controllers -sizing of PV arrays – applications.

MODULE VI HYBRID RENEWABLE ENERGY SYSTEMS 6

Need for Hybrid Systems- Range and type of Hybrid systems- micro wind systems and solar system- Grid integrated PMSG and SCIG Based WECS -Case studies.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Rashid .M. H "power electronics Hand book", Academic press, 2001. .
2. Rai. G.D, "Non conventional energy sources", Khanna publishes, 1993
3. Rai. G.D," Solar energy utilization", Khanna publishes, 1993.
4. Gray, L. Johnson, "Wind energy system", prentice hall linc, 1995.
5. Non-conventional Energy sources B.H.Khan Tata McGraw-hill Publishing Company, New Delhi

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Identifying integrating and justifying techniques to be used in the planning and operation of grid control with renewable energy sources
- Identifying power electronics topologies for used in controlling active and reactive power in a power system.
- Awareness on the advancements in designing of power electronics equipments related to renewable energy sources

PTEEBX18 EMBEDDED CONTROL OF ELECTRIC DRIVES

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To make the student into a competent and independent practitioner in the field of embedded systems.
- To provide an In-depth study both of microcontroller design, and of the Power Electronic Converters and Electric Drives to which the microcontroller must interface
- Study and application of a Real Time Operating System using programming in C

MODULE I **PIC16F8XX- MICROCONTROLLERS** 8

Function-I/O Ports- Timers- CCP Modules- Serial Communication Modules- Analog Modules **-** EEPROM .

MODULE II **MICROCONTROLLER C** 8

Mikro C Compiler reference - mikro C Libraries: ADC,PWM, Keypad, LCD, Trigonometric Libraries - Preprocessor- Statements.

MODULE III **ALGORITHM AND PROGRAMMING IN MIKROC** 8

Source codes in Mikro C : ADC and PWM – Unipolar SPWM – Phase Angle Control with Zero Crossing Detection- LCD with Key Pad - . Speed Measurement.

MODULE IV **ISOLATORS AND SENSORS** 10

High Speed Opto-Couplers – Zero Crossing Detectors - Optically Isolated High Voltage and High Current sensing circuits –Optical Encoders – Tachogenerators

MODULE V **CLOSED LOOP CONTROL OF ELECTRIC DRIVES** 6

Closed Loop Control - Hardware and Software Implementation: DC Motor control using PWM based DC-DC converters and Controlled Rectifiers – AC Motor Control Using TRIAC Phase Controller, SPWM inverter fed single and three phase induction motors

MODULE VI **MIKRO C BUILDING APPLICATIONS** 5

Mikro C IDE : Code Editor- Code Explorer – Debugger – Error Window – Statistics – Integrated Tools - Building applications :Projects – Source Files : Search Paths –Managing Source Files – Compilation : Output Files – Assembly View – Error Messages.- Burning Software : Overview of Microbrn - ICSP port

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL: 45 Hours

REFERENCES:

1. John Main, “PIC Microcontroller C”, 2006-2007 Edition.
2. Mikro C- Compiler for PIC Microchip controllers- mikro Electronika.
3. Martin P. Bates,” Programming 8-bit PIC Microcontrollers in C: With Interactive Hardware Simulation”
4. Tim Wilmshurst “Designing Embedded Systems with PIC Microcontrollers-Principles and applications” Newnes,2007.
5. Martin P. Bates,” PIC Microcontrollers –An Introduction” Newnes,2011.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Applying the underlying knowledge and skills appropriate to today’s embedded systems, in both hardware and software development.
- The skills and knowledge acquired through the study of this set of microcontrollers can readily be transferred to industrial sectors.
    - Master the advancements in designing of power electronics equipments related to renewable energy sources

PTEEBX19 ELECTRIC VEHICLE TECHNOLOGY

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To introduce the concept of Electric Vehicles.
- To familiarize the basic energy transfer processes that govern existing and proposed methods of power generation for Electric Vehicles
- To familiarize with the traditional and non-traditional sources for Electric Vehicles in terms of energy content, accessibility, required processing steps and projected remaining reserves.

MODULE I INTRODUCTION 12

A Brief History - Types of Electric Vehcle in Use Today : Battery electric vehicles - he IC engine/electric hybrid vehicle - Fuelled electric vehicles - Electric vehicles using supply lines - Solar powered vehicles - Electric vehicles which use flywheels or super capacitors

MODULE II BATTERIES 10

Battery Parameters - Lead Acid Batteries - Nickel-based Batteries - Sodium-based Batteries - Lithium Batteries - Metal Air Batteries - Battery Charging - Choice of Battery - Use of Batteries in Hybrid - Vehicles - Battery Modelling

MODULE III FUEL CELLS 12

Hydrogen Fuel Cells - Fuel Cell Thermodynamics - Connecting Cells in Series - Water Management in the PEM Fuel Cell - Thermal Management of the PEM Fuel Cell - A Complete Fuel Cell System - Hydrogen Supply: Fuel Reforming - Hydrogen Storage

MODULE IV ELECTRIC VEHICLE MODELLING AND DESIGN CONSIDERATIONS 8

Tractive Effort - Modelling Vehicle Acceleration - Modelling Electric Vehicle Range - Aerodynamic Considerations - Transmission Efficiency - Electric Vehicle Chassis and Body Design - General Issues in Design.

MODULE V DESIGN OF ANCILLARY SYSTEMS 10

Heating and Cooling Systems - Design of the Controls - Power Steering - Choice of Tyres - Wing Mirrors, Aerials and Luggage Racks - Electric Vehicle Recharging and Refuelling Systems

MODULE VI ELECTRIC VEHICLES AND THE ENVIRONMENT 8

Vehicle Pollution: the Effects - Vehicles Pollution: a Quantitative Analysis - Vehicle Pollution in Context - Alternative and Sustainable Energy Used via the Grid - Using Sustainable Energy with Fuelled Vehicles

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. James Larminie and John Lowry “Electric Vehicle Technology Explained”, John Wiley & Sons Ltd,2003 Edition,

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Identify and quantify the important energy transfer for Batteries and fuel cell schemes.
- Identify the opportunities and challenges of advances in Electric Vehicles
- Identify the current industry activities , by car makers, electricity utilities, parts suppliers (motors and batteries), including joint ventures, product announcements and pilot projects.

HIGH VOLTAGE ENGINEERING

PTEEBX20 BIOELECTRICS	L	T	P	C
	3	0	0	3

COURSE OBJECTIVES:

- To teach the students, some of the basic concepts of bioelectrics through pulsed power principles.
- To impart a detailed knowledge on pulsed power systems
- To study about various applications of electroporation

MODULE I BIOELECTRICITY 8

Introduction – diffusion – comparison of gravity and diffusion – membrane potential – membrane capacitance – ion selectivity – channel density – channel conductance – channel number, channel conductance and membrane potential – channel conductance and random switch – probability – membrane potential revisited – diffusion potential – more realistic view of cell potential – channel opening probability – channels in membranes – classes of selective holes – total membrane conductance and potential.

MODULE II PULSED SYSTEMS: DESIGN PRINCIPLES 7

LUMPED PARAMETER PULSED SYSTEMS

Principle schemes for pulse generation – Voltage multiplication and transformation

PULSE GENERATION UISNG LONG LINES

Generation of nanosecond pulses – voltage multiplication in line based generators – pulse systems with segmented and non uniform lines

MODULE III APPLICATIONS OF PULSED POWER AND PLASMAS TO BIOSYSTEMS AND LIVING ORGANSISMS 8

Pulsed power source using magnetic compression system – discharge plasma by pulsed power – action of pulsed power and discharge plasma to biosystems

MODULE IV ELECTROPORATION 7

Introduction to Electroporation – Electroporation and cellular physiology – the cell in the electric field

MODULE V EQUIPMENT FOR ELECTROPORATION 8

Pulse generator – Applicator – Electrode – Electrochemotherapy – Gene Electrotransfer – DNA Vaccination – Irreversible Electroporation

MODULE VI APPLICATIONS OF ELECTROPORATION 7

Case Study

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Louis j. Defelice “Electrical Properties of Cells: Patch Clamp for Biologists” Plenum press, 1997.
2. Electroporation and Electrofusion in cell biology – Eberhard Neumann, Arthur.E.Sowers, carol.A.Jordan , plenum press, new York, 1989.
3. Gennadiĭ Andreevich Mesiats, , ‘Pulsed power”, springer, 2005.
4. Yoshinobu Kawai, Hideo Ikegami, Noriyoshi Sato, Akihisa Matsuda, Kiichiro Uchino, Masayuki Kuzuya, Akira Mizuno, “Industrial Plasma Technology”, 2007.
5. Clinical aspects of electroporation, Stephen T.Lee, Julie Gehl, Edward W.Lee Springer, 2011.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Pulsed power principles and bioelectricity
- Electroporation and applications of electroporation through conducting of case studies.

.

PTEEBX21 MICROGRID PROTECTION

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To impart knowledge in the formation, development, protection and control of Microgrid.
- To study about impacts, protection issues and microgrid economics.

MODULE I **DISTRIBUTED GENERATION AND MICROGRIDS** 8

Distributed generation - Why integration of distributed generation? - Active distribution network

Concept of microgrid, need & applications of microgrid, formation of microgrid, Issues of interconnection, protection & control of microgrid – Advantages of Microgrid - Challenges and disadvantages of Microgrid development - Management and operational issues of a Microgrid - Dynamic interactions of Microgrid with main grid

MODULE II **DISTRIBUTED ENERGY RESOURCES** 7

Introduction - Combined heat and power (CHP) systems - Wind energy conversion systems (WECS) - Solar photovoltaic (PV) systems - Small-scale hydroelectric power generation - Other renewable energy sources - Storage devices

MODULE III **IMPACTS OF MICROGRID** 8

Introduction – impact on heat utilization – impact on process optimization – impact on market – impact on environment – impact on distribution system – impact on communication standards and protocols.

MODULE IV **MICROGRID AND ACTIVE DISTRIBUTION NETWORK MANAGEMENT SYSTEM** 7

Introduction - Network management needs of Microgrid - Microsource controller - Central controller

MODULE V **PROTECTION ISSUES FOR MICROGRIDS** 8

Introduction – Islanding, separation from utility: Different islanding scenarios – Major protection issues of standalone microgrid: microgrid distribution protection , protection of microsources, NEC requirements for distribution transformer protection, Neutral grounding requirements.

MODULE VI **MICROGRID ECONOMICS** 7

Introduction – Main issues of Microgrid economies - Microgrids and traditional power system economics - Emerging economic issues in Microgrids - Economic issues between Microgrids and bulk power systems.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL: 45 Hours

REFERENCES:

1. S. Chowdhury, S. P. Chowdhury, P. Crossley, "Microgrids and Active Distribution Networks." Institution of Engineering and Technology, 30 Jun 2009.
2. J. Duncan Glover, Mulukutla S. Sarma, Thomas Jeffrey Overbye, "Power system analysis and design" fifth edition, Thomson learning, 2011
3. Tai-hoon Kim, Adrian Stoica, Ruay-Shiung Chang, "Security-Enriched Urban Computing and Smart Grid", springer, 2010.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Indepth knowledge in the formation, development, protection and control of Microgrid.
- Exposure to distributed energy resources, impacts and protection issues for microgrids.

PTEEBX22	HIGH VOLTAGE DIRECT CURRENT TRANSMISSION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To develop the skills in the area of HVDC power transmission with the analysis of HVDC converters, harmonics and design of filters.
- To study about different applications of HVDC systems.

MODULE I **INTRODUCTION TO TRANSMISSION SYSTEMS** 8

Introduction – Evolution of HVDC Transmission systems – Comparison of HVAC and HVDC transmission systems – Types of HVDC transmission systems – Components of HVDC transmission systems

MODULE II **ANALYSIS OF HVDC CONVERTERS AND HVDC SYSTEM** 8

Analysis of simple rectifier circuits – Bridge Rectifier analysis – Analysis of HVDC Converter: Different modes of converter operation, Output voltage waveforms and DC voltage in rectification, Output voltage waveforms and dc in inverter operation, thyristor voltages, Equivalent electrical circuit

MODULE III **HVDC SYSTEM CONTROL** 8

HVDC System control features – Control modes - Control schemes – Control comparisons

MODULE IV **MULTITERMINAL DC SYSTEMS** 10

Converter mal-operations – Commutation failure – starting and shutting down the converter Bridge – Converter Protection - Smoothing reactor and dc lines – Reactive power requirements – Harmonic Analysis – Filter Design

MODULE V **POWER FLOW ANALYSIS IN AC/DC SYSTEMS** 6

Component Models for the Analysis of AC and DC Systems - Power flow analysis of AC-DC systems - Transient stability analysis - Dynamic stability analysis

MODULE VI **APPLICATIONS OF HVDC SYSTEMS** 5

Multi-terminal HVDC system - Advances in HVDC transmission - HVDC system application in wind power generation

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. KR Padiyar, “HVDC Power Transmission Systems”, Willey Eastern Limited, Second edition.
2. J Arrillaga, “High Voltage Direct current Transmission”, Peter Peregrinus Ltd, UK.
3. EW Kimbark, “Direct Current Transmission”, Wiley-Interscience, New York.
4. SN Singh, “Electric Power Generation, Transmission and Distribution, PHI, New Delhi 2nd edition, 2008.
5. P. Kundur, “Power System Stability and Control”, McGraw-Hill, 1993.
6. Additional reading: Research Papers.
7. Erich Uhlmann, “ Power Transmission by Direct Current”, BS Publications, 2004
8. V.K.Sood,HVDC and FACTS controllers – Applications of Static Converters in Power System, APRIL 2004 , Kluwer Academic Publishers.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Understand and analyze the operation and control of HVDC systems
- Design filters for mitigating the effects of harmonics .

PTEEBX23 POWER QUALITY

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To acquire knowledge on factors affecting Power Quality
- To analyze and control power quality problems

MODULE I **POWER QUALITY TERMS AND DEFINITIONS** 8

Introduction, transients, short duration/long duration voltage variations, voltage imbalance, waveform distortion, voltage fluctuations, power frequency variation.

Power Quality Problems: Poor load power factor, loads containing harmonics, notching in load voltage, DC offset in loads, unbalanced loads, disturbance in supply voltage

MODULE II **VOLTAGE SAGS AND INTERRUPTIONS** 8

Sources of sags and interruptions, end user issues: Ferro resonant transformer, on-line UPS, hybrid UPS, motor generator set, SMES etc., motor starting sags, utility system fault clearing issues. **Transient over Voltage:** Sources of transient over voltages, principles of over voltage protection, devices for over voltage protection, utility capacitor switching transients, utility lightning protection, load-switching transient problems.

MODULE III **LONG DURATION VOLTAGE VARIATIONS** 8

Devices for voltage regulation, utility voltage regulator applications, capacitors for voltage regulation, end-user capacitor application, regulating Utility voltage with dispersed sources. **Quality and Reliability of Power Supply**: Reliability of power supply, reliability measurements consumer interruption cost, distribution automation, substation grounding, energy auditing.

MODULE IV **HARMONICS** 10

Voltage and current harmonics distortions, harmonics of single-phase power supplies, three phase power converters, arcing devices, storable devices, effects of harmonics distortion, system response characteristics, locating sources of harmonics, peripherals for controlling

harmonics, devices for filtering harmonics,

MODULE V **WIRING AND GROUNDING** 6

Harmonics study procedure, symmetrical components, modeling harmonics sources, harmonic filter design, telecommunication interferences, Reason for grounding, typical wiring and grounding problems and their solutions

MODULE VI **POWER QUALITY MONITORING AND CUSTOM POWER DEVICES** 5

Power quality related standards, standard test waveform, and detailed power quality monitoring, power quality measurement equipments.

Custom Power Devices: Utility customer interface, network reconfiguring device load compensation using shunt compensators, voltage regulation using shunt compensators, dynamic voltage restorer, unified power quality conditioner. computer tools for harmonic analysis.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL: 45 Hours

REFERENCES:

1. Roger C.Dugan, Mark F. Mc Granhgan, Surya Santoso," Electrical Power System Quality"Mc Graw hill, 2nd Edition.
2. Arindam Ghosh and Gerard Ledwich,"Power Quality Enhancement using custom power devices ", Kulwer academic publishers.
3. 3. C.L Wadhwa,"Generation and Distribution utilization of electrical Energy" New Age International.
4. C. Sankarm,"Power Quality" CRC Press USA.
5. Barry W. Kennedy, "Power Quality Primer "McGraw Hill.
6. Wilson E. Kazibwe,"Electrical power quality controls techniques" Van Nostrand Reinhold
7. Reference http://www.uktech.in/files/EE_Proposed_Syllabus_2009-10.pdf

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Understand the power quality issues and its importance.
- Evaluate the characteristics of power quality disturbances.

		L	T	P	C
PTEEBX24	**ELECTROMAGNETIC INTERFERENCE AND ELECTROMAGNETIC COMPATIBILITY**	3	**0**	**0**	**3**

COURSE OBJECTIVES:

This course conveys essential facts on:

- Different electromagnetic Interference problems occurring in Intersystem and their possible mitigation techniques in Electronic design
- EMI Sources, EMI problems and their solution methods in PCB level / Subsystem and system level design.
- Possible EMC standards

MODULE I **BASIC CONCEPTS** 6

Definition of EMI and EMC with examples, Classification of EMI/EMC - CE, RE, CS, RS, MODULEs of parameters, Sources of EMI, EMI coupling modes - CM and DM, ESD phenomena and effects, Transient phenomena and suppression.

MODULE II **EMI MEASUREMENTS** 8

Basic principles of RE, CE, RS and CS measurements, EMI measuring instruments- Antennas, LISN, Feed through capacitor, current probe, EMC analyzer and detection technique ,Open area site, shielded anechoic chamber, TEM cell.

MODULE III **EMC STANDARD AND REGULATIONS** 8

National and Intentional standardizing organizations- FCC, CISPR, ANSI, DOD, IEC, CENEEC, FCC CE and RE standards, CISPR, CE and RE Standards, IEC/EN, CS standards, Frequency assignment - spectrum conversation

MODULE IV **EMI CONTROL METHODS AND FIXES** 8

Shielding, Grounding, Bonding, Filtering, EMI gasket, Isolation transformer, Opto isolator

MODULE V **GROUNDING FOR THE EMI CONTROL** 8

Characteristics of grounding systems: Impedance characteristics, Antenna characteristics – Ground,related interference - Circuit, Equipment, and System grounding: Single-point grounding scheme, Multipoint grounding Scheme, Selection of a grounding Scheme - Ground system configurations - EMI control devices and techniques

MODULE VI **EMC DESIGN AND INTERCONNECTION TECHNIQUES** 7

Cable routing and connection, Component selection and mounting, PCB design- Trace routing, Impedance control, decoupling, Zoning and grounding

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Prasad Kodali.V, Engineering Electromagnetic Compatibility, S.Chand&Co, New Delhi, 2000
2. Clayton R.Paul, Introduction to Electromagnetic compatibility , John Wiley & Sons, 1992
3. Keiser, Principles of Electromagnetic Compatibility, Artech House , 3rd Edition 1994
4. Donwhite Consultant Incorporate , Handbook of EMI / EMC , Vol I – 1985
5. http://www.eetimes.com/ContentEETimes/Documents/Duff_Ch_5.pdf

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Ability to understand Electromagnetic Interference problems and their mitigation techniques.
- Be aware of grounding systems for EMI control.
- Knowledge and awareness on EMC design and interconnection techniques..

PTEEBX25 OUTDOOR INSULATORS

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

The course aims at giving a comprehensive knowledge on Outdoor Insulators, which are mainly used for Transmission and Distribution systems.

Upon completing the Course, the student will be able to do the following:

- Become familiar with different stresses encountered in the service of the insulator as well as the types and performance of Insulators.
- Able to connect the current area of Research in insulators including non-ceramic insulators
- Design and Manufacturing process of insulators can be understood
- The testing standards, selection and maintenance of insulators will also be made aware.

MODULE I **INTRODUCTION** 7

Overview – Important Definitions – Types of Outdoor Insulators – Uses of Outdoor Insulators – Stresses Encountered in Service – Electrical Performance – Mechanical Performance – Role of Insulators on Overall Power System Reliability – Shapes of Outdoor Insulators – Mechanical and Electrical Ratings of Insulators – Comparison of Porcelain, Glass and Composite Insulators – Life Expectancy.

MODULE II **NONCERAMIC INSULATOR TECHNOLOGY** 7

Introduction - Materials for Weathersheds / Housings – Shed Design – Insulator Core – Hardware – Establishing Equivalency to Porcelain/Glass – Manufacturing Changes and Quality Control (QC) – Un-standardization/Propagation - Live-line Maintenance Handling, Cleaning and Packaging - Brittle Fracture – Water Drop Corona – Aging and Longevity – Grading Control Rings.

MODULE III **DESIGN AND MANUFACTURE OF INSULATORS** 8

Porcelain Insulators – Manufacture of Porcelain Insulators – The Porcelain Suspension Insulator – Porcelain Pin-type Insulators – Porcelain Multicone Insulators – Porcelain Long-rod and Post Insulators – Porcelain Insulators Glazes - Porcelain Insulator Hardware – Porcelain Insulator Cement – The Porcelain Dielectric.

Glass Insulators – The Glass Suspension Insulator – Glass Pin-type Insulators – Glass Multicone Post Insulators – Manufacture of Glass Insulators – Glass Insulator Hardware – Glass Insulator Cement – The

Glass Dielectric.

Nonceramic Insulators - Nonceramic Suspension Insulator – Line Post Insulator – Hollow Core Insulator – Manufacture of Nonceramic Insulators – The Composite Dielectric – Voltage Stress Control.

MODULE IV TESTING STANDARDS FOR INSULATORS 8

Need for Standards – Standards Producing Organizations – Insulator Standards – Classification of Porcelain / Glass Insulator Tests – Brief Description and Philosophy of Various Tests for Cap and Pin Porcelain/Glass Insulators – Summary of Standards for Porcelain/Glass Insulators – Standards of Nonceramic (Composite) Insulators – Classification of Tests, Philosophy and Brief Description – Standards for Nonceramic Insulators.

MODULE V DETECTING DEFECTIVE INSULATORS 7

Detecting defective porcelain insulators – principles involved – electrical methods – thermography .

Detecting defective non ceramic insulators – detection prior to installation – detecting degraded insulator during service

MODULE VI SELECTION AND MAINTENANCE OF INSULATORS 8

Introduction – Cost and Weight – National Electricity Safety Code (NESC) – Basic Lightning Impulse Insulation Level (BIL) – Contamination Performance – Experience with Silicone Rubber Insulators in Salt Areas – Compaction – Grading Rings for Nonceramic Insulators.Maintenance of Insulators-Maintenance Inspection – Hotline washing – equivalent salt deposit

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Ravi S. Gorur, Edward A. Cherney and Jeffrey T. Burnham, “Outdoor Insulators”, Ravi S. Gorur. Inc., Phoenix, Arizona 85044, USA,1999.
2. J.S.T. Looms, “Insulators for High Voltages”, Peter Peregrinus Ltd., 1988.
3. A.O. Austin, “Porcelain Insulators”, Ohio Brass Company, 1980.
4. IEC 1109, “Composite Insulators for AC overhead lines with a Nominal Voltage Greater than 1000V, Definition, Test Methods and Acceptance Criteria”, 1992.
5. EPRI, “Transmission Lines Reference Book – 345kV and above”, 1982

6 ANSI C 29.1, “Electrical Power Insulator – Test Methods”, 1992

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Various types of outdoor insulators and their characteristics
- Design, testing and maintenance of different types of insulators
- Selection and detection of defensive insulators

PTEEBX26	HIGH VOLTAGE GENERATION AND MEASUREMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To study about high voltage,high current generation and measurement techniques.
- To study about the destructive and nondestructive testing of electrical equipments.

MODULE I **INTRODUCTION** 5

Introduction to HV technology, Advantages of electric power transmission at high AC and DC voltages. Need for generating high AC and DC voltages in a laboratory.

MODULE II **GENERATION OF HIGH VOLTAGE AC AND DC** 8

HVAC - HV transformer; Need for cascade connection and working of transformer MODULEs connected in cascade. Series resonant circuit - Principle of operation and advantages. Tesla coil. HVDC - Voltage doubler circuit.

Cockcroft-Walton type high voltage DC set. Calculation of voltage regulation, Ripple - Optimum number of stages for minimum voltage drop.

MODULE III **GENERATION OF IMPULSE VOLTAGES AND CURRENTS** 8

Introduction to standard Lightning and Switching impulse voltages. Analysis of single stage impulse generator - Expression for output impulse voltage. Multistage impulse Marx generator and its working. Rating of impulse generator. Components of multistage impulse generator. Triggering of impulse generator by three electrode gap arrangement, Trigatron gap and oscillograph time sweep circuits. Generation of switching impulse voltage.. Generation of high impulse currents.

MODULE IV **MEASUREMENT OF HIGH VOLTAGES** 8

Electrostatic voltmeter - Principle, construction and limitations. Chubb and Fortescue method for HVAC measurement. Generating voltmeter - Principle and construction. Series resistance micro ammeter for HVDC measurement.Standard sphere gap for measurement of HVAC, HVDC and impulse voltages; Factors affecting measurements. Potential dividers - Resistance dividers, Capacitance divider, Mixed RC potential divider. Surge current measurement - Klydanograph and magnetic links.

MODULE V NON-DESTRUCTIVE INSULATION TESTING TECHNIQUES 8

Dielectric loss and loss angle measurement using Schering Bridge, Transformer ratio- Arm bridge. Need for discharge detection and PD measurement aspects. Factors affecting discharge detection. Discharge detection methods - Straight and balance methods.

MODULE VI HIGH VOLTAGE TESTS ON ELECTRICAL APPARATUS 8

Terminologies used for Tests on isolators, circuit breakers, cables, insulators and transformers, bushings and surge absorbers

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. M.S. Naidu and V. Kamaraju, High Voltage Engineering, 3rd edition, Tata McGraw Hill, 1995.
2. C. L. Wadhwa, High Voltage Engineering, New Age International Private Limited, 1995.
3. E. Kufell and W.S. Zaengl, High voltage Engineering fundamentals, 2nd edition, pergamon press, 1984.
4. Dieter Kind, Kurt Feser, “High Voltage Test Techniques”, SBA Electrical Engineering Series, New Delhi, 1999.
5. Gallagher, T.J., and Permain, A., “High Voltage Measurement, Testing and Design”, John Wiley Sons, New York, 1983.
6. R.Mazen Abdel-Salam, Hussein Anis, Ahdab El-Morshedy, Roshdy Radwan, “High Voltage Engineering Theory and Practice” Second Edition, Revised and Expanded, Marcel Dekker, Inc., New York, 2000.
7. N.H.Malik, A.A.Al_Arainy, M.I.Qureshi, “ Electrical Insulation in Power Systems”, marcel Dekker,Inc., New York 1988.
8. Adolf J. Schwab, “High Voltage Measurement Techniques”, M.I.T Press, 1972.
9. http://www.eolss.net/Sample-Chapters/C05/E6-39A-04-03.pdf

COURSE OUTCOME :

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Execute a vibrant analysis of high voltage measurement techniques.
- Portray the generating principles of high DC-, AC- and impulse voltages and currents.
- Illustrate the principles for measurement of capacitance and dielectric loss
- Confer the measurement principles behind partial discharges

PTEEBX27 INSULATION TECHNOLOGY

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVE:

- To acquire knowledge in the area of insulation technology.
- To study about different applications of insulating materials.

MODULE I **TYPES OF INSULATING MATERIALS IN USE TODAY** 8

Insulating materials – classification, brief study of preparation and properties of ceramics, mica, paper, PVC, PE Epoxy resin, teflon, SF6 transformer oil, polychlorobiphenyls (PCB) vacuum purification of transformer oil- drying and degassing. Impregnation of paper and cotton insulation.

MODULE II **GENERAL PROPERTIES OF INSULATING MATERIALS** 8

Requirements of insulating materials – electrical properties – molecular properties of dielectrics – dependence of permittivity on temperature, pressure, humidity and voltage, permittivity of mixtures, practical importance of permittivity – behavior of dielectric under alternating fields – complex dielectric constants – bipolar relaxation and dielectric loss, dielectric strength

MODULE III **BREAKDOWN MECHANISMS IN GASEOUS DIELECTRICS** 8

Behaviour of gaseous dielectrics in electric fields – gaseous discharges – different ionization processes – effect of electrodes on gaseous discharge – Townsend's theory, Streamer theory – electronegative gases and their influence on gaseous discharge – Townsend's criterion for spark breakdown, gaseous discharges in non-uniform fields - breakdown in vacuum insulation

MODULE IV **BREAKDOWN MECHANISMS IN SOLID DIELECTRICS** 8

Intrinsic breakdown of solid dielectrics – electromechanical breakdown-Streamer breakdown, thermal breakdown and partial discharges in solid dielectrics - electrochemical breakdown – tracking and treeing – classification of solid dielectrics, composite insulation and its mechanism of failure.

MODULE V **BREAKDOWN MECHANISMS IN LIQUID DIELECTRICS** 7

Liquids as insulators, conduction and breakdown in pure and commercial liquids, Cryogenic insulation.

MODULE VI **APPLICATION OF INSULATING MATERIALS** 6

Application of insulating materials in transformers. rotating machines, circuit breakers, cables, power capacitors and bushings.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Adrinaus, J.Dekker, “Electrical Engineering Materials”, Prentice Hall of India Pvt. Ltd., New Delhi, 1979.
2. Alston, L.L, “High Voltage Technology”, Oxford University Press, London, 1968 (B.S Publications, First Indian Edition 2006)
3. Kuffel, E., Zaengl, W.S. and Kuffel J., “High Voltage Engineering Fundamentals”, Elsvier India Pvt. Ltd, 2005
4. Dieter Kind and Hermann Karner, “High Voltage Insulation Technology”, 1985. (Translated from German by Y. Narayana Rao, Friedr. Vieweg & Sohn, Braunschweig,).
5. M.S Naidu, V.Kamaraj, “High Voltage Engineering”, Tata Mc Graw-Hill Publishing Company Ltd., New Delhi, 2004.
6. V.Y.Ushakov, “Insulation of High Voltage Equipment”, Springer ISBN.3-540-20729-5, 2004.

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Portray the general properties of insulating materials
- Execute a vibrant analysis of breakdown mechanisms and applications of insulating materials

PTEEBX28 ELECTROMAGNETIC FIELD COMPUTATION AND MODELLING	L	T	P	C
	3	0	0	3

COURSE OBJECTIVES:

- To provide a theoretical framework for understanding the electrical and magnetic fields.
- To understand electromagnetic (EM) waves and EM properties of various materials.
- To exposes the students to introduction of modern physics with basic knowledge of relativity and quantum mechanics as well

MODULE I INTRODUCTION 7

Review of basic field theory – electric and magnetic fields – Maxwell's equations – Laplace, Poisson and Helmoltz equations – principle of energy conversion – force/torque calculation – Electro thermal formulation.

MODULE II SOLUTION OF FIELD EQUATIONS I 8

Limitations of the conventional design procedure, need for the field analysis based design, problem definition , solution by analytical methods-direct integration method – variable separable method – method of images, solution by numerical methods- Finite Difference Method.

MODULE III SOLUTION OF FIELD EQUATIONS II 8

Finite element method (FEM) – Differential/ integral functions – Variational method – Energy minimization – Discretisation – Shape functions –Stiffness matrix –1D and 2D planar and axial symmetry problem.

MODULE IV FIELD COMPUTATION FOR BASIC CONFIGURATIONS 8

Computation of electric and magnetic field intensities– Capacitance and Inductance – Force, Torque, Energy for basic configurations.

MODULE V DESIGN APPLICATIONS 8

Insulators- Bushings – Cylindrical magnetic actuators – Transformers – Rotating machines

MODULE VI **COMPUTATIONAL METHODS FOR ELECTROMAGNETIC ANALYSIS** 6

Frequency versus time domain analysis – High frequency asymptotic techniques – First principle numerical methods – Time domain simulation methods – Hybrid techniques.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL: 45 Hours

REFERENCES:

1. K.J.Binns, P.J.Lawrenson, C.W Trowbridge, “The analytical and numerical solution of Electric and magnetic fields”, John Wiley & Sons, 1993.
2. Nathan Ida, Joao P.A.Bastos , “Electromagnetics and calculation of fields”, Springer-Verlage, 1992.
3. Nicola Biyanchi , “Electrical Machine analysis using Finite Elements”, Taylor and Francis Group, CRC Publishers, 2005.
4. S.J Salon, “Finite Element Analysis of Electrical Machines.” Kluwer Academic Publishers, London, 1995, distributed by TBH Publishers & Distributors, Chennai, India
5. User manuals of MAGNET, MAXWELL & ANSYS software.
6. Silvester and Ferrari, “Finite Elements for Electrical Engineers” Cambridge University press, 1983.
7. Jian Ming Jin “Theory and Computation of Electromagnetic fields” John Wiley and Sons, 2010.

COURSE OUTCOME :

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Understand the basic concepts of electric charge, electric field and potential, electrical energy and power.
- To apply laws of electromagnetic induction in simple situations.
- Understand magnetic circuits and apply laws of magnetism to analyse them.
- Appreciate the principles of operation of electromagnetic devices .
- Understand basic modern physics with the ideas of particle–wave duality and a quantum mechanical model of an atom.

PTEEBX29	PULSED ELECTRIC FIELD AND FOOD PRESERVATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

- To acquire skills in the area of food preservation using pulsed electric field treatment.
- To study about different inactivation techniques used in pulsed electric field.

MODULE I FUNDAMENTALS OF PULSED ELECTRIC FIELD 7

Introduction- Methods of Applying Electricity – High Intensity PEF Processing System – Basics of High Intensity PEF – Energy Requirements – Applications of PEF in Food Preservation – Disadvantages of PEF

MODULE II DESIGN OF PEF PROCESSING EQUIPMENT 8

Introduction – High Voltage Pulsers – Switches – Treatment Chambers – Cooling system – Typical Measurements in PEF system – Packaging and Storaging

MODULE III MICROBIAL INACTIVATION IN ELECTRIC FIELDS 7

Introduction – Transmembrane Potential – Electromechanical Compression and instability – Osmotic Balance – Viscoelastic Model – Hydrophobic and Hydrophilic pores - Theories based on conformational changes – Electric Field induced structural changes

MODULE IV PEF INDUCED BIOLOGICAL CHANGES 8

Introduction – electropermeabilization – Electrofusion – Disruption and Biological Alteration – Electrical and Thermal Gradients induced by PEF on microbial cell membranes – Main factors in Microbial inactivation

MODULE V PEF INACTIVATION OF VEGETATIVE CELLS SPORES AND ENZYMES IN FOODS AND FOOD PROCESSING BY PEF 7

Introduction – Microbial Inactivation : Inactivation of yeasts, E.Coli, S.aureus, Lactobacillus, Bacillus, Salmonella, Pseuomonas, Inactivation of other microorganisms, Spore Inactivation, Standardization of inactivation assessment, Enzyme inactivation

MODULE VI **FOOD PROCESSING BY PEF** 8

Microbial Analysis – Chemical and Physical Analysis – Sensory evaluation and Shelf life studies - Quality and Shelf Life Evaluation of PEF products : Processing of Apple Juice, Orange Juice, Milk, Eggs, Green Pea Soup, Processing of Brine solutions and water in cooling systems

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL: 45 Hours

REFERENCES:

1. Gustavo V. Barbosa Canovas, M. Marcela gongora nieto, usha R. Pothakamury, Barry G. Swanson, “Preservation of Foods with Pulsed Electric Fields” , academic press, 1999
2. Javier Raso, Volker Heinz, “Pulsed electric field technology for the food industry, Fundamentals and applications” , Springer science and business media, 2006
3. Huub L. M. Lelieveld, S. L. H. Notermans, S. W. H. De Haan, “Food preservation by pulsed electric fields:from research to application” Wood head publishing limited, 2007

COURSE OUTCOME:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Understand and analyze the PEF concept in different applications
- Study different inactivation techniques used in pulsed electric field.

COMPUTER SCIENCE & INFORMATION TECHNOLOGY

PTITB3103 DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- Master the basic concepts and appreciate the applications of database systems.
- Master the basics of SQL and construct queries using SQL.
- Be familiar with the relational database theory, and be able to write relational algebra Expressions for queries.
- Mastering the design principles for logical design of databases, including the E-R method and normalization approach.
- Be familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B-tree, and hashing.
- Master the basics of query evaluation techniques and query optimization.
- Be familiar with the basic issues of transaction processing and concurrency control.

MODULE I **INTRODUCTION AND CONCEPTUAL MODELING** 7

Introduction to File and Database systems- Database system structure – Data Models – Introduction to Network and Hierarchical Models – ER model

MODULE II **RELATIONAL MODEL** 7

Relational Model - Relational Algebra and Calculus - SQL – Data definition- Queries in SQL- Updates- Views – Integrity and Security

MODULE III **DATA STORAGE** 8

Relational Database design – Functional dependences and Normalization for Relational Databases (up to BCNF) - Record storage and Primary file organization- Secondary storage Devices- Operations on Files- Heap File- Sorted Files

MODULE IV **HASHING, INDEXING AND QUERY PROCESSING** 7

Hashing Techniques – Index Structure for files –Different types of Indexes- B-Tree - B+Tree – Query Processing

MODULE V **TRANSACTION MANAGEMENT** 8

Transaction Processing – Introduction- Need for Concurrency control- Desirable properties of Transaction- Schedule and Recoverability- Serializability and Schedules – Concurrency Control – Types of Locks- Two Phases locking- Deadlock- Time stamp based concurrency control – Recovery Techniques – Concepts- Immediate Update- Deferred Update - Shadow Paging.

MODULE VI **CURRENT TRENDS** 8

Object Oriented Databases – Need for Complex Data types - OO data Model- Nested relations - Complex Types- Inheritance Reference Types - Distributed databases- Homogenous and Heterogenous- Distributed data Storage – XML – Structure of XML- Data- XML Document- Schema- Querying and Transformation – Data Mining and Data Warehousing

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan - 'Database System Concepts', Fourth Edition, McGraw-Hill, 2002.
2. Ramez Elmasri and Shamkant B. Navathe, 'Fundamental Database Systems', Third Edition, Pearson Education, 2003.
3. Raghu Ramakrishnan, 'Database Management System', Tata McGraw-Hill Publishing Company, 2003.
4. Peter Rob and Corlos Coronel- 'Database System, Design, Implementation and Management', Thompson Learning Course Technology, Fifth edition, 2003.
5. Hector Garcia–Molina, Jeffrey D.Ullman and Jennifer Widom- 'Database System Implementation'- Pearson Education, 2000.

COURSE OUTCOME :

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Study the physical and logical database designs, database modeling, relational, hierarchical, and network models.

- Understand and use data manipulation language SQL to query, update, and manage a database.
- Develop an understanding of essential DBMS concepts such as: Integrity, Concurrency, Object oriented database, Distributed database, Data mining and Data Warehousing.
- Design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

PTITBX21 WEB COLLABORATION AND TECHNOLOGY

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To have current knowledge about the collaborative and interactive web.
- To describe the actions, including those related to the cache, performed by a browser in the process of visiting a Web address
- To demonstrate techniques for improving the accessibility of JavaScript Webpage.
- To demonstrate server side programming with semantic web implications

MODULE I INTRODUCTION 8

History of the Internet and World Wide Web – HTML 4 protocols – HTTP, SMTP, POP3, MIME, and IMAP. Introduction to JAVA Scripts – Object Based Scripting for the web. Structures – Functions – Arrays – Objects – Jquery implementation of JavaScript.

MODULE II DYNAMIC HTML 7

Introduction – Object reference - Collectors all and Children. Dynamic style - Dynamic positioning - Event Model – Filters –Transitions – Data Binding –Sorting table data – Binding of an Image and table – Cascading Style Sheets – Types and Dynamic Implementation.

MODULE III TRANSFORMATION OF WEB 1.0 to WEB 2.0 and WEB 3.0 7

Technology Overview, Rich User Experience, User Participation, Dynamic Content, Metadata, Web Standards and scalability, Openness and collective intelligence, Web 1.0 vs. Web 2.0 – Mashups- Semantic Web and its Implications.

MODULE IV SERVER SIDE PROGRAMMING 8

Three tiers Architecture – Java Servlets – Architecture Overview – Generating Dynamic Content – Life cycle – JSP - Applications – Introduction to JSF- Java struts - Data base Connectivity- Open source Languages - Introduction to PHP and MYSQL – WAMP- Web servers – Apache – Nginix.

MODULE V WEB SERVICES, STANDARDS & SPECIFICATIONS 8

Description Languages, Protocols - REST (Representational State Transfer), SOAP, Collaboration architecture and standards (Enterprise bus), Security, Messaging, Reliability, Transaction, Business Process & Management, Collaboration- SOA.

MODULE VI RICH INTERNET APPLICATIONS 7

Introduction to Photoshop - Dream weaver – Flash – AJAX – Cloud and RIA - Software as a Service – Applications in SaaS - Impact of RIA on cloud.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Deitel & Deitel, Goldberg, 'Internet and World Wide Web – How to Program', Pearson Education Asia, 2001.
2. Eric Ladd, Jim O' Donnel, 'Using HTML 4, XML and JAVA', Prentice Hall of India
3. QUE, 1999.Aferganatel, 'Web Programming: Desktop Management', PHI, 2004.
4. Ravi Kumar Jain Brajesh Prabhakar, 'Wiki - A New Wave In Web Collaboration', Icfai University Press,2006
5. Vivek Chopra, Sing Li, Rupert Jones, Jon Eaves, John T. Bell, 'Beginning JavaServer Pages', Wrox Publishers, February 18, 2005.
6. Thomas Erl, 'Service-Oriented Architecture: Concepts, Technology, and Design'-Prentice Hall, 2006.
7. Beginning PHP 6, Apache, MySQL 6 Web Development, imothy Boronczyk, Elizabeth Naramore,
8. Jason Gerner, Yann Le Scouarnec, Jeremy Stolz, Wrox Publications, January 2009.

COURSE OUTCOME :

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

- analyze the web page and identify elements and attributes.
- create Web pages dynamically using Cascading style sheets and XHTML.
- imbibe knowledge about new technologies like JSF, PHP and Jquery.
- acquire knowledge about Cloud and RIA.

PTITB2101 DATA STRUCTURES

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- Describe the usage of various data structures
- Explain the operations for maintaining common data structures
- Recognize the associated algorithm operations and complexity

MODULE I **PROBLEM SOLVING & ABSTRACT DATA TYPES** 8

Problem solving - Top-down Design - Implementation - Verification - Efficiency - Analysis - Sample algorithms .

MODULE II **ADT** 7

Introduction to datastructures, Arrays, Sparse matrices, Strings. Abstract Data Type (ADT) - The List ADT - The Stack ADT - The Queue ADT.

MODULE III **TREES** 7

Preliminaries - Binary Trees - The Search Tree ADT - Binary Search Trees - AVL Trees - Tree Traversals - Hashing - General Idea - Hash Function - Separate Chaining - Open Addressing - Linear Probing - Model - Simple implementations - Binary Heap.

MODULE IV **SORTING** 8

Preliminaries - Insertion Sort -selection sort- Shell sort - Heap sort – Merge sort - Quick sort - External Sorting.

MODULE V **GRAPHS** 8

Definitions - Topological Sort - Shortest-Path Algorithms - Unweighted Shortest Paths - Dijkstra's Algorithm - Minimum Spanning Tree - Prim's Algorithm - Applications of Depth-First Search - Undirected Graphs - Biconnectivity.

MODULE VI **APPLICATIONS** 7

Linked List - Maintaining an inventory -- Stack - conversion of infix to postfix expression, evaluation of arithmetic expression - Queue - scheduler in OS - Tree - Priority queue - Graph - Traveling Salesman Problem.

LECTURE HOURS: 45	**TUTORIAL HOURS: 0**	**PRACTICE HOURS: 0**	**TOTAL: 45 Hours**

REFERENCES:

1. R. G. Dromey, 'How to Solve it by Computer' (Chaps 1-2), Prentice-Hall of India, 2009.

2 M. A. Weiss, 'Data Structures and Algorithm Analysis in C', 3rd Edition, Pearson Education Asia, 2007.

3 A.V. Aho, J. E. Hopcroft, and J. D. Ullman, “Data Structures and Algorithms”, Pearson Education, First Edition Reprint 2003.

4 Y. Langasam, M.J Augenstein and A.M. Tenenbaum, 'Data Structures using C and C++, 2nd Edition, Prentice - Hall of India, 2000.

COURSE OUTCOME :

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

- Design and apply appropriate data structures for solving computing problems
- Develop computer programs to implement different data structures and related algorithms
- Possess the ability to design simple algorithms for solving computing problems

PTITB2104 COMPUTER NETWORKS

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To understand the layering concepts in computer networks.
- To understand the functions of each layer.
- To have knowledge in different applications that use computer networks.

MODULE I DATA COMMUNICATIONS 8

Components – Direction of Data flow – networks – Components and Categories – types of Connections – Topologies –Protocols and Standards – ISO / OSI model – Transmission Media – Coaxial Cable – Fiber Optics – Line Coding – Modems – RS232 Interfacing sequences

MODULE II DATA LINK LAYER 8

Error – detection and correction – Parity – LRC – CRC – Hamming code – low Control and Error control - stop and wait – go back-N ARQ – selective repeat ARQ- sliding window – HDLC - LAN - Ethernet IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - IEEE 802.11 – FDDI - SONET – Bridges.

MODULE III NETWORK LAYER 8

Internetworks – Packet Switching and Datagram approach – IP addressing methods – Sub netting – Routing – Distance Vector Routing – Link State Routing – Routers.

MODULE IV TRANSPORT LAYER 7

Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – Integrated Services.

MODULE V APPLICATION LAYER 7

Domain Name Space (DNS) – SMTP – FTP – HTTP – WWW – Network Simulation Tools – NS2 / Glomosim.

MODULE VI CRYPTOGRAPHY 7

OSI Security Architecture – Classical Encryption techniques – Data Encryption Standard – Block Cipher Design Principles and Modes of Operation – Principles of Public key Cryptosystems – RSA algorithm.

LECTURE TUTORIAL PRACTICE TOTAL: 45 Hours

HOURS: 45 HOURS: 0 HOURS: 0

REFERENCES:

1. Behrouz A. Forouzan, 'Data Communication and Networking', Tata McGraw-Hill, 2004.

2 James F. Kurose and Keith W. Ross, 'Computer Networking: A Top-Down Approach Featuring the Internet', Pearson Education, Fifth Edition, 2003.

3 Larry L.Peterson and Peter S. Davie, 'Computer Networks', Harcourt Asia Pvt. Ltd., Second Edition, Pearson education Asia**,** 2000.

4 Andrew S. Tanenbaum, 'Computer Networks', PHI, Fourth Edition, 2003

5 William Stallings, 'Data and Computer Communication', Sixth Edition, Pearson Education, 2000.

6 William Stallings, 'Cryptography and Network Security – Principles and Practices', Prentice Hall of India, Third Edition, 2003.

COURSE OUTCOME :

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

- Master the terminology and concepts of the OSI reference model and the TCP-IP reference model.
- Master the concepts of protocols, network interfaces and design/performance issues in local area networks and wide area networks.
- Be familiar with contemporary issues in networking technologies.
- Be familiar with network tools and network programming.

PTITBX82 JAVA PROGRAMMING

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To understand the basic concepts of java programming using OOPs concepts.
- To acquire knowledge and skills in Graphical User Interface (GUI) using AWT Applet & Swing programming.
- To understand database connectivity using JDBC.

MODULE I JAVA FUNDAMENTALS 8

Features of Java, OOPs concepts , Java virtual machine , Reflection byte codes Byte code interpretation, Data types, variable, arrays, expressions, operators, and control structures.

MODULE II OBJECTS AND CLASSES 8

Java Classes: Abstract classes, Static classes, Inner classes, Packages, Wrapper classes, Interfaces This, Super, Access control.

MODULE III EXCEPTION HANDLING AND IO PACKAGE 8

Exception as objects, Exception hierarchy, Try catch finally, Throw, throws. IO Package: Input streams, Output streams ,Object serialization, Deserialization ,Sample programs on IO files ,Filter and pipe streams.

MODULE IV MULTI THREADING 7

Thread, Thread Life cycle, Multi threading advantages and issues, Simple thread program Thread synchronization.

MODULE V GRAPHICAL USER INTERFACE 7

Introduction to AWT programming, Layout and component managers, Event handling, Applet class, Applet life-cycle ,Passing parameters embedding in HTML, Swing components – JApplet, JButton, JFrame, etc., Sample swing programs.

MODULE VI DATABASE CONNECTIVITY 7

Database Connectivity: JDBC architecture, Establishing connectivity and working with connection interface Working with statements.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Cay S. Horstmann and Gary Cornell, “Core Java: Volume I – Fundamentals”, EighthEdition, Sun Microsystems Press, 2008.
2 K. Arnold and J. Gosling, “The JAVA programming language”, Third edition, Pearson Education, 2000
3 The complete reference JAVA2, Herbert schildt. TMH.
4 C. Thomas Wu, “An introduction to Object-oriented programming with Java”, Fourth Edition, Tata McGraw-Hill Publishing company Ltd., 2006.

COURSE OUTCOME :

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

- Experience in basic concepts of java programming.
- Know practical knowledge in java concepts like objects, classes, streams, multi-threading & GUI.
- Design a small-scale application oriented java program.

PTCSBX53 COMPUTER HARDWARE & INTERFACING

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To enable the student to get a detailed knowledge of all the hardware components that make up a computer and to understand the different interfaces required for connecting these hardware devices.

MODULE I CPU AND MEMORY 8

CPU essentials – processor modes – modern CPU concepts – Architectural performance features – the Intel's CPU – CPU over clocking – over clocking requirements – over clocking the system – over clocking the Intel processors – Essential memory concepts – memory organizations – memory packages – modules – logical memory organizations – memory considerations – memory types – memory techniques – selecting and installing memory.

MODULE II MOTHERBOARDS 8

Active motherboards – sockets and slots – Intel D850GB – Pentium4 mother board – expansion slots – form factor – upgrading a mother board – chipsets – north bridge – south bridge – CMOS – CMOS optimization tactics – configuring the standard CMOS setup – motherboard BIOS – POST – BIOS features – BIOS and Boot sequences – BIOS shortcomings and compatibility issues – power supplies and power management – concepts of switching regulation – potential power problems – power management.

MODULE III STORAGE DEVICES 8

The floppy drive – magnetic storage – magnetic recording principles – data and disk organization – floppy drive – hard drive – data organization and hard drive – sector layout – IDE drive standard and features – Hard drive electronics – CD-ROM drive – construction – CDROM electronics – DVD-ROM – DVD media – DVD drive and decoder.

MODULE IV I/O PERIPHERALS 7

Parallel port – signals and timing diagram – IEEE1284 modes – asynchronous communication - serial port signals – video adapters – graphic accelerators – 3D graphics accelerator issues – DirectX – mice –

modems – keyboards – sound boards – audio bench marks.

MODULE V BUS ARCHITECTURE 7

Buses – Industry standard architecture (ISA), peripheral component Interconnect (PCI) – Accelerated Graphics port (AGP) – plug-and-play devices – SCSI concepts – USB architecture.

MODULE VI 7

Scanners- types. Web and Digital camera. Printers – Dot Matrix – Laser, Inkjet. MODEMS and standards – Lap Top specifications – Configuration and Assembling of a latest PC System.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Craig Zacker & John Rourke, The complete reference:PC hardware , Tata McGraw-Hill, New Delhi, 2001..
2. Stephen J.Bigelow, “Trouble Shooting, maintaining and Repairing PCs”, Tata McGraw-Hill, New Delhi, 2003
3. Computer Fundamentals – B.Ram
4. IBM Clones – B. Govinda Rajulu, TATA McGrraw Hill

COURSE OUTCOME :

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

- Describe and explain the differentiate various analysis in computer field
- Differentiate issues related to CPU and memory.
- Understand the components on the motherboard
- Feature the different I/O peripheral devices and their interfaces.

PTCSBX47 CYBER SECURITY

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To understand the basic concepts related to security
- To study various security models and authentication techniques
- To give an exposure to security threats and evaluation mechanisms

MODULE I INTRODUCTION TO SECURITY FUNDAMENTALS 8

Introduction to security - Information security- Security triad: Confidential, Integrity, Availability -Focus of control - Security threats and attacks - Security management- Identification -Authentication - Authentication by passwords - Protecting passwords

MODULE II ACCESS CONTROL AND SECURITY LEVELS 7

Access control structures -Types of access control-Security levels and categories -Lattice diagram - Reference monitors -Security kernel - Hardware security features -Protecting memory

MODULE III SECURITY MODELS AND CRYPTOGRAPHY 8

Security Models - Bell-LaPadula - Biba - Non-deducibility - Non-interference - Cryptography Basics- Cryptographic mechanisms - Digital signatures -Encryption - Digital Certificates

MODULE IV ADVANCED SECURITY MECHANISMS 8

Authentication in distributed systems - Key establishments and authentication - Kerberos -Public key infrastructures - Single sign-on-Network security - Protocol design principles ISO architecture- IP security - SSL/TLS - Firewalls - Intrusion detection

MODULE V SOFTWARE AND DATABASE SECURITY 7

Software security - Database security -Memory management - Data and code -Relational databases - Access control in databases - Statistical database security-Unix Security-Windows Security

MODULE VI EMERGING SECURITY FOCUS 7

Java Security - Mobile Security - GSM security - Wireless LAN security- Protection measures - Business risk analysis - Prevention, detection and response - Information classifications- Security evaluation

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. *Edward Amoroso, "Cyber Security", Silicon, First Edition Edition, 2006*
2. Dieter Gollmann , "Computer Security", Wiley, 2011

COURSE OUTCOME :

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

- Be able to understand security principles, threats and attack techniques
- Be able to recommend appropriate authentication and access controls
- Be able to understand concepts pertaining to network security, operating system Security, software security and database security

PTCSBX08 CLOUD COMPUTING

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To learn the various cloud concepts and deployment models.
- Describe the landscape of different types of virtualization.
- Comprehend the technical capabilities and business benefits of virtualization and cloud computing and learn how to measure those benefits.

MODULE I VIRTUALIZATION 7

Virtualization : Virtualization and cloud computing - Need of virtualization – cost , administration , fast deployment , reduce infrastructure cost – limitations - Types of hardware virtualization: Full virtualization - partial virtualization - Para virtualization - Desktop virtualization: Software virtualization – Memory virtualization - Storage virtualization – Data virtualization – Network virtualization - Thin client

MODULE II CLOUD INTRODUCTION - ARCHITECTURAL INFLUENCES 7

Cloud Computing Overview – Origins of Cloud computing – Cloud components - Essential characteristics – On-demand self-service, Broad network access, Location independent resource pooling, Rapid elasticity - Architectural influences – High-performance computing , Utility and Enterprise grid computing , Autonomic computing , Service consolidation , Horizontal scaling , Web services, High scalability architecture.

MODULE III CLOUD SCENARIOS AND DEPLOYMENT MODEL 7

Cloud Scenarios – Benefits: Scalability , simplicity , vendors ,security - limitations – application development – security concerns - privacy concern with a third party - security level of third party - security benefits - Regularity issues: Government policies - Cloud deployment model : Public clouds – Private clouds – Community clouds - Hybrid clouds - Advantages of Cloud computing

MODULE IV CLOUD ARCHITECTURE MODELS 7

Cloud architecture: Cloud delivery model - Software as a Service (SaaS): SaaS service providers – Google App Engine, Salesforce.com and google platfrom – Benefits – Operational benefits - Economic benefits – Evaluating SaaS - Platform as a Service (PaaS): PaaS service providers – Right Scale – Salesforce.com – Rackspace – Force.com – Services and Benefits - Infrastructure as a Service (IaaS): IaaS service providers – Amazon EC2 , GoGrid – Microsoft soft implementation and support – Amazon EC service level

agreement – Recent developments – Benefits.

MODULE V CLOUD COLLABORATION 8

Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications – Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Databases – Storing and Sharing Files

MODULE VI CLOUD SERVICES 9

Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services –Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud With SLAs", Haley Beard, Emereo Publishing Limited, July 2008
2. The Hand Book of Cloud Computing ", Borivoje Furht, Armando Escalante, Springer,2010.
3. Cloud computing a practical approach", Anthony T.Velte , Toby J. Velte Robert Elsenpeter TATA McGraw- Hill , 2010.
4. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online", Michael Miller Que, 2008.

COURSE OUTCOME :

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

- Understand cloud computing concepts and deployment of cloud models
- Recognize the pros and cons of cloud computing and operational issues such as vendor selection, initial migration, onsite support, costs, and private versus public deployment
- Aware of the risks associated with cloud computing, including data security and disaster recovery.

PTCSBX51 OPERATING SYSTEMS

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To learn the concepts and creation computer processes and threads.
- To understand memory management and virtual memory concepts.
- To understand process concurrency and synchronization.
- To learn the scheduling policies of modern operating systems.

MODULE I **OVERVIEW OF OPERATING SYSTEMS** 7

Operating Systems Objectives and Functions – Evolution of the Operating systems – Operating System Structures.

MODULE II **PROCESS MANAGEMENT & SCHEDULING** 7

Process Life cycle – Process control – Threads – Multi Threads – Scheduling criteria – Types of scheduling – Scheduling Algorithms.

MODULE III **PROCESS SYNCHRONIZATION** 7

Concurrent process – Principles of Concurrency – IPC – Semaphores – Deadlock – Deadlock Prevention, Avoidance, Detection and recovery.

MODULE IV **MEMORY MANAGEMENT** 7

Introduction – Partitions – paging – segmentation – segmentation and paging – Need for virtual memory management – Demand Paging – Page fault and page replacement policies.

MODULE V **I/O MANAGEMENT AND DISK SCHEDULING** 8

Organization of I/O functions – Evolution of I/O Functions – Logical Structure of I/O functions – I/O Buffering and Blocking – Disk I/O – Disk Scheduling algorithms.

MODULE VI **FILE MANAGEMENT** 9

Principles – File management Techniques – File directories – File System Architecture – file allocation.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Mauerer, Wolfgang , “Professional Linux® Kernel Architecture”, Wrox, 2008.
2. Deitel H M, “Operating Systems”, Pearson education India, New Delhi, 2007.
3. Jim Mauro and Richard McDougall, “Solaris Internals: Solaris 10 and Open Solaris kernel architecture”, Sun Microsystems Press/Prentice Hall, 2007.
4. Dhamdhere D M, “Operating Systems”, Tata Mc Graw Hill, New Delhi, 2006.

COURSE OUTCOME :

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

- A high level understanding of the structure of operating systems, applications, and the relationship between them.
- The students will able to have knowledge of the services provided by operating systems.
- The students will able to have an exposure to some details of major OS concepts.

ELECTRONICS, COMMUNICATION & INSTRUMENTATION

PTEIBX81	BIO INSTRUMENTATION AND SIGNAL ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide an acquaintance of the physiology of the brain , heart and lungs.
- To introduce the student to the biosensors, electrodes and amplifiers.
- To introduce the typical measurement and devices of bio-electric origin
- To provide the latest ideas on devices of imaging techniques and monitoring and awareness of electrical safety of medical equipments
- To bring out the importance of bio-signal analysis and diagnosis

MODULE I ANATOMY AND PHYSIOLOGY 7

Basic components of a biomedical system, Cell and its structure – Action and resting – Potential propagation of action potential – Sodium pump – Nervous system : Nerve cell – Synapse – Cardio pulmonary system : Physiology of heart and lungs – Circulation and respiration.

MODULE II TRANSDUCERS AND AMPLIFIERS 7

Transducers – Different types – Piezo-electric, ultrasonic, resistive, capacitive, inductive transducers – Selection criteria. Electrodes – Micro, needle and surface electrodes – Amplifiers: Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier- ECG isolation amplifiers.

MODULE III ELECTRO – PHYSIOLOGICAL MEASUREMENTS 7

ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms.

MODULE IV MEDICAL IMAGING AND PMS 7

X-ray machine - Radio graphic and fluoroscopic techniques – Computer tomo-graphy – MRI – Ultrasonography – types of biotelemetry systems and patient monitoring systems (PMS) – Electrical safety.

MODULE V BIO SIGNAL ANALYSIS 8

Objectives of biomedical signal analysis – Fundamental of Biosignals – classification of biosignals -

Difficulties encountered in biomedical signal acquisition and analysis – Filtering for removal of artifacts – biosignal processing algorithms: time domain alaysis and frequency domain analysis – Computer aided diagnosis

MODULE VI CASE STUDY 9

Problem statement: Connect up to 8/16 ECG input leads with ECG system or get available ECG data. Use automated analysis features for HRV, to classify heartbeats, identify arrhythmias, perform ECG averaging and report.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL: 45 Hours

REFERENCES:

1. R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', 12th reprint, Tata McGraw Hill Publishing Co Ltd., 2008.
2. J.Webster, 'Medical Instrumentation – Application and Design', 4th Edition, John Wiley & Sons, 2009.
3. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2006.
4. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley & Sons, 1975.
5. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II Edition, Pearson Education, 2008 / PHI.
6. Rangaraj M. Rangayan, Biomedical signal analysis , John Wiley and sons (ASIA) Pvt Ltd., ,2009.

COURSE OUTCOME :

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

1. Students will have an exposure of the physiology of the brain ,heart and lungs
2. Students will be well equipped to choose the proper electrodes and required amplifiers for specific bioapplication.
3. They will be able to analyze typical waveforms of bio potentials
4. They will show their enhanced knowledge on Imaging and will be able provide safety during measurement.

   The students will have the ability to acquire , analyse and identify the abnormalities in biosignals

PTECBX81	INTRODUCTION TO COMPUTER GRAPHICS AND IMAGE PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce students to various two and three dimensional primitives and concepts
- To provide an opportunity for students to represent, design and implement two dimensional and three dimensional objects
- To identify all techniques related to modern graphics programming concepts

MODULE I **DIGITAL IMAGE FUNDAMENTALS** 7

Elements of digital image processing systems, Vidicon and Digital Camera working principles, - Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, Color image fundamentals - RGB, HSI models, Image sampling, Quantization, dither, Two-dimensional mathematical preliminaries, 2D transforms -DFT, DCT.

MODULE II **IMAGE SEGMENTATION** 7

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and Merging – Segmentation by morphological watersheds – basic concepts.

MODULE III **IMAGE COMPRESSION** 7

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Transform coding, JPEG standard, MPEG.

MODULE IV **2D PRIMITIVES** 8

Output primitives – Line, Circle and Ellipse drawing algorithms - Attributes of output primitives – Two dimensional Geometric transformation - Two dimensional viewing – Line and Text clipping algorithms

MODULE V **3D CONCEPTS** 8

Parallel and Perspective projections - Three dimensional object representation – Polygons, Curved lines, Splines, Quadric Surfaces - Visualization of data sets - 3D transformations – Viewing -Visible surface identification.

MODULE VI **GRAPHICS PROGRAMMING** 7

Color Models – RGB, YIQ, CMY, HSV – Animations – General Computer Animation, Raster, Keyframe - Graphics programming using OPENGL – Basic graphics primitives – Drawing three dimensional objects.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Rafael C. Gonzalez, Richard E. Woods, , Digital Image Processing', Pearson, Education, Inc., Second Edition, 2004.
2. Anil K. Jain, , Fundamentals of Digital Image Processing', Pearson Education,Inc., 2002
3. William K. Pratt, “Digital Image Processing” , John Wiley, New York, 2002
4. Milan Sonka et al, “Image Processing, Analysis and Machine vision”, Brookes/Cole, Vikas Publishing House, 2nd edition, 1999
5. Donald Hearn, M.Pauline Baker, “Computer Graphics – C Version”, second edition, Pearson Education,2004
6. Prabhat K Andleigh, Kiran Thakrar, “Multimedia systems design”, PHI, 2007.
7. F.S.Hill, “Computer Graphics using OPENGL” , Second edition, Pearson Education,2003.
8. Ralf Steinmetz and Klara, “Multimedia Computing, Communications and Applications”, Pearson Education, 2004

COURSE OUTCOME :

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

- The students will be able to process digital images
- The students will be able to analyze the images to get information.
- The students will be able to generate images.

PTEIBX82 SENSORS FOR BIO-MEDICAL APPLICATION

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To introduce the student to the various principles, technologies, methods and applications of biosensors and bioinstrumentation.
- to link engineering principles to understanding of bio systems in sensors and bioelectronics
- To bring out the important and modern methods of sensor techniques.
- To provide the student with detail methods and procedures used in the design, fabrication and application of biosensors and bio electronic devices.

MODULE I INTRODUCTION TO BIOSENSORS 7

Introduction to biosensors - Types of bio sensors: Bio transducers – Different types - active and passive transducer – factors influencing and selection criteria of transducers for physiological parameters - Transducer for biomedical application

MODULE II BIO RESISTIVE SENSORS 7

Resistive Transducers: Strain Gauge - types, construction, selection materials, Gauge factor, Bridge circuit, calibration. Strain Gauge type Blood pressure transducers. Thermistor used for cardiac output measurement, nasal air flow measurement - Photoelectric type resistive transducer.

MODULE III NON CONTACT TYPE BIOSENSORS 7

Non contact type infrared thermometry; Optical pyrometer - Electrochemical Biosensors: Electrochemical principles - Glucose biosensors – piezoelectric sensors – ultrasonic sensors

MODULE IV BIO ELECTRODES AND AMPLIFIERS 8

Electrodes – Micro, needle and surface electrodes – Amplifiers: Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier- ECG isolation amplifiers.

MODULE V BIO-CHEMICAL SENSORS AND NON ELECTRICAL MEASUREMENT 8

pH, pO2, pCO2, Electrophoresis, photometer, Auto analyzer, Blood flow sensors, phonocardiogram,

respiratory measurement, pulse, Blood cell counters.

MODULE VI CASE STUDY 7

To analyse a diabetic patient using glucose biosensors – to analyse an asthma patient using respiratory sensors – selection of temperature, pressure and flow sensors for biomedical application

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. R.S. Khandpar, “Hand Book of Biomedical Instrumentation and measurement”, McGraw Hill publishing Co., 2009.
2. Aston, “Principles of Biomedical Instrumentation and measurements”, McGraw Hill publishing Co., 2007
3. Arumugam, “Biomedical Instrumentation”, Anuradha Agencies Publishers, Vidayal Karuppar, 612 606, Kumbakonam, R.M.S: 2008.
4. John G. Webster, ‘*Medical Instrumentation application and design*’ 3 edition (Wiley) (1997).
5. E.A.H.Hall, ‘*Biosensors*’, (Prentice Hall, Advanced Reference Series, Engineering, New Jersey) (1991)

COURSE OUTCOME :

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

- On bio sensing and transducing techniques, design and construct biosensors instrumentation.
- of detail methods and procedures used in the design, fabrication and application of biosensors and bio electronic devices.
- To apply the above techniques for biomedical applications

PTECBX82	VLSI DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the students to VLSI Design Flow, Transistor-Level CMOS Logic Design, VLSI Fabrication and Physical Design
- To enable the student to Analyze Gate Function and Timing Characteristics and to study High-Level Digital Functional Blocks

MODULE I VHDL MODELING AND DESIGN FLOW 7

Introduction to VLSI- complete VLSI design flow (with reference to an EDA tool). Sequential, Data flow, and Structural Modeling. Functions. Procedures, attributes. Test benches, Synthesizable, and non synthesizable statements; packages and configurations Modeling in VHDL with examples of circuits such as counters, shift registers, bidirectional bus, etc.

MODULE II FSM AND SEQUENTIAL LOGIC PRINCIPLES 7

Sequential Circuits, Meta-stability Synchronization, Design of Finite State Machines, and State minimization, FSM CASE STUDIES - Traffic Light control. Lift Control and UART STA and DTA

MODULE III PROGRAMMABLE LOGIC DEVICES 7

Introduction to the CPLDs, Study of architecture of CPLD. and Study of the Architecture of FPGA

MODULE IV SYSTEM ON CHIP 8

One, two phase clock, Clock distribution. Power distribution. Power optimization, SRC and DRC, Design validation, Global routing, Switch box routing. Off chip connections, I/O Architectures, Wire parasitics, EMI immune design. Study of memory-Basics of memory Includes types of memory cells and memory architectures. Types of memory, based on architecture specific and application specific viz. SRAM, DRAM, SDRAM, FLASH, FIFO.

MODULE V CMOS VLSI 8

CMOS parasitics, equivalent circuit, body effect, Technology Scaling, A. parameter. Detail study of Inverter Characteristics, power dissipation, power delay product, CMOS combinational logic design and W/L calculations. Transmission gates, Introduction to CMOS layout.

MODULE VI TESTABILITY 7

Need of Design for testability, Introduction to Fault Coverage, Testability. Design- for- Testability, Controllability and Observability, Stuck-at Fault Model. Stuck-Open and Stuck-Short faults. Boundary Scan check. JTAG technology; TAP Controller and TAP Controller State Diagram. Scan path. Full and Partial scan. BIST.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Charles Roth, "Digital System Design using VHDL". McGraw hill.
2 Xilinx Data Manual "The Programmable Logic Data Book".
3 Stephen Brown and Zvonko Vranesic, "Fundamentals of Digital
4 Logic with VHDL Design", Second Edition, McGraw-Hill, 2005.
5 Michael John Sebastian Smith, "Application-Specific Integrated Circuits", Addison Wesley.
6 Wayne Wolf, "FPGA-Based System Design", Prentice Hall,
7 Miron Abramovici, "Digital Systems Testing and Testable Design", Jaico Publishing
8 Sung-Mo (Steve) kang, Yusuf Leblebici, " CMOS Digital
9 Integrated Circuit", Tata McGraw-Hill Publication.

COURSE OUTCOME :

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

- The student will have an understanding of how to construct fundamental VLSI systems structures from primitive circuit structures, we also will learn about the processes associated with fabricating CMOS devices.
- The student will have a complete picture of the VLSI systems design flow, starting at the Systems

level, proceeding through the Register Transfer Level, to the Digital Logic, level—therefore having a complete idea of the VLSI systems architecture and engineering design process and associated design methods.

PTECBX83	INTEGRATED CIRCUITS AND SYSTEM DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the students to active and passive components available in CMOS and their parasitic elements of first order transistor modelling for initial manual design and the limits of applicability.
- To teach the student behaviour and design of basic analogue and digital circuit primitives, including quantitative treatment of matching.
- The students are introduced to switched capacitor techniques and continuous time filters.

MODULE I BASIC SEMICONDUCTOR PHYSICS 7

Quantum mechanical concepts and atomic states – Solid state structure – Intrinsic, Extrinsic and compensated semiconductors – Lattice vibrations – Electron and hole mobilities and drift velocities

MODULE II DEVICES 7

Diode - CMOS – Wire models – CMOS inverter - Static behavior, Dynamic Behavior, Power, Energy.

MODULE III DIGITAL SYSTEMS 7

DTL IC – HTL IC – TTL IC – ECL IC – Basic digital circuits – Special Purpose gates – Flip flops – Clock and waveform generators.

MODULE IV SEQUENTIAL AND COMBINATIONAL LOGIC DESIGN 8

Ripple Adder, Look Ahead Carry Generator, Binary Parallel Adder, n-Bit Parallel Subtractor, Priority Encoder, Design considerations of the above combinational logic circuits with relevant Digital ICs.

MSI Registers - Shift Registers - Modes of Operation of Shift Registers, Ring Counter, Johnson Counter -Basic sequential logic Design steps - Design considerations of the above sequential logic circuits with relevant Digital ICs.

MODULE V ANALOGUE INTEGRATED CIRCUIT DESIGN 8

CMOS amplifier basics – Current and Voltage sources – CMOS operational amplifiers – Data conversion circuits.

MODULE VI SYSTEM DESIGN EXAMPLES 7

Frequency counter – DACs and ADCs – Filter design - Filter response, Low pass RC active filter, Bandpass RC active filter, Switched C filter – Combinational logic design.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Physics of Semiconductor Devices – Michael Shur, Prentice Hall.
2. Introduction to system design – B. S. Sonde, New Age International.
3. Razavi, B. 1998 Design of Analog CMOS Integrated Circuits, McGraw Hill.
4. Digital Design Principles & Practices By John F. Wakerly, PHI Publications, Third Edition., 2005.
5. Digital Integrated Circuits-A Design Perspective By Jan M.Rabaey, Anantha Chandrakasan, Borivoje Nikolic, Pearson Education, 2005.
6. Introduction to Logic Design – Alan B. Marcovitz,TMH, 2nd Edition,2005. Digital Logic and Computer Design By Mano, Pearson Education.

COURSE OUTCOME :

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

- The student has a thorough understanding of the characteristic and design aspects of IC circuits.
- The student will be able to build simple digital and analogue ICs.

PTECBX84	COMMUNICATION SYTEM SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To familiarize the students with the issues and technologies involved in designing a communication network system that is robust against attack.
- Students will gain an understanding of the various ways in which a network can be attacked and the tradeoffs in protecting it.

MODULE I **NETWORK FUNDAMENTALS AND PHYSICAL LAYER** 7

Introduction to Networks, definition of layers, services, interface and protocols. OSI reference model- layers and duties. TCP/IP reference model – layers and duties. Physical layer- general description, characteristics, signaling media types, topologies, examples physical layer (RS232C, ISDN, ATM,SONET)

MODULE II **INTRODUCTION ON SECURITY** 7

Security Goals, Types of Attacks- Passive attack, active attack, attacks on confidentiality, attacks on Integrity and availability. Security services and mechanisms, Techniques - Cryptography, Steganography , Revision on Mathematics for Cryptography.

MODULE III **SYMMETRIC & ASYMMETRIC KEY ALGORITHMS** 7

Substitution Ciphers, Transposition Ciphers, Stream and Block Ciphers, Data Encryption Standards (DES), Advanced Encryption Standard (AES), RC4, principle of asymmetric key algorithms, RSA Cryptosystem.

MODULE IV **INTEGRITY, AUTHENTICATION AND KEY MANAGEMENT** 8

Message Integrity, Hash functions - SHA, Digital signatures - Digital signature standards. Authentication Entity Authentication- Biometrics, Key management Techniques.

MODULE V **NETWORK SECURITY, FIREWALLS AND WEB SECURITY** 8

Introduction on Firewalls, Types of Firewalls, Firewall Configuration and Limitation of Firewall. IP Security Overview, IP security Architecture, authentication Header, Security payload, security associations, Key Management. Web security requirement, secure sockets layer, transport layer security, secure electronic transaction, dual signature.

MODULE VI **WIRELESS NETWORK SECURITY** 7

Security Attack issues specific to Wireless systems- Worm hole, Tunneling, DoS.WEP for Wi-Fi network, Security for 4G networks- Secure Ad hoc Network, Secure Sensor Network

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Behrouz.A. Forouzan, Data Communication And Networking, 4th Edition, Tata McGraw Hill, 2007.
2. John C. Bellamy, Digital Telephony, 3rd Edition, John Wiley 2006.
3. Wireless Security – Models, Threats, and Solutions," by Nichols and Lekkas, McGraw-Hill, 2002.
4. Behrouz A. Fourcuzan ," Cryptography and Network security" Tata McGraw- Hill, 2008.
5. William Stallings,"Cryptography and Network security- principles and practice",2nd Edition,Prentice Hall of India,New Delhi,2002
6. Atul Kahate ," Cryptography and Network security", 2nd Edition, Tata McGraw- Hill, 2008
7. R.K.Nichols and P.C. Lekkas ," Wireless Security"

COURSE OUTCOME :

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

- Students will gain an appreciation of the need to develop an understanding of underlying system applications and potential security issues early in the design process.

PTECBX85	EMBEDDED HARDWARE & SOFTWARE SYSTEM DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- The objective of this course is to present to the student the computation devices, peripherals and networks associated with an embedded system.
- The students are introduced to embedded - C used in the design of a modern day embedded system.

MODULE I **ARCHITECTURE OF EMBEDDED SYSTEMS** 7

Categories of Embedded Systems - Specifications of Embedded systems - Resent trends in Embedded Systems - Hardware Architecture - Software Architecture - Communication software - Process of generation of executable image-development/testing tools.

MODULE II **HARDWARE FUNDAMENTALS** 7

Buses – DMA – interrupts – Built-ins on the microprocessor – Conventions used on schematics – Microprocessor Architectures – Software Architectures – RTOS Architectures – Selecting and Architecture. PIC microcontroller - Architecture of PIC 16c6x/7x – FSR - Reset action – Oscillatory connection - Memory organization - Instructions - Addressing modes - I/O ports – Interrupts – Timers – ADC - Assembly language programming.

MODULE III **RTOS** 7

Tasks and Task states – Semaphores – Shared data – Message queues, Mail boxes and pipes – Memory management – Interrupt routines – Encapsulating semaphore and queues – Hard Real-time scheduling – Power saving

MODULE IV **PROGRAMMING EMBEDDED SYSTEMS** 8

Embedded Program – Role of Infinite loop – Compiling, Linking and locating – downloading and debugging – Emulators and simulators processor – External peripherals – Memory testing – Flash Memory

MODULE V **OPERATING SYSTEM** 8

Embedded operating system – Real time characteristics – Selection process – Flashing the LED – serial ports – Zilog 85230 serial controlled code efficiency – Code size – Reducing memory usage .

MODULE VI **EMBEDDED SOFTWARE DEVELOPMENT TOOLS** 7

Host and target machines – Linkers / Locators for Embedded Software – Debugging techniques – Instruction set simulators Laboratory tools – Practical example – Source code

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. David E.Simon, “An Embedded Software Primer”, Perason Education, 2003.
2. Michael Bass, “Programming Embedded Systems in C and C++”, Oreilly, 2003.
3. K.V.K.K.Prasad “Embedded /Real-Time Systems-Concepts, Design and Programming” Dream tech, Wiley 2003.
4. Ajay V Deshmukh “Microcontroller Theory and Applications” Tata McGraw Hill 2005
5. Raj Kamal “Embedded Systems Architecture Programming and Design” 2nd Edition TMH,2008
6. David E Simon “An Embedded Software Primer ” Pearson Education 2003
7. Daniel 5.W Lewis, “Fundamentals of Embedded Software” Pearson Education-2001
8. Peatman “ Designing with PIC Micro Controller”,Pearson 2003.

COURSE OUTCOME :

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

- Will provide a knowledge foundation which will enable students to pursue subsequent courses in real-time embedded systems software and computer design.

PTECBX86	SPEECH PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce fundamental models for production, perception and recognition of speech.
- To provide an introduction to the field of digital speech processing.
- The students are introduced to speech synthesis analysis and application.

MODULE I **BASIC CONCEPTS** 7

Speech Fundamentals- Articulatory Phonetics – Production and Classification of Speech Sounds- Acoustic Phonetics – acoustics of speech production- Review of Digital Signal Processing concepts- Short-Time Fourier Transform- Filter-Bank and LPC Methods

MODULE II **SPEECH ANALYSIS** 7

Features, Feature Extraction and Pattern Comparison Techniques- Speech distortion measures – mathematical and perceptual – Log Spectral Distance- Cepstral Distances-Weighted Cepstral Distances and Filtering- Likelihood Distortions-Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

MODULE III **SPEECH MODELING** 7

Hidden Markov Models- Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.

MODULE IV **TIME DOMAIN METHODS FOR SPEECH PROCESSING** 8

Time domain parameters of Speech signal – Methods for extracting the parameters Energy, Average Magnitude, Zero crossing Rate – Silence Discrimination using ZCR and energy – Short Time Auto Correlation Function – Pitch period estimation using Auto Correlation Function

MODULE V **FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING** 8

Short Time Fourier analysis- Fourier transform and linear filtering interpretations, Sampling rates - Spectrographic displays - Pitch and formant extraction - Analysis by Synthesis - Analysis synthesis systems- Phase vocoder, Channel Vocoder - Homomorphic speech analysis- Cepstral analysis of Speech, Formant and Pitch Estimation, Homomorphic Vocoders

MODULE VI **APPLICATION OF SPEECH SIGNAL PROCESSING** 7

Algorithms- Dynamic time warping, K-means clustering and Vector quantization, Gaussian mixture modeling, hidden Markov modeling - Automatic Speech Recognition- Feature Extraction for ASR, Deterministic sequence recognition, Statistical Sequence recognition, Language models - Speaker identification and verification – Voice response system – Speech synthesis- basics of articulatory, source-filter, and concatenative synthesis – VOIP

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	**TOTAL: 45 Hours**

REFERENCES:

1. Steven W. Smith, “The Scientist and Engineer’s Guide to Digital Signal Processing”, California Technical Publishing, 1997..
2. Thomas F Quatieri, “Discrete-Time Speech Signal Processing – Principles and Practice”, Pearson Education, 2004.
3. Claudio Becchetti and Lucio Prina Ricotti, “Speech Recognition”, John Wiley and Sons, 1999.
4. Ben gold and Nelson Morgan, “Speech and audio signal processing”, processing and perception of speech and music, Wiley- India Edition, 2006 Edition.
5. Ben Gold and Nelson Morgan, Speech and Audio Signal Processing, John Wiley and Sons Inc., Singapore, 2004
6. L.R.Rabiner and R.W.Schaffer – Digital Processing of Speech signals – Prentice Hall -1979
7. L.R. Rabiner and B. H. Juang, Fundamentals of Speech Recognition, Prentice Hall, 1993.
8. .R. Deller, J.H.L. Hansen and J.G. Proakis, Discrete Time Processing of Speech Signals, John Wiley, IEEE Press, 1999.

COURSE OUTCOME :

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

- To be able to describe and implement methods and systems for efficient quantization and coding of speech signals.
- To be able to describe and implement simple pattern-recognition applications of speech processing, such as speaker and speech recognition.

PTEIBX83 INTELLIGENCE CONTROL

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES:

- This course will obtain a basic understanding of artificial neural networks, fuzzy logic control and intelligent technique.
- Students will know how these techniques are applied to engineering problems, including control systems.

MODULE I INTRODUCTION TO INTELLIGENT CONTROL 7

Introduction and motivation, Approaches to intelligent control, Architecture for intelligent control, Symbolic reasoning system, rule-based systems, the AI approach, Knowledge representation, Expert systems.

MODULE II MATHEMATICAL MODELING 7

Concept of Artificial Neural Networks and its basic mathematical model ,McCulloch-Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron, Learning and Training the neural network, Data Processing: Scaling, Fourier transformation, principal-component analysis and wavelet transformations.

MODULE III NEURAL NETWORKS 7

Networks: Hopfield network, Self-organizing network and recurrent network, Neural Net based controller. Case studies: Identification and control of linear and nonlinear dynamic systems using Mat lab-Neural Network toolbox

MODULE IV INTRODUCTION TO FUZZY LOGIC 8

Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning, Introduction to fuzzy logic modeling and control, Fuzzification, inference and defuzzification. Fuzzy knowledge and rule bases, Fuzzy modeling and control schemes for nonlinear systems, Fuzzy logic control for nonlinear time-delay system, Implementation of fuzzy logic controller using Mat lab fuzzy-logic toolbox.

MODULE V FUZZY LOGIC SYSTEM 8

Fuzzy logic system: Basic concepts of Fuzzy logic approaches, classical sets & Fuzzy sets, linguistic variables, membership functions, basic operation, Fuzzy relations, numbers and arithmetic & logical operations, different de-Fuzzification techniques, Fuzzy rule based model & model based controllers, PID controllers, and application of Fuzzy controllers.

MODULE VI GENETIC ALGORITHM 7

Genetic Algorithm: Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters. Solution of typical control problems using genetic algorithm.

LECTURE HOURS: 45	TUTORIAL HOURS: 0	PRACTICE HOURS: 0	TOTAL: 45 Hours

REFERENCES:

1. Freeman Neural network : Algorithms Applications and Programming Techniques,
2. Goldberg, Genetic Algorithm in Search, Optimization, and Machine Learning,
3. Addison Wesley Publishing Company, Inc. 1989.
4. Millon W.T., Sutton R.S., and Webrose P.J., Neural Networks for control, MIT Press,1992.
5. MATLAB Neural Network Tool Box Manual.
6. MATLAB Fuzzy Logic Tool Box Manual.
7. R. Eberhart, P.simpson and R.Dobbins,"Computional Intelligence" PC Tools", AP
8. Laurence Fausett, Fundamentals of Neural Networks, Prentice Hall, Englewood cliffs, N.J., 1992. Professional, Boston 1996.
9. Jacek M.Zurada, Introduction to Artificial Neural Systems, Jaico Publishing House, Mumbai, 1997.
10. Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw Hill Inc.,1997.

COURSE OUTCOME :

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

- Students will be able to design control systems using fuzzy logic and artificial neural networks.
- Students will understand the advantages and disadvantages of these methods relative to other control methods.
- Students will be aware of current research trends and issues.