GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to - Anna University)

Coimbatore - 641 013

Curriculum & Syllabi (I - VII SEM)

B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING)

(Part Time)

2012

Regulations

Regulations

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**Regulations for Part Time candidates admitted during the academic year
2012 - 2013 and onwards**

1. **CONDITIONS FOR ADMISSION**

   Candidates for admission to the first year of the Part Time - Seven Semester B.E. Degree course shall be required to have passed,

   i.   the Diploma Examination in Engineering conducted by the State Board of Technical Education and Training, Tamil Nadu.

   (or)

   ii.   an Examination of any University or Authority, accepted by the Syndicate of the Anna University as equivalent thereto.

   (or)

   iii.   any other examination as notified by the Government of Tamil Nadu.

   Any other conditions as notified by the Government of Tamil Nadu.

2. **BRANCHES OF STUDY**

   Branches will be offered at the time of admission to the course. The following are the branches offered in this college.

   1. B.E.   Civil Engineering
   2. B.E.   Mechanical Engineering
   3. B.E.   Electrical and Electronics Engineering
   4. B.E.   Electronics and Communication Engineering

3. **STRUCTURE OF PROGRAMMES**

   3.1 Every programme shall have a curriculum with well – defined syllabi comprising of both theory and practical courses such as :

   i.   General core subjects comprising Mathematics, Basic Sciences, Engineering Sciences, Humanities and Engineering arts.
   ii.   Core subjects of Engineering / Technology
   iii.   Elective subjects for specialization in related fields
   iv.   Workshop practice, computer practice, engineering graphics, laboratory work, industrial training, seminar presentation, project work, educational tours, camps etc.

   3.2 The subjects of study shall be both theory and practical and shall be in accordance with the prescribed syllabus.

   3.3 Each semester curriculum shall normally have a blend of lecture and practical subjects not exceeding 5.

   3.4 A student who has passed all the subjects prescribed in the curriculum for the award of the

degree shall not be permitted to re-enroll to improve his/her **credits** in a subject or the aggregate **credits**.

3.5 The medium of instruction in examinations and project report shall be English.

4. DURATION OF THE PROGRAMME

The duration of the programme for the Degree of B.E. Programme shall be SEVEN (7) semesters with semester pattern. The number of working days will be **90 days** (which includes **15 days** for end semester examinations) or **450 Hours** or **540** periods of each 5Q minutes duration for semester pattern. The number of working days is to be calculated excluding study holidays, Government holidays and end - semester examination days. The Head of the Department shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught.

5. SYSTEM OF EXAMINATION

Performance in each subject of study shall be evaluated based on (i) continuous internal assessment through the semester and (ii) an end semester examination.

THEORY

End semester Examinations will be conducted in all the theory subjects of study at the end of each semester for all the subjects. The maximum marks of each subject shall be 100, out of which the continuous internal assessment will carry 25 marks, while the end semester Examination will carry 75 marks.

To arrive the internal mark the following guidelines are to be followed.
(i)	Test	(3 Nos.) { each test is to be conducted for 50 Marks}	: 60 Marks
(ii)	Assignment	(3 Nos.)	: 30 Marks
(iii)	Attendance		: 10 Marks
			100 Marks

Total 100 Marks should be reduced to 25 Marks

* Attendance (10 Marks)

Percentage of attendance	Marks
75	0
76 - 80	2
81 - 84	4
85 - 89	6
90 - 94	8
95 and above	10

PRACTICAL

The Practical classes for all the Practical / Lab component subjects will be assessed continuously and marks will be entered in the prescribed proforma. The progress of Practical classes will be monitored by a committee formed by the concerned Head of the Departments / Professor in-charge of the Programme to ensure that the concerned staff conducts the laboratory experiments as specified in the syllabus. The proforma should be submitted at the end of the each month for Principal's / Chairman, Board of Examinations' approval. The maximum marks for the Practical / Lab component subjects shall be 100, out of which the continuous internal assessment

will carry 25 marks, while the end semester practical examination will carry 75 marks. If any practical subject contains Part A and Part B components, the maximum marks for each Part of the lab will be 50 marks, out of which the continuous internal assessment will carry 12.5 marks, while the end semester practical examination will carry 37.5 marks. The award of the end semester practical examination marks shall be conducted by both the Internal and External examiners. To arrive the internal mark the following guidelines are to be followed.

(i) Continuous Assessment : 50 Marks
(ii) Test (minimum one) : 40 Marks
(iii) Attendance* : 10 Marks

Total 100 Marks should be reduced to 25 Marks

*Attendance (10 Marks)

Percentage of attendance	Marks
75	0
76 - 80	2
81 - 84	4
85 - 89	6
90 - 94	8
95 and above	10

PROJECT WORK AND VIVA - VOCE :

For the project work and viva-voce examination the maximum marks shall be 200 comprising of 50 marks for internal assessment and 150 for the end semester examination. The award of the end semester marks for 150 shall be evaluated by both the Internal and External examiners, out of which the project report shall carry a maximum of 50 marks (same mark must be awarded to every student of the project group) while the viva-voce examination shall carry 100 marks (awarded to each student of the project group based on the individual performance in the viva-voce examination).

For Internal Mark:

Work assessed by Guide / Supervisor : 50 % weight
Work assessed by a Committee : 50 % weight

6. REQUIREMENTS OF EXAMINATIONS AND ATTENDANCE

A candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester.

6.1   A candidate will be permitted to appear for the Examination for any semester, only if

i.   he / she secures not less than 75% of attendance in the number of working days during that semester, provided that it shall be open to Chairman of the Academic Council or any authority delegated with such powers (by the governing body) to grant exemption (based on the recommendation of the Head of the Department) to a candidate who has failed to secure 75% of the attendance for valid reasons and has secured not less than 66% of the attendance. Such exemptions can be allowed only TWO times during his/ her entire period of study.

ii.   Candidates representing University in State / National / International / Inter University Sports events, Co & Extra - Curricular activities, paper or project presentation with prior permission from the Head of Institution are given exemption upto 10% of the required attendance and such candidates shall be permitted to appear for the current semester examination.

iii.   his / her conduct has been certified to be satisfactory by the concerned Head of Department.

iv.   **Condonation can be allowed only two times during his / her entire course of study.**

6.2   Candidates who do not complete the semester (as per clause 6.1), will not be permitted to write the end-semester examination and are not permitted to go to next semester. They are required to repeat the incomplete semester in the next academic year.

7.   PROCEDURES FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

i.   Every teacher is required to maintain a 'ATTENDANCE AND ASSESSMENT RECORD' which consists of attendance marked in each lecture or practical or project work class, the test marks and the record of class work (topic covered), separately for each course. This should be submitted to the Head of the Departments periodically (atleast three times in a semester) for checking the syllabus coverage and the records of test marks and attendance. The Head of the Departments will put his signature and date after due verification at the end of the semester, the record should be verified by the Head of the Institution who will keep this document in safe custody (for five years).

ii.   **Theory subjects [25 marks]**

   (a).   **Unit Tests [60% weight] :**
   Three tests each carrying fifty (50) marks shall be conducted by the Department / Institution. The total marks obtained in all the test put together out of 150, shall be reduced to 60 marks and rounded to nearest integer (this implies equal weight to all the three tests). However a retest at the discretion of the Head of the Department may be conducted for the deserving candidates.

   (b).   **Assignment [30% weight] :**
   Three Assignments requiring work of average 5 to 6 hours of study and written work of average 5 to 6 hours, each carried out by a student in a separate assignment folder, duly indexed with headings, date of submission, marks, remarks and signature of faculty with date etc.

   (c).   **Attendance [10% weight] :**
   A maximum 10 marks for attendance out of 100 marks shall be given to each student depending on his/her attendance percentage as per the distribution given below:

   Attendance (10 Marks)

Percentage of attendance	Marks
75	0
76 - 80	2
81 - 84	4
85 - 89	6
90 - 94	8
95 and above	10

The Internal marks are valid for two more attempts in addition to the current attempt for the candidates admitted from the academic year 2009 - 2010 and onwards. If a candidate scores 50% of marks only in the end semester examination, after three attempts (First attempt + two more attempts), he / she would be declared as a passed candidate in that examination.

iii. **Practical Courses [25 marks]**

Every practical exercise / experiment shall be evaluated based on conduct of exercise / experiment and records maintained. There shall be atleast one test. The criteria for arriving the internal assessment marks are :

> Experiment / Record / Average Practical classes performance: 50% weight
> Practical Test   : 40% weight
> Attendance   : 10% weight
> Total 100 marks should be reduced to 25 marks

iv. **Theory Subjects with Laboratory Component**

(a). **Unit Tests [60% weight] :**

If there is a theory subject with Laboratory component, there shall be three tests; the first two tests (each 50 Marks) will be from theory portions and third test (maximum marks 50) will be for laboratory component. The total 150 marks should be reduced to 60 marks. However a retest at the discretion of the Head of the Department may be conducted for the deserving candidates.

(b). **Assignment [30% weight] :**

Three Assignments (at least 2 per term) requiring work of average 5 to 6 hours of study and written work of average 5 to 6 hours, each carried out by a student in a separate assignment folder, duly indexed with headings, date of submission, marks, remarks and signature of faculty with date etc.

(c). **Attendance [10% weight] :**

A maximum 10 marks for attendance out of 100 marks shall be given to each student depending on his/her attendance percentage as per the distribution given below:

Attendance (10) Marks

Percentage of attendance	Marks
75	0
76 - 80	2
81 - 84	4
85 - 89	6
90 - 94	8
95 and above	10

The Internal marks are valid for two more attempts in addition to the current attempt for the candidates admitted from the academic year 2009 - 2010 and onwards. If a candidate scores 50% of marks only in the end semester examination, after three attempts (First attempt + two more attempts), he / she would be declared as a passed candidate in that examination.

v. **Project Work**

There shall be three assessments during the semester by a review committee. The students shall make presentation on the progress made before the committee. The Head of the Institution shall constitute the review committee for each branch of study. The criteria for arriving the internal assessment marks for the Project Work evaluated for 50 marks are :

Work assessed by the Project Guide   : 50%
Work Assessed by a committee   : 50%

The Internal marks are valid for two more attempts in addition to the current attempt for the candidates admitted from the academic year 2009 - 2010 and onwards. If a candidate scores 50% of marks only in the end semester examination, after three attempts (First attempt + two more attempts), he / she would be declared as a passed candidate in that examination.

8. PROCEDURE FOR COMPLETING THE PROGRAMME

i.   A candidate who has for some reason discontinued the course can join the course of study of any semester only at the time of its normal commencement in the Institution for regular students upon satisfying all the following conditions

   a) he / she should have completed the course of study of the previous semesters.
   b) he / she should be eligible to register for the examinations and satisfy rule 8 (iii)
   c) he / she should have registered for all the examinations of the previous semesters.

ii.   A candidate will be permitted to proceed from one semester to the next higher semester only if he / she has satisfied the regulation for eligibility to appear for the End-Semester examination in the concerned semester, subject to the condition that the candidate should register for all the arrear subjects of lower semesters along with the current (higher) semester subjects.

iii. A candidate should have completed the B.E. Degree Programme within a period of **SEVEN** consecutive academic years (14 semesters) from the date of admission to the course, even if the candidate discontinues and rejoins subsequently, to be eligible for the award of the degree. The minimum and maximum period for completion of the U.G. Programmes are given below:

Programme	Min. No. of Semesters	Max. No. of Semesters
B.E. (Part Time)	7	14

9. REQUIREMENTS FOR APPEARING FOR SEMESTER EXAMINATION

A candidate shall normally be permitted to appear for the semester examination of the current semester if he/she has satisfied the semester completion requirements (Subject to Clause 6.1) and has registered for examination in all subjects of that semester. Registration is mandatory for current semester examinations as well as arrears examinations failing which the candidate will not be permitted to move to the higher semester.

10. PASSING MINIMUM AND CLASSIFICATION OF SUCCESSFULL CANDIDATES

i.   For each subject the examination will be conducted for 100 marks. A candidate who secures not less than 50% of the total marks in the End Semester examination and Internal Assessment put together in both theory and Practical courses, including Project work, subject to securing a minimum of 50% in the End - Semester examination,

wherever applicable, shall be declared to have passed the examination in that subject. When the mark secured for 100 is converted to 75, minimum 37 marks must be secured for pass. Any Programme, during any semester, conducts the lab in two parts, say A and B, it is mandatory that the student must appear for both the parts of the lab in the end semester practical examination. The candidate is declared as pass in both the parts A and B lab, only if he / she secures a minimum **of 50% put together,** and the student must compulsorily appear for both the parts of the lab in the end semester practical examination. If the candidate is absent for any one part of the lab, the candidate is declared as fail in both the parts A and B of the lab [marked as Absent in External Examinations] and he / she should appear in both, part A and B in the Subsequent semesters.

ii. A candidate who successfully completes the course requirements and has passed all the prescribed examinations in all the Seven Semesters within a maximum period of Seven years(14 semesters) reckoned from the commencement of the first semester to which the candidate was admitted is eligible to get the degree.

iii. A candidate who qualifies for the Degree by passing the examination in all subjects of the entire Programme in first attempt within a period of Seven Semesters from the date of admission to the Programme and secures a **CGPA of not less than 8.00** for the entire Programme shall be declared to have passed the examination for the degree in **FIRST CLASS WITH DISTINCTION.** For this purpose the withdrawal from examination will not be construed as an appearance. Further, the authorized break of study will not be counted for the purpose of classification.

iv. A candidate transferred from other Institution, who qualifies for the Degree by passing the examination in all subjects of the entire Programme in first attempt within a period of Seven Semesters from the date of admission to the Programme and secures a **CGPA of not less than 8.00** for the entire Programme shall be declared to have passed the examination for the degree in **FIRST CLASS WITH DISTINCTION.** For this purpose the withdrawal from examination will not be construed as an appearance. Further, the authorized break of study will not be counted for the purpose of classification.

v. A candidate who qualifies for the award of the Degree having passed the examinations in all the subjects of the Programme in the semesters first to seven within a maximum period of Nine consecutive semesters after his/her commencement of study in the first semester and secures a **CGPA of not less than 6.50** for the entire Programme shall be declared to have passed the examination for the degree in **FIRST CLASS.** For this purpose, the authorized break of study will not be counted for the purpose of classification.

vi. All other successful candidates shall be declared to have passed the examination for the Degree in **SECOND CLASS.**

vii. A candidate who is absent in semester examination in a subject / project work after having registered for the same shall be considered to have appeared in that examination for the purpose of classification.

11. ISSUE OF GRADE SHEETS

Individual grade sheet for each semester will be issued, containing the following information through the Head of the Department concerned, after the publication of the results.

i)   The **credits** obtained in each subject in internal assessment and end semester examination and total **credits** obtained for each course.

ii)   Whether the candidate has passed / failed in the courses concerned.

12. MALPRACTICE

If a student indulges in malpractice in any of the end semester examinations, he / she shall be liable for punitive action as and when prescribed by the **Anna University, chennai.**

13. REVALUATION

i.   Copies of answer script for theory subjects can be obtained from the Office of the Controller of Examinations on payment of a prescribed fee specified for this purpose through proper application.

ii. A candidate can apply for revaluation of his / her semester examination answer paper in a theory subject, on payment of a prescribed fee through proper application to the Office of the Controller of Examinations, as per the norms given by the Chairman, Academic Council. Revaluation is not permitted for Practical subjects and for Project work.

iii. Retotalling is permissible for all arrear and current theory subjects.

iv. Challenging the revaluation is permitted ,for those students who have applied for photocopy of the answer script. The Copy of answer Script is to be valued by a competent authority and the valued script should be submitted to COE's office along with the prescribed fee for challenging revaluation.

14. ELIGIBILITY FOR THE AWARD OF DEGREE

A candidate shall be declared to be eligible for the award of the B.E Degree provided the candidate has

i)   Successfully completed the course requirements and has passed all the prescribed examinations in all **the 7 semesters within a maximum period of 7 years** from the commencement of first semester to which the candidate was admitted.

ii) The award of degree must have been approved by the Syndicate of the University.

iii) The Minimum credit to be earned to get -PTBE degree is 90 .

15. CLASS COMMITTEE

15.1 A class committee consists of teachers of the concerned class, student representatives and a chairperson who is not teaching the class. It is like the 'Quality Circle' (more commonly used in industries) with the overall goal of improving the teaching-learning process. The functions of the class committee include

- Solving problems experienced by students in the class room and in the laboratories.
- Clarifying the regulations of the degree programme and the details of rules therein.
- Informing the student representatives the academic schedule including the dates of assessments and the syllabus coverage for each assessment.
- Informing the student representatives the details of Regulations regarding weightage used for each assessment. In the case of practical courses (laboratory/drawing/ project work/ seminar etc.) the breakup of marks for each experiment / exercise/ module of work, should be clearly discussed in the class committee meeting and informed to the students.
- Analyzing the performance of the students of the class after each test and finding the ways and means of solving problems, if any.
- Identifying the weak students, if any, and requesting the teachers concerned to provide some additional help or guidance or coaching to such weak students.

15.2   The class committee for a class under a particular branch is normally constituted by the Head of the Department. However, if the students of different branches are mixed in each class of the first semester (generally common to all branches), the class committee is to be constituted by the Head of the Institution.

15.3   The class committee shall be constituted on the first working day of any semester or earlier.

15.4   Atleast 4 student representatives (usually 2 boys and 2 girls) shall be included in the class committee.

15.5   The chairperson of the class committee may invite the Faculty Adviser(s) and the Head of the Department to the meeting of the class committee.

15.6   The Head of the Institution may participate in any class committee of the institution.

15.7   The chairperson is required to prepare the minutes of every meeting, submit the same to the Head of the Institution within two days of the meeting and arrange to circulate among the concerned students and teachers. If there are some points in the minutes requiring action by the management, the same shall be brought to the notice of the management by the Head of the Institution.

15.8   The first meeting of the class committee shall be held within one week from the date of commencement of the semester, in order to inform the students about the nature and weight of assessments within the framework of the Regulations. Two or three subsequent meetings may be held at suitable intervals. During these meetings the student members representing the entire class, shall meaningfully interact and express the opinions and suggestions of the class students to improve the effectiveness of the teaching-learning process.

16. FACULTY ADVISER

To help the students in planning their courses of study and for general advise on the academic programme, the Head of the Department of the student will attach a certain number of students to a teacher of the Department who shall function as Faculty Adviser for those students throughout their period of study. Such Faculty Adviser shall advise the students and monitor the courses taken by the students, check the attendance and progress of the students attached to him / her and counsel them periodically. If necessary, the faculty adviser may also discuss with or inform the parents about the progress of the students.

17. COURSE COMMITTEE FOR COMMON SUBJECTS

Each common theory subjects offered to more than one discipline or group, shall have a "Course Committee" comprising all the teachers teaching the common subject with one of them nominated as Course Coordinator. The nomination of the course Coordinator shall be made by the Head of the Department / Head of the institution depending upon whether all the teachers teaching the common subject belong to a single department or to several departments. The 'Course committee' shall meet as often as possible and ensure uniform evaluation of the tests and arrive at a common scheme of evaluation for the tests. Where it is feasible, the course committee may also prepare a common question paper for the test(s).

18. PROVISION FOR WITHDRAWAL FROM EXAMINATION

i. A candidate may, for valid reasons, be granted permission to withdraw from appearing for the examination in any subject or subjects of only one semester examination during the entire duration of the degree programme. Also only one application for withdrawal is permitted for that semester examination in which withdrawal is sought.

ii. Withdrawal application shall be valid only if the candidate is otherwise eligible to write the examination and if it is made prior to the commencement of the last examination in that semester and duly recommended by the Head of the Department and approved by the Head of the Institution.

iii. Withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction.

iv. Withdrawal is possible only if the candidate satisfies the attendance requirements [as per Clause 6.1]

19. TEMPORARY BREAK OF STUDY FROM A PROGRAMME

i. A candidate is not normally permitted to temporarily break the study. However if a candidate intends to temporarily discontinue the programme in the middle for valid reasons (such as accident or hospitalization due to prolonged ill health) and to rejoin the programme in a later semester he/she shall apply to the Head of the Institution in advance, in any case, not later than the last date for registering for the semester examinations of the semester in question, through the Head of the Department stating the reasons thereof.

ii. The candidate permitted to rejoin the programme after the break shall be governed by the rules and regulations in force at the time of rejoining.

iii. The duration specified for passing all the subjects for the purpose of classification vide Clause 10(iii), 10(iv) and 10(v) shall be increased by the period of such permitted break of study.

iv. The total period for completion of the programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 8(iii) irrespective of the period of break of study in order that he/she may be eligible for the award of the degree (vide clause 14).

v. If any student is detained for want of requisite attendance, progress and good conduct, the period spent in that semester shall not be considered as permitted 'Break of Study' and Clause 19(iii) is not applicable for this case.

20. RANK OF A STUDENT

A candidate who qualifies for the Degree by passing the examination in all subjects of the entire Programme in first attempt within a period of Seven Semesters from the date of admission to the Programme can be given his position in the class as rank. The Rank is determined from I Semester to VII Semester end semester examination CGPA . Students transferred from other institutions to GCT are not eligible for rank.

21. PROCEDURE FOR USING SCRIBER

If a candidate is physically handicapped (in case of accidents / ill health) at the time of examination, then he / she may be permitted to use a scriber to write the examination. In such case 30 minutes extra time will be permitted. The Scriber shall be a non-engineering student / graduate.

22. DISCIPLINE

Every student is required to observe disciplined and decorous behaviour both inside and outside the college and not to indulge in any activity which will tend to bring down the prestige of the College. In the event an act of indiscipline being reported, the Principal shall constitute a disciplinary committee consisting of three Heads of Department of which one should be from the faculty of the student, to enquire into acts of indiscipline. The disciplinary action is subject to review by the University in case the student represents to the University. Any expulsion of the student from the college shall be with prior concurrence from Director of Technical Education / University.

23. CREDIT SYSTEM

The letter grade and the grade point are awarded based on percentage of marks secured by a candidate in individual course as detailed below:

Range of Total Marks	Letter Grade	Grade Points (GP)
90 to 100	S	10
80 to 89	A	9
70 to 79	B	8
60 to 69	C	7
55 to 59	D	6
50 to 54	E	5
0 to 49	U	0
Incomplete	I	0
Withdrawal	W	0

"U"   denotes failure in the subject.
"I"   denotes incomplete as per clause 6.1 and hence prevention from writing End Semester Examination.
"W"   denotes withdrawal from the subject.

After results are declared, Grade sheets will be issued to each student which will contain the following details :

The list of subjects enrolled during the semester and the grades 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 subjects registered and the points corresponding to the grades scored in those subjects, taken for all the subjects, to the sum of the number of credits of all the subjects in the semester.

$$GPA = \frac{Sum\ of\ [\ C \times GP\ ]}{Sum\ of\ C}$$

where   C   - credit of a particular subject

        GP   - grade point obtained by the student in the respective subject.

CGPA will be calculated in a similar manner, considering all the subjects enrolled from first semester. "U", "I" and "W" grades will be excluded for calculating GPA and CGPA.

Each subject is normally assigned certain number of credits with 1 credit per lecture period per week, 1 credit per tutorial period per week, 1 credit for 2 periods of laboratory or practical or seminar or project work per week (2 credits for 3 or 4 periods of practical).

However, the performance of a student is evaluated only based on the credit system.

24. REVISION OF REGULATION AND CURRICULUM

The college may from time to time revise, amend or change the regulations, scheme of examinations and syllabus, if found necessary.

END OF REGULATIONS ...

Curriculum

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B.E. - ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM
(Part Time Candidates admitted during 2012-2013 and onwards)

FIRST SEMESTER

S. No.	Subject Code	Course title	Sessional marks	Final Exam marks	Total marks	L	T	P	C
1	12E1Z2	ENGINEERING MATHEMATICS -I	25	75	100	3	1	0	4
2	12E106	PROGRAMMING IN C	25	75	100	3	1	0	4
3	12E303	ELECTRONIC DEVICES AND CIRCUITS	25	75	100	3	1	0	4
4	12E304	NETWORK ANALYSIS AND SYNTHESIS	25	75	100	3	1	0	4
		PRACTICAL							
5	12E109	C PROGRAMMING LABORATORY	25	75	100	3	0	0	2
		TOTAL			500				18

SECOND SEMESTER

S. No.	Subject Code	Course title	Sessional marks	Final Exam marks	Total marks	L	T	P	C
		THEORY							
1	12E2Z2	ENGINEERING MATHEMATICS -II	25	75	100	3	1	0	4
2	12E305	DC MACHINES AND TRANSFORMERS	25	75	100	3	0	0	3
3	12E402	ENVIRONMENTAL SCIENCE AND ENGINEERING	25	75	100	3	0	0	3
4	12E403	PULSE AND SWITCHING CIRCUITS	25	75	100	3	1	0	4
5	12E405	DIGITAL CIRCUITS	25	75	100	3	1	0	4
		TOTAL			500				18

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THIRD SEMESTER

S. No.	Subject Code	Course title	Sessional marks	Final Exam marks	Total marks	L	T	P	C
		THEORY							
1	12E3Z1	ENGINEERING MATHEMATICS -III	25	75	100	3	1	0	4
2	12E306	ELECTRICAL AND ELECTRONIC MEASUREMENTS	25	75	100	3	1	0	4
3	12E501	CONTROL SYSTEMS ENGINEERING	25	75	100	3	1	0	4
4	12E502	ELECTRONIC CIRCUIT DESIGN WITH ICs	25	75	100	3	1	0	4
5	12E504	ROTATING AC MACHINERY AND SPECIAL MACHINES	25	75	100	3	1	0	4
		TOTAL			500				20

FOURTH SEMESTER

S. No.	Subject Code	Course title	Sessional marks	Final Exam marks	Total marks	L	T	P	C
		THEORY							
1	12E401	NUMERICAL METHODS	25	75	100	3	1	0	4
2	12E601	MODERN CONTROL THEORY	25	75	100	3	1	0	4
3	12E602	POWER ELECTRONIC DEVICES AND CIRCUITS	25	75	100	3	1	0	4
4	12E604	POWER SYSTEM ANALYSIS AND STABILITY	25	75	100	3	1	0	4
		PRACTICAL							
5	12E608	POWER ELECTRONICS AND DRIVES LABORATORY	25	75	100	0	0	3	2
		TOTAL			500				18

FIFTH SEMESTER

S. No.	Subject Code	Course title	Sessional marks	Final Exam marks	Total marks	L	T	P	C
		THEORY							
1	12E503	MICROPROCESSORS AND MICROCONTROLLERS PROGRAMMING	25	75	100	3	1	0	4
2	12E505	POWER GENERATION AND UTILIZATION	25	75	100	3	0	0	3
3	12E506	POWER SYSTEMS -I	25	75	100	3	0	0	3
4	12E701	INDUSTRIAL MANAGEMENT AND ECONOMICS	25	75	100	3	0	0	3
5	E1	ELECTIVE -I	25	75	100	3	0	0	3
		TOTAL			500				16

SIXTH SEMESTER

S. No.	Subject Code	Course title	Sessional marks	Final Exam marks	Total marks	L	T	P	C
		THEORY							
1	12E603	DIGITAL SIGNAL PROCESSING AND PROCESSORS	25	75	100	3	1	0	4
2	12E605	POWER SYSTEMS -II	25	75	100	3	0	0	3
3	E2	ELECTIVE - II	25	75	100	3	0	0	3
4	E3	ELECTIVE - III	25	75	100	3	0	0	3
		PRACTICAL							
5	12E708	POWER SYSTEM LABORATORY	25	75	100	0	0	3	2
		TOTAL			500				15

SEVENTH SEMESTER

S. No.	Subject Code	Course title	Sessional marks	Final Exam marks	Total marks	L	T	P	C
		THEORY							
1	12E702	ELECTRICAL MACHINE DESIGN	25	75	100	3	1	0	4
2	12E703	POWER SYSTEM PROTECTION AND SWITCHGEAR	25	75	100	3	0	0	3
3	E4	ELECTIVE - IV	25	75	100	3	0	0	3
4	E5	ELECTIVE - V	25	75	100	3	0	0	3
		PRACTICAL							
5	12E801	PROJECT WORK AND VIVA - VOCE	50	150	200	0	0	12	6
		TOTAL			500				19

TOTAL CREDITS: 18+18+20+18+16+15+19= 124

LIST OF ELECTIVE SUBJECTS
(FIFTH SEMESTER)

S. No.	Subject Code	Course title	Sessional marks	Final Exam marks	Total marks	L	T	P	C
1	12E6E0*	PRINCIPLES OF VIRTUAL INSTRUMENTATION	25	75	100	3	0	0	3
2	12E6E1*	NEURAL AND FUZZY SYSTEMS	25	75	100	3	0	0	3
3	12E6E2*	OPTIMIZATION TECHNIQUES	25	75	100	3	0	0	3
4	12E6E3*	COMPUTER SYSTEM ARCHITECTURE	25	75	100	3	0	0	3
5	12E6E4 #	BIOMEDICAL INSTRUMENT TECHNOLOGY	25	75	100	3	0	0	3

\# Common with Core Subject of EIE

LIST OF ELECTIVE SUBJECTS
(SIXTH SEMESTER)

S. No.	Subject Code	Course title	Sessional marks	Final Exam marks	Total marks	L	T	P	C
1	12E7E0 @	PROFESSIONAL ETHICS	25	75	100	3	0	0	3
2	12E7E1*	POWER PLANT INSTRUMENTATION	25	75	100	3	0	0	3
3	12E7E2	POWER SYSTEM ECONOMICS	25	75	100	3	0	0	3
4	12E7E3	POWER QUALITY ENGINEERING	25	75	100	3	0	0	3
5	12E7E4	HVDC TRANSMISSION	25	75	100	3	0	0	3
6	12E7E5	EXTRA HIGH VOLTAGE AC TRANSMISSION	25	75	100	3	0	0	3
7	12E7E6	ENERGY AUDITING AND MANAGEMENT	25	75	100	3	0	0	3
8	12E7E7	POWER ELECTRONICS APPLICATIONS TO POWER SYSTEMS	25	75	100	3	0	0	3
9	12E7E8	RENEWABLE ENERGY SOURCES	25	75	100	3	0	0	3
10	12E7E9	SOLID STATE RELAYS	25	75	100	3	0	0	3

* Common with EIE   @ Common with EIE and ECE

LIST OF ELECTIVE SUBJECTS
(SEVENTH SEMESTER)

S. No.	Subject Code	Course title	Sessional marks	Final Exam marks	Total marks	L	T	P	C
1	12E8E0*	INDUSTRIAL DRIVES AND CONTROL	25	75	100	3	0	0	3
2	12E8E1*	AUTOMOTIVE ELECTRONICS	25	75	100	3	0	0	3
3	12E8E2*	PRINCIPLES OF EMBEDDED SYSTEMS	25	75	100	3	0	0	3
4	12E8E3*	VHDL BASED DIGITAL SYSTEM DESIGN	25	75	100	3	0	0	3
5	12E8E4**	TOTAL QUALITY MANAGEMENT	25	75	100	3	0	0	3
6	12E8E5*	COMPUTER NETWORK ENGINEERING	25	75	100	3	0	0	3
7	12E8E6*	MEMS AND APPLICATIONS	25	75	100	3	0	0	3
8	12E8E7 #	LOGIC AND DISTRIBUTED CONTROL SYSTEMS	25	75	100	3	0	0	3
9	12E8E8	COMPUTER AIDED DESIGN OF ELECTRICAL MACHINES	25	75	100	3	0	0	3
10	12E8E9	SPECIAL MACHINES AND CONTROLLERS	25	75	100	3	0	0	3

@ Common with EIE and ECE   # Common with Core Subject of EIE

* Common with EIE   ** Common with Mechanical, ECE, EIE and Production.

Syllabi

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12E1Z2 ENGINEERING MATHEMATICS – I

(Common to all branches) ✓

	L	T	P	C
	3	1	0	4

MATRICES (09)

Characteristic equation – Eigen values and Eigen vectors of a real matrix - Properties of Eigen values – Cayley-Hamilton Theorem(statement only) and applications- Diagonalisation of a symmetric matrix by orthogonal transformation - Reduction of quadratic form to canonical form.

HYPERBOLIC FUNCTIONS AND SOLID GEOMETRY (09)

Hyperbolic functions and Inverse Hyperbolic functions-Identities-Real and imaginary parts-solving problems using hyperbolic functions.
Sphere-tangent plane-Orthogonal spheres-Cone-right circular cone-Cylinder-right circular cylinder.

APPLICATIONS OF DIFFERENTIAL CALCULUS (09)

Curvature - Cartesian and Polar Coordinates – centre and radius of curvature - Circle of curvature -Evolutes - Envelopes - Evolutes as envelope of normal.

FUNCTION OF SEVERAL VARIABLES (09)

Function of two variables - Taylor's expansion - maxima and minima - constrained maxima and minima by Lagrangian multiplier method - Jacobians - differentiation under integral sign.

INTEGRAL CALCULUS (09)

Gamma and Beta functions - Double integration - Cartesian and Polar Coordinates – change of order of integration - Area as double integral –Change of variables between Cartesian and Polar Coordinates - Triple integration –Volume as a triple integral - Transformation to Polar, Cylindrical and Spherical co-ordinates.

Lecture: 45 Tutorial: 15 Total Hrs.: 60

Text Book

1. Veerarajan.T., "Engineering Mathematics" for Semesters I and II , Tata McGraw Hill Publishing Co., New Delhi., 2010.

Reference Books

1. N.P.Bali., Dr. Manish Goyal., "A Text Book of Engineering Mathematics" vol. I , University science Press, New Delhi, 2010.

2. Dr.Kandasamy.P., Dr.Thilagavathy.K and Dr.Gunavathy.K., *"Engineering Mathematics"* for First Year B.E/B.Tech, S. Chand & Co., Ram Nagar, New Delhi, 2010.

3. H.C.Taneja., *"Advanced Engineering Mathematics"* vol. I, I.K.International Pub.House Pvt.Ltd., New Delhi, 2007.

4. Baburam., *" Engineering Mathematics"* vol. I, Pearson, New Delhi, 2010.

5. B.V.Ramana, *"Higher Engineering Mathematics"* Tata McGraw Hill Publishing Co., New Delhi, 2007.

6. Grewal B.S., *"Higher Engineering Mathematics"* (40th Edition) Khanna Publishers, New Delhi., 200

12E106 PROGRAMMING IN C

(COMMON TO ALL BRANCHES)

L	T	P	C
3	1	0	4

BASICS OF COMPUTER, PROGRAMMING AND INFORMATION TECHNOLOGY (09)

Digital Computer Fundamentals- Block diagram of a computer-Components of a Computer system-Applications of Computers-Hardware and Software definitions-Categories of Software-Booting-Installing and Uninstalling Software-Software privacy-Software terminologies-Information Technology Basics-History of Internet-Internet Tools. Problem solving Techniques-Program-Program development cycle-Algorithm-Flow Chart-Pseudo Code-Program control structures-Types and generation of programming languages-Development of algorithms for simple problems.

BASIC ELEMENTS OF C (09)

Introduction to C-C Declaration- Operators and Expressions-Input and output Functions- Decision statements: If-If else-Nested If else-If else If ladder-break-continue-goto-switch-nested switch case-Switch case and nested ifs-Loop control: for, nested for, while, do-while- do while statement with while loop-Arrays: initialization, characteristics, types and operations.

POINTERS AND FUNCTIONS (09)

Strings and Standard functions: Declaration and initialization, formats, standard, conversion and memory functions, applications; Pointers-pointers and address- declaration-void ,wild, constant pointers –arithmetic operations with pointers-pointers and arrays- pointers to pointers-pointers to pointers- pointers and strings; Functions-return statement-types-call by value and reference-returning more values, function as an argument, function with operators, decision statements, loop statements, arrays and pointers, recursion-Tower of Hanoi.

STORAGE CLASSES, STRUCTURE AND UNION (09)

Storage classes: auto-extern-static-register; Preprocessor directives; Structures: Declaration and initialization, structure within structure-Array Of Structures-pointer to structure-structure and functions-type def-bit fields- enumerated data types; union: calling BIOS and DOS services-union of structures.

FILES, GRAPHICS AND DYNAMIC MEMORY ALLOCATION (09)

Files: streams and file types-operations-File I/O-read and write-other –creating, processing and updating files-simple file handling programs-low level programming-command line arguments- Environment variables; Graphics: initialization-functions-library functions-text-patterns and styles-mouse programming-drawing non common figures; Dynamic memory allocation.

Lecture: 45 Tutorial: 15 Total Hrs. :60

Text Books

1. *ITL Education solutions Limited, "Introduction to Information Technology",Pearson Education(India), 2005. (Unit I) (Chapter:1,7,9,10,15,16)*

2. *Ashok N. Kamthane, " Programming in C", Pearson Education,Second Edition,2012.*

Reference Books

1. *Byron Gottfried, "Programming with C", II Edition,(Indian Adapted Edition),TMH publications,2006.*

2. *Brain W.kernighan and Dennis M.Ritchie, "The C programming language" , Pearson Education Inc.(2005).*

3. *E. Balagurusamy, "Programming in ANSI C", 5E, Tata McGraw-Hill Education, 2011.*

12E303 ELECTRONIC DEVICES AND CIRCUITS

(Common to EEE and EIE)

	L	T	P	C
	3	1	0	4

DIODES, SPECIAL DIODES AND APPLICATIONS (09)

PN diode: diode, biasing, voltage-current characteristics, transition & diffusion capacitance, reverse recovery time, diode models. PN diode applications: Half-wave & Full-wave rectifiers, power supply filters & regulators, diode limiting and clamping circuits. Basic parameters of zener diodes, zener diode applications, varactor diodes, optical diodes.

BI-POLAR JUNCTION TRANSISTORS AND BIASING (10)

BJT: Structure, operation and characteristics with parameters; as an amplifier and switch. - Biasing: DC operating point; Voltage-divider bias; other methods of biasing; Miller theorem - BJT amplifier: operation; AC equivalent circuits; CE, CC, CB, multistage, RC-coupled, transformer coupled, darlington & differential amplifiers.

FIELD-EFFECT TRANSISTORS AND BIASING (08)

JFET: Structure, operation and characteristics with parameters; biasing configurations - MOSFET: Structure, types (Depletion & Enhancement), operation and characteristics with parameters; biasing configurations - VMOS-FET: construction - CMOS-FET: construction; CMOS inverter MESFET: construction and types.

AMPLIFIER ANALYSIS AND OPERATIONAL AMPLIFIERS (10)

BJT & FET amplifiers: basics of frequency response, Low, high and total Frequency response - Power amplifiers: operation, characteristics, parameters of Class A, AB, B & C amplifiers - Op-Amp: Introduction; parameters; concepts of feedbacks; Negative feedback on Op-Amps; open and close loop response.

THYRISTORS AND OTHER DEVICES (08)

Basic 4-layer devices; SCR – Diac – Triac - Silicon-Controlled Switches - Uni-Junction Transistors - programmable Uni-Junction Transistors - IGBTs - photo-transistors and optical couplers – basic constructions, characteristics curves, parameters and applications.

Lecture: 45 Tutorial: 15 Total Hrs. :60

Text Books

1. Thomas L.Floyd, *"Electronic Devices (Conventional Current flow version)"*, 9th Edition, Prentice Hall, 2012.

2. Robert L.Boylestad & Louis Nashelsky, *"Electronic Devices and Circuit Theory"*, 10th Edition, Prentice Hall, 2009.

Reference Books

1. Jacob Millman, Christos C Halkias and Satyabrata JIT, *"Electron Devices and Circuits"*, 2nd edition, Tata McGraw Hill, 2008.

2. Allen Mottershead, *"Electronic Devices and Circuits, An Introduction"*, Eastern Economy Edition, Prentice-Hall of India, 2009.

3. Adel S. Sedra and Kenneth C. Smith, *"Microelectronic Circuits"*, 6th edition, Oxford University Press, 2009.

12E304 NETWORK ANALYSIS AND SYNTHESIS

(Common to EEE and EIE)

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ONE PORT AND TWO PORT NETWORKS   (09)

Driving point impedance and admittance of one port networks - Two port networks - Open circuit impedance and short circuit admittance parameters – Transmission and inverse transmission parameters – Hybrid and inverse hybrid parameters- Image parameters.

NETWORK FUNCTIONS   (09)

Network functions : Singularity functions – Unit functions – Shifter functions – Gate function. Transfer Functions of Two-port network –Poles and Zeros – Necessary conditions for Driving point and Transfer functions – Time domain response from pole – zero plot – Amplitude and phase response from pole zero plot – Stability criterion for active network – Routh criteria.

RESONANCE   (09)

Series resonance – Impedance, phase angle voltages and currents – BW of an RLC circuit - Q factor and its effect on bandwidth – Magnification in resonance – Parallel Resonance – Resonant frequency for a tank circuit – Variation of impedance with frequency – Q factor of parallel resonance- Pole zero configuration in parallel resonance circuits – Multiple resonance in high –Q circuits.

FILTERS AND ATTENUATORS   (09)

Classification of filters - Low pass and high pass filters - Band pass and Band stop filters- Constant K and m-derived filters. Attenuators – Types of Attenuators – T-type – Ð-type – Lattice – Bridged T and L-Type Attenuator.

ELEMENTS OF REALIZABILITY AND NETWORK SYNTHESIS   (09)

Hurwitz polynomials - Positive real function – Frequency response of reactive one-port networks - Synthesis of reactive one port RL, RC networks using Cauer and Foster methods.

Lecture: 45 Tutorial: 15 Total Hrs. :60

Text Books

1. C.L.Wadhwa , " **Network Analysis** ", *New Age International Publishers , Delhi , 2004.*

2. Sudakar A. and Shyam Mohan S.Palli , "**Circuits and Networks (Analysis and Synthesis)**", *Tata McGraw Hill Book Co., New Delhi, Third Edition, 2007.*

Reference Books

1. C.P. Kuriakose "**Circuit Theory: Continuous and Discrete – time systems – Elements of Network Synthesis** " *PHI, Delhi, 2005.*

2. A.Chakrabarti , " **Circuit Theory –Analysis and Synthesis** " , *Dhanpat Rai & Co. New Delhi, Fifth   Edition 2006.*

3. M.E.Van Valkenburg, "**Network Analysis**", *PHI, Delhi, 2003.*

12E109 C PROGRAMMING LABORATORY

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Exercises illustrating the following concepts:

- Operators , Expressions and IO formatting
- Decision Making and Looping
- Arrays and Strings
- Functions and Recursion
- Pointers
- Dynamic Memory Allocation
- Structures
- Unions
- Files
- Command line arguments
- Graphics.
- Mini Project

Total Hrs: 45

12E2Z2 ENGINEERING MATHEMATICS – II

(Common to all branches)

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VECTOR CALCULUS (9)

Gradient , Divergence , Curl -Directional derivative - Irrotational and Solenoidal fields-Vector identities - Line, Surface and Volume Integrals -Green's Theorem in a Plane , Gauss Divergence and Stoke's Theorems (Statements only) - Verifications and Applications.

ORDINARY DIFFERENTIAL EQUATIONS (09)

Linear equations of Second and Higher order with constant coefficients-Simultaneous first order Linear equations with constant coefficients- Linear equations of Second and Higher order with variable coefficients -Legendre type -Method of variation of parameters-method of reduction of order.

COMPLEX DIFFERENTIATION (09)

Functions of a Complex variable-Analytic functions- Cauchy Riemann equations and sufficient conditions(excluding proof)–Harmonic and orthogonal properties of analytic functions –Construction of analytic functions-Conformal mappings : $w = z + a$, az , $1/z$, z^2 , e^z , $\cos z$, $\sin z$ and Bilinear Transformation.

COMPLEX INTEGRATION (09)

Cauchy's integral theorem, Cauchy's integral formula -Taylor's and Laurent's theorems (Statements only) and expansions – Poles and Residues – Cauchy's Residue theorem – Contour integration – Circular and semi circular contour (Excluding poles on real axis).

LAPLACE TRANSFORMATIONS (09)

Laplace transforms- Properties and standard transforms-Transforms of unit step and unit Impulse functions –Transforms of periodic functions- Inverse Laplace transforms- Initial and Final value theorems- Applications to Solution of Linear ordinary differential equations of second order with constant coefficients.

Lecture: 45 Tutorial: 15 Total Hrs: 60

Text Book

1. Veerarajan.T., **"Engineering Mathematics"** for Semesters I and II , Tata McGraw Hill Publishing Co., New Delhi., 2010.

Reference Books

1. N.P.Bali., Dr. Manish Goyal., **"A Text Book of Engineering Mathematics"** vol. II , University science Press, New Delhi, 2010.

2. Dr.Kandasamy.P., Dr.Thilagavathy.K and Dr.Gunavathy.K., *"Engineering Mathematics"* for First Year B.E/ B.Tech, S. Chand & Co., Ram Nagar, New Delhi, 2010.

3. H.C.Taneja., *"Advanced Engineering Mathematics"* vol.II, I.K.International Pub.House Pvt.Ltd., New Delhi, 2007.

4. Baburam., " *Engineering Mathematics"*, Pearson, New Delhi, 2010.

5. B.V.Ramana., *"Higher Engineering Mathematics"* Tata McGraw Hill Publishing Co., New Delhi, 2007.

6. Grewal B.S., *"Higher Engineering Mathematics"*(40th Edition) Khanna Publishers, New Delhi., 2007.

12E305 DC MACHINES AND TRANSFORMERS

L T P C
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CONSTRUCTIONAL FEATURES OF DC MACHINES (08)

Emf equation – Armature windings – Characteristics of different types of DC generators – Commutation – Armature reaction – Parallel operation.

DC MOTORS (10)

Torque equation – Electrical and mechanical characteristics of different types of DC motors –– Starters – Speed control-Applications.

TESTING OF DC MACHINES (09)

Losses and efficiency – Swinburne's, Hopkinson's and load tests – Retardation test – Electric braking.

TRANSFORMER CONSTRUCTION AND ITS PERFORMANCE (10)

Principle of operation – Types and constructional features of single phase and three phase transformers –EMF equation-Phasor diagram – Equivalent circuit – Regulation and efficiency.

TRANSFORMER TESTING AND INSTRUMENT TRANSFORMERS (08)

All day efficiency – Sumpner's test – Three phase transformers connections – Scott connection – Parallel operation – Instrument transformers : Current transformers – Potential Transformers - Auto transformers – Inrush current phenomenon and its prevention – Off-load and on-load tap changing.

Total Hrs. :45

Text Books

1. Kothari D.P. and Nagrath I.J , *"Electric Machines"*, Tata McGraw Hill, Fourth Edition, 2011

2. Fitzgerald A.E., Kingsly C. and Kusko.A., *"Electric Machinery"*, Tata McGraw Hill, 2007.

Reference Books

1. Sen S.K., *"Electric Machinery"*, Khanna Publishers, New Delhi, 2008.

2. Say M.G., *"Alternating Current Machines"*, 5th Edition, Pitman Publishing,1984.

3. Irving. L. Kosow, *"Electrical Machines and Transformers"*, PHI, 2 nd Edition, 2007.

4. Theraja B.L. and Theraja A.K., *"A Text Book of Electrical Technology"*, Vol. II, S.Chand & Co. Ltd., New Delhi, 2007.

5. Bimbhra P.S., *"Electrical Machinery"*, Khanna Publishers, New Delhi, 2009.

12E402 ENVIRONMENTAL SCIENCE AND ENGINEERING

(Common to all branches)

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ENVIRONMENTAL RESOURCES (09)

Earth structure, Internal and external earth processes, plate tectonics, erosion, weathering, deforestation, anomalous properties of water, hydrological cycle, effect of modern agriculture, fertilizers, pesticides, eutrophication, biomagnifications, land degradation, minerals, rocks, rock cycle, mining, types of mining, desertification, soil erosion, methods of conservation of soil erosion, renewable energy resources, wind, solar, geothermal, tidal, OTEC.

ECO SYSTEM AND BIODIVERSITY (09)

Weather and climate, ocean current, upwelling, EL Nino, Ecology, ecosystem, biomass, physical and chemical components of ecosystem, biological components of ecosystem, forest ecosystem, desert ecosystem and pond ecosystem, Energy flow in ecosystem, nitrogen cycle, carbon dioxide cycle, phosphorous cycle, food pyramid, Ecological succession, types, biodiversity, need for biodiversity, values of biodiversity, hot spots of biodiversity, endangered and endemic species, conservation of biodiversity insitu-exitu conservation.

ENVIRONMENTAL POLLUTION (09)

Air pollution, classification of air pollutants gaseous particulars, sources effects and control of gaseous pollutants SO_2, NO_2, H_2S, CO, CO_2 and particulates, control methods, cyclone separator, electrostatic precipitator, catalytic combustion-water pollution-classification of water pollutants, inorganic pollutants, sources, effects and control of heavy metals, organic pollutants, oxygen demanding wastes, aerobic and anaerobic decomposition, soil pollution, Noise pollution, sources, effects, decibel scale.

ENVIRONMENTAL THREATS (09)

Acid rain, green house effect, global warming, disaster management, flood, drought, earthquake, tsunami, threats to biodiversity, destruction of habitat, habit fragmentation- hunting, over exploitation – man- wildlife conflicts, The IUCN red list categories, status of threatened species.

SOCIAL ISSUES AND ENVIRONMENT (09)

Sustainable development- sustainable technologies, need for energy and water conservation, rain water harvesting, water shed management, waste land reclamation, Air act, Wild life protection act, forest conservation act, population growth, exponential and logistic growth, variation in population among nations, population policy, women and child welfare programs, Role of information technology in human and health, HIV/AIDS, effects and preventive measures.

Total Hrs.:45

Text Books

1. *Sharma J.P.,* **'Environmental Studies'**, *3rd Edn, University Science Press, New Delhi (2009)*

2. *Anubha Kaushik and C.P.Kaushik,* **'Environmental Science and Engineering'**, *3rd Edn New age International Publishers, New Delhi (2008)*

Reference Books

1. *R.K.Trivedi,* **'Hand book of Environmental laws, Rules, Guidelines, Compliances and Standards'**, *Vol.I &II, Environ Media.(2006)*

2. *G.Tyler Miller,J_R* **'Environmental Science'**, *Tenth Edition, Thomson BROOKS/COLE (2004)*

3. *Gilbert M.Masters,* **'Introduction to Environmental Engineering and Science'**, *2nd Edition Pearson Education (2004).*

12E403 PULSE AND SWITCHING CIRCUITS

(Common to EEE and EIE)

	L	T	P	C
	3	1	0	4

LINEAR WAVE SHAPING (09)

Analysis of High pass and Low pass RC circuits with sinusoidal, step, pulse, exponential and ramp inputs– differentiator – integrator – attenuation networks– effect of shunt capacitance –compensated networks— ringing circuits.

NON-LINEAR WAVE SHAPING (09)

Simple Diode clippers; Biased diode clipper; Transistor clippers; Simple diode Clamper; Practical Diode Clampers. Transient and Steady state behaviour of diode clampers-clamping circuit's theorem - Transistor switch with inductive and capacitive loads; damper diodes; collector.

MULTIVIBRATORS (10)

Types - self biased transistor bistable multivibrator – commutating capacitor – unsymmetrical triggering of bistable multivibrator - symmetrical triggering – direct connected bistable multivibrator – Schmitt trigger – emitter coupled, bistable multivibrator –gate with of collector coupled of monostable multivibrator – waveforms – emitter coupled monostable multivibrator – triggering of monostable multivibrator – astable collector coupled multivibrator.

VOLTAGE AND CURRENT TIMEBASE GENERATORS (09)

General features of timebase signal –methods of generating timebase waveforms – exponential sweep circuits – negative resistance switches – sweep circuits using transistor switch – transistor constant current sweep – Miller and Boot-strap time base generators- a simple current sweep generator – linearity correction – transistorized current time base generator- methods of linearity improvement.

BLOCKING OSCILLATORS (08)

Pulse Transformers – Applications – Triggered transistor blocking oscillator; methods to control pulse duration; diode controlled astable transistor blocking oscillator; applications of blocking oscillator.

Lecture: 45   Tutorial: 15   Total Hrs. : 60

Text Books

1. *Jacob Millman and Herbert Taub and Mothiki Prakash Rao, **"Pulse, Digital and Switching Waveforms"**, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, Second Edition, 2008.*

2. *Mithal G.K. and Vanwani A.K., **"Pulse and Digital Electronics"**, Khanna Publishers, New Delhi, 1981.*

Reference Books

1. *Venkataraman R. **"Pulse Digital Circuits and Computer Fundamentals"**, Dhanpat Rai Publications, New Delhi, 2001.*

2. *Prakash Rao, **"Pulse and Digital Circuits"**, Tata McGraw-Hill Education, 2006*

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12E405 DIGITAL CIRCUITS

(Common to EEE and EIE)

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L	T	P	C
3	1	0	4

BOOLEAN ALGEBRA AND LOGIC GATES (08)

Binary Systems, Boolean Algebra and Logic gates –Boolean functions - canonical and Standard Forms- Digital Logic gates – Integrated circuits. Gate level minimization – Map methods- NAND and NOR Implementation – Hardware Description Language.

COMBINATIONAL LOGIC (09)

Combinational circuits- Analysis and Design Procedure- Binary adder subtractor- Decimal adder – Binary multiplier – Magnitude comparator – Decoders- Encoders- Multiplexers- HDL for Combinational Circuits.

SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL LOGIC (10)

Sequential circuits- latches – Flip flops – Analysis of Clocked Sequential Circuits – HDL for sequential Circuits- State Reduction and Assignment- Design Procedure. Asynchronous Circuits- Analysis Procedure- Circuits with Latches – Reduction of State Flow Tables – Race Free State Assignment – Hazards- Design Example.

REGISTERS, COUNTERS AND MEMORY (10)

Registers, Shift Registers, Ripple Counters, Synchronous Counters, Random access memory, Memory Decoding, Error Detection and correction, Read only Memory, Programmable Logic Array. Register Transfer Level introduction, Algorithmic State Machines, Binary Multiplier.

DIGITAL INTEGRATED CIRCUITS (08)

Bipolar Transistor Characteristics, RTL and DTL Circuits, Transistor – Transistor Logic (TTL) – Emitter –Coupled Logic (ECL)- Metal –Oxide Semiconductor (MOS) – Complementary MOS (CMOS) – CMOS Transmission Gate circuits- Switch level Modeling with HDL.

Lecture: 45 Tutorial: 15 Total Hrs.:60

Text Book

1. Morris Mano,M *"Digital Design"* Pearson Education,New Delhi, 4th edition, 2011.

Reference

1. Charles H.Roth, *"Fundamentals of Logic Design"*, Sixth Edition, Jaico Publishing House, 2000.

2. Floyd,Floyd Thomas L., *"Digital fundamentals"* Pearson Education, New Delhi 9th edition, 2006.

3. Ronald J. Tocci, Neal S Widmer,Gregory L Moss, *"Digital Systems: Principles and Applications"*, Pearson/Prentice Hall, 2004.

12E3Z1 ENGINEERING MATHEMATICS – III

(Common to all branches)

L T P C

3 1 0 4

PARTIAL DIFFERENTIAL EQUATIONS (09)

Formation of PDE by elimination arbitrary constants and functions – Solutions of standard first order partial differential equations – Lagrange's equation – Linear partial differential equations of second and higher order with constant coefficients-homogeneous and non – homogeneous types.

FOURIER SERIES (09)

Dirichlet's Conditions – General Fourier Series –Odd and even functions- Half range Sine and Cosine series – Parseval's Identity – Harmonic Analysis.

FOURIER TRANSFORMS (09)

Statement of Fourier integral Theorem – Fourier transform pair– Fourier Sine and Cosine Transforms – Properties – Transforms of Simple functions- Convolution Theorem – Parseval's Identity-Finite Fourier transforms

BOUNDARY VALUE PROBLEMS (09)

Method of separation of variables – One dimensional wave equation – One dimensional heat equation – Unsteady and Steady state conditions –Fourier series solution.

Z-TRANSFORMS (09)

Z-transforms - Elementary properties-Inverse Z-transform - Initial and Final value theorems - Convolution theorem - Formation of difference equations - Solution to difference equations of second order with constant coefficients using Z - transform.

Lecture: 45 Tutorial: 15 Total Hrs. :60

Text Book

1. Veerarajan.T., *"Transforms and Partial Differential Equations"*, Tata McGraw Hill Publishing Co., New Delhi. 2010.

Reference Books

1. N.P.Bali., Dr. Manish Goyal., *"Transforms and Partial Differential Equations"* , University science Press, New Delhi, 2010.

2. Dr.Kandasamy.P., Dr.Thilagavathy.K and Dr.Gunavathy.K., *"Engineering Mathematics"* for Third Semester B.E/B.Tech, S. Chand & Co., Ram Nagar, New Delhi, 2010.

3. B.V.Ramana., *"Higher Engineering Mathematics"* Tata McGraw Hill Publishing Co., New Delhi, 2007.

4. Grewal B.S., *"Higher Engineering Mathematics"* (40th Edition) Khanna Publishers, New Delhi., 2007.

5. Glyn James, *"Advanced Modern Engineering Mathematics"* (8th Edition) Wiley India , New Delhi., 2007.

12E306 ELECTRICAL AND ELECTRONIC MEASUREMENTS

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MEASUREMENTS OF ELECTRICAL QUANTITIES AND ERROR ANALYSIS (10)

Functional elements of Instruments, Limiting errors of instruments - Combination of limiting errors – Gross, systematic and random errors in measurements - Statistical analysis of errors-Standards and calibrations - Principle of operation of permanent magnet moving coil, moving iron, dynamometer, induction, thermal and rectifier instruments - Extension of instrument ranges-Digital meters-calibration.

MEASUREMENTS OF R, L AND C USING BRIDGES (08)

Wheatstone, Kelvin, Wein, Hay's, Maxwell, Anderson and Schering bridges -   Q meter - Measurement of self and mutual inductances - Wagner earthing device - Megger.

MEASUREMENT OF MAGNETIC QUANTITIES AND INSTRUMENT TRANSFORMERS (09)

DC ballistic and vibration galvanometers – Flux meters – B-H curve and permeability measurements on ring and bar specimens – Iron loss measurement by magnetic squares – Theory and construction of instrument transformers - Instrument transformer errors-Instruments for measurement of frequency and phase.

ELECTRONIC INSTRUMENTS (09)

Standard signal generators - Function generator - Spectrum analyzer - Distortion factor meter - Frequency and phase meters - General purpose and storage CROs - Measurements of electrical quantities using CROs - Strip-chart and X-Y recorders- displays- LED, LCD, Dot matrix – Transducers - AD/DA converters.

INSTRUMENT TRANSFORMERS AND SPECIAL INSTRUMENTS (09)

PT's and CT's –theory, classification, accuracy regarding ratio and phase angles – linear couplers – KVA meters, KVAR meters - Maximum demand indicators- electrodynamometer type power factor meter - Synchroscope

Lecture: 45 Tutorial: 15 Total Hrs. :60

Text Books

1. Sawhney A.K., *"A Course in Electrical and Electronics Measurements and Instrumentation"*, Dhanpat Rai & Sons, 2004.

2. Rangan C.S., Sharma G.R and Mani V.S.V., *"Instrumentation Devices and Systems"*,   Tata McGraw Hill Book Co., New Delhi, 1997.

Reference Books

1. Golding E.W. and Widdis F.G, *"Electrical Measurements and Measuring Instruments"*, A.H. Wheeler & Co., Ahmedabad, 1991.

2. Terman F.E. and Pettit J.M., *"Electronic Measurements"*, Tata McGraw Hill Book Co., New Delhi, 1984.

3. Alan S.Morris, *"Principles of Measurements and Instruments"*, Prentice Hall of India Pvt.Ltd., New Delhi 1999.

4. Doebelin E.O., *"Measurement systems - Applications and Design"*, Tata McGraw Hill   Publishing Company, 2003.

12E501 CONTROL SYSTEMS ENGINEERING

(Common to EEE and EIE)

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CONTROL SYSTEM MODELING (08)

Basic Elements of Control System – Open loop and Closed loop systems - Differential equation - Transfer function, Modelling of Electric systems, Translational and rotational mechanical systems - Block diagram reduction Techniques - Signal flow graph.

TIME DOMAIN AND FREQUENCY DOMAIN ANALYSIS (11)

Time response analysis - First Order Systems - Impulse and Step Response analysis of second order systems - Steady state errors.Frequency Response analysis - Bode Plot, Polar Plot, Nyquist Plot - Frequency Domain specifications from the plots - Constant M and N Circles - Nichol's Chart - Use of Nichol's Chart in Control System Analysis.

COMPENSATORS AND STABILITY ANALYSIS (09)

Series, Parallel, series-parallel Compensators - Lead - Lag, and Lead Lag Compensators, Stability, Routh - Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Stability, Dominant Poles, Application of Root Locus Diagram - Nyquist Stability Criterion - Relative Stability

STATE SPACE ANALYSIS (09)

State model – Decomposition of transfer function – Canonical state model – Transfer function from state model – Solution of state model – State transition matrix – Controllability and Observability

CONTROL SYSTEM COMPONENTS (08)

Potentiometer – Error detector – Magnetic amplifier – Hydraulic elements – Synchros – Stepper motors – Tachogenerators – Servomechanisms – Modulators and demodulators – PID controllers – Servo motors.

Lecture: 45   Tutorial: 15   Total Hrs.: 60

Text Books

1. Sivanandam S.N., **"Control Systems Engineering"**, *Vikas Publishing House Pvt. Ltd., New Delhi, 2001.*

2. Nagrath I.J. and Gopal M., **"Control Systems Engineering"**, *Wiley Eastern Limited, New Delhi, 5th Ed. 2008.*

Reference Books

1. Katsuhiko Ogata, **"Modern Control Engineering"**, *Pearson Education, New Delhi, 5th Ed. 2010.*

2. Gopal M., **"Control systems – Principles and Design"**, *Third Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2008.*

3. Richard C. Dorf and Robert H. Bishop, **"Modern Control Systems"**, *Pearson Education Pvt. Ltd., New Delhi, 4th Edition, 2010.*

12E502 ELECTRONIC CIRCUIT DESIGN WITH ICs

(Common to EEE and EIE)

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AMPLIFIERS (09)

Inverting amplifiers – Non Inverting amplifiers – Differential amplifiers- Integrator and differentiator – logarithmic amplifiers and multipliers – Filters – Voltage to frequency converters – Sample and Hold circuits – high input impedance amplifiers – Instrumentation amplifiers – Sensing amplifiers – Comparators – zero crossing detectors.

OSCILLATORS (09)

Sine wave oscillators – Multivibrators – function generator – Schmitt Trigger – Voltage controlled oscillators – Crystal oscillators.

IC VOLTAGE REGULATORS (09)

Positive and negative voltage regulators (IC723) – Adjustable voltage regulators (LM117/LM317) – High current short circuit protected regulators – Dual tracking regulators (78xx & 79xx series) – Programmable supply – Current regulators (LAS 1800/ 1500) – Switching regulators (ICUA78S40) – Fold back current limited and shut down circuits.

COMMUNICATION CIRCUITS (09)

RF and IF amplifiers – Video amplifiers – AM detectors – Balanced modulators and demodulators – Phase locked loops (PLL) – FM demodulation – Frequency multiplication

DIGITAL SYSTEMS (09)

Frequency counters – A/D and D/A converters – Digital voltmeters – Programmable digital generators – Frequency synthesizer.

Lecture: 45 Tutorial: 15 Total Hrs: 60

Text Books

1. Roy Choudhry D. and Shail Jain, *"Linear Integrated Circuits"*, New Age international, New Delhi, 4th Edition, 2010.

2. Michael Jacob, *"Applications and design with Analog Integrated Circuits"*, Prentice Hall of India Pvt.Ltd., New Delhi, 1996.

3. Morris Mano,M *"Digital Design"* Pearson Education, New Delhi, 4th edition, 2011.

Reference Books

1. Ramakant A.Gayakwad, *"OPAMPs and Linear Integrated Circuits"*, Prentice Hall of India Pvt.Ltd. New Delhi, 4th Edition 2010.

2. Sonde B.S., *"Introduction to System Design Using Integrated Circuits"*, Wiley Eastern Ltd., New Delhi, 1994.

3. Somnathan Nair, *"Linear Integrated Circuits Analysis Design and Applications"*, Wiley India Pvt. Ltd., New Delhi, First Edition, 2009.

4. Ronald J. Tocci, Neal S Widmer,Gregory L Moss, *"Digital Systems: Principles and Applications"*, Pearson/Prentice Hall,2004.

12E504 ROTATING AC MACHINERY AND SPECIAL MACHINES

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ALTERNATORS   (09)

Alternators - Types and constructional features - Emf equation - Armature reaction - Load characteristics - Phasor diagram - Predetermination of regulation by EMF, MMF and ZPF methods.

TWO REACTION THEORY   (09)

Basic ideas of two reaction theory - Direct and quadrature axis reactances and their determination - Phasor diagram and regulation of salient pole alternators - Parallel operation - Synchronising torque - Expression for synchronising power.

SYNCHRONOUS MOTORS   (09)

Synchronous motors - Principle of operation - Synchronous machines on infinite bus bars - Phasor diagram - V and inverted V curves - Current and power circle diagrams - Hunting and its suppression - Starting methods - Synchronous condenser.

INDUCTION MOTORS   (09)

Polyphase induction motors - Types and constructional features - Principle of operation - Torque - slip characteristics - Effect of rotor resistance - Equivalent circuit - Circle diagram - Starting and speed control. Single phase induction motor - Principle of operation - Double revolving field theory - Methods of starting - Applications.

SPECIAL MACHINES   (09)

Construction and Principle of operation of Universal motor - Reluctance motor - Hysteresis motor - Permanent magnet DC motor - Permanent magnet Synchronous motor - Switched reluctance motor - Linear induction motors – BLDC Motors

Lecture: 45 Tutorial: 15 Total Hrs: 60

Text Books

1. Kothari D. P. and Nagrath I. J , **"Electric Machines"**, *Tata McGraw Hill, Fourth Edition, 2011*

2. Theraja B. L and Theraja A. K., **"A Textbook of Electrical Technology"**, *Vol. II, S Chand & Co. Ltd., New Delhi, 2009.*

Reference Books

1. Fitzgerald A. E., Kingsly C. and Kusko A.,**"Electric Machinery"**,*Tata McGraw Hill, 2007*

2. Langsdorf A. S., **"Theory of A.C Machinery"**, *Tata McGraw Hill, 2001.*

3. Sen. S. K, **"Electric Machinery"**, *Khanna Publishers, New Delhi, 2008.*

4. Say M.G., **"Alternating Current Machines"**, *5th Edition, Pitman Publishing, 1986.*

5. Bimbhra P.S., **"Electrical Machinery"**, *Khanna Publishers, New Delhi, 2009.*

12E401 NUMERICAL METHODS

(Common to CIVIL, EEE, EIE, CSE and IT)

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SOLUTIONS OF EQUATIONS AND EIGEN VALUE PROBLEMS (09)

Iterative method – Newton – Raphson Method for single variable and for simultaneous equations with two variables – Solutions of Linear system by Gauss elimination , Gauss – Jordan , Crout's and Gauss Seidel Methods – Relaxation Method – Eigen value of a Matrix by Power Method.

INTERPOLATION (09)

Operators – Relation between the operators – Newton's divided difference formula – Lagrange's and Hermite's Polynomials – Newton Forward and Backward difference formulae – Stirlings and Bessel's Central difference formulae.

NUMERICAL DIFFERENTIATION AND INTEGRATION (09)

Numerical differentiation with Interpolation Polynomials – Numerical Integration by Trapezoidal and Simpson's (Both $1/3^{rd}$ and $3/8^{th}$) rules – two and three point Gaussian quadrature formula – Double integrals using Trapezoidal and Simpson's Rules – Difference equation.

INITIALVALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS (09)

Single step methods – Taylor series , Euler and Modified Euler, Runge – Kutta method of order four for first order differential equations – Multistep methods – Milne and Adam – Bashforth predictor and Corrector methods.

BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS (09)

Finite difference solutions for the second order ordinary differential equations – Finite difference solutions for one dimensional Heat equation (Both Implicit and Explicit) – One dimensional Wave equation -Two dimensional Laplace and Poisson equations.

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Lecture: 45   Tutorial : 15   Total Hrs. : 60

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Text Book

1. Dr.Kandasamy. P, Dr.Thilagavathy . K, Dr. Gunavathy . K., *"Numerical Methods"*, S. Chand and Co., New Delhi, 2010.

Reference Books

1. Veerarajan. T and Ramachandran. T., *"Numerical Methods with Programming in C"*, Tata Mc.Graw Hill Publishers, New Delhi, 2007.

2. Balagurusamy .E. *"Numerical Methods"*, Tata McGraw Hill Publishers, New Delhi, 1999, reprint 2007.

3. Grewal. B. S. and Grewal. J.S., *"Numerical Methods in Engineering and Science"*, (Sixth Edition), Khanna Publishers, New Delhi, 2004.

4. Gerald.C.F. and Wheatley. P.O., *"Applied Numerical Analysis"*, (Sixth Edition), Pearson Education,Asia, New Delhi, 2006.

5. Sankar Rao K, *"Numerical Methods for Scientists and Engineers"*, (Third edition), Prentice Hall of India, New Delhi , 2007.

6. Dr.Manish-Goyal , *"Statistics and Numerical Methods"*, University Science Press, New Delhi, 010.

7. Dr.J.S.Chitode, *"Numerical Methods "*, Technical Publications, Pune, 2010.

12E601 MODERN CONTROL THEORY
(Common to EEE and EIE)

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Z – TRANSFORM   (09)

Sampled data theory – Sampling process – Sampling theorem – Signal reconstruction – Sample and hold circuits – Z Transform – Theorems on Z Transforms – Inverse Z Transforms

SAMPLED DATA SYSTEMS

Pulse transfer function – Response of sampled data system to step and ramp Inputs – Steady state error – Stability studies – Jury's test and bilinear transformation.   (09)

STATE SPACE ANALYSIS OF DISCRETE SYSTEMS   (09)

State variables – Canonical forms – Diagonalisation – Solutions of state equations – Controllability and observability – Effect of sampling time on controllability – Pole placement by state feedback – Linear observer design – First order and second order problems.

NON-LINEAR SYSTEMS   (09)

Types of non linearity – Typical examples – Phase plane analysis – Singular points – Limit cycles – Construction of phase trajectories – Describing function method –Basic concepts – Dead Zone – Saturation - Relay - Backlash- – Liapunov stability analysis – Stability in the sense of Liapunov – Definiteness of scalar functions – Quadratic forms- Second method of Liapunov – Liapunov stability analysis of linear time invariant systems and non-linear system.

OPTIMAL CONTROL   (09)

Introduction to Optimal Control, statement of the optimal control problem, dynamic programming general introduction to the principle of optimality, application to DTS, discretetime linear quadratic problem, optimal state feedback solution.Formation of optimal control problems-results of Calculus of variations- Hamiltonian formulation-solution of optimal control problems- Evaluation of Riccati s equation State and output Regulator problems-Design examples

Lecture: 45. Tutorial: 15. Total Hrs: 60

Text Books

1. Gopal M., *"Digital Control and State Variable Methods"*, Tata MC Graw Hill, 3rd Edition 2008

2. Richard C. Dorf and Robert H. Bishop, *"Modern Control Systems"*, 12th Edition, Pearson   Education, 2004.

3. D.E. Kirk, *"Optimal Control Theory-An Introduction"*, Prentice Hall, 2nd Edition 1998

Reference Books

1.   *Katsuhiko Ogato, "**Discrete-Time Control Systems**", Pearson Education Pvt., New Delhi, 5th Edition.*

2.   *Nagrath I.J. and Gopal M., "**Control Systems Engineering**", Wiley Eastern Limited, New Delhi, 5th Ed. 2008.*

3.   *B.C. Kuo, "**Digital Control Systems**", Oxford University Press, Second Edition, 2007.*

4.   *Loan D. Landau, Gianluca Zito, "**Digital Control Systems, Design, Identification and Implementation**", Springer, 2006.*

12E602 POWER ELECTRONIC DEVICES AND CIRCUITS

(Common to EEE and EIE)

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SEMICONDUCTOR DEVICES (09)

Basic structure and Switching characteristics of Power diode- Power transistor- SCR- Triac- GTO- MOSFET and IGBT- ratings of SCR- series parallel operation of SCR- di/dt and dv/dt protection Introduction of ICT- SIT- SITH and MCT- Triggering Circuits.

CONTROLLED RECTIFIERS (09)

Operation of 1-phase half wave rectifiers with R- RL- and RLE load - 1-phase Full Wave Rectifier with R- RL and RLE load (Fully controlled and half controlled) operation and analysis of rectifiers operation of 3-phase Half Wave Rectifier and Full Wave Rectifier with R and RL loads - Effect of source inductance in 1-phase Full Wave Rectifier - 1-phase dual converter operation.

DC CHOPPERS (09)

Types of forced commutation- classification and operation of different types of choppers (A- B- C- D- E) - Control strategies - operation of voltage- current and load commutated choppers -Multiphase chopper operation - SMPS.

INVERTERS (09)

Types of inverters- operation of 1-phase - 3 phase (120° and 180°) modes for R- load operation of CSI with ideal switches- 1-phase ASCSI, basic series Inverter- modified series and Improved series inverter - 1-phase parallel inverter 1-phase basic McMurray inverter.

AC VOLTAGE CONTROLLERS (09)

Types of control (Phase and Integrated cycle control) - Operation of 1-phase voltage regulator with R- RL loads. Operation of 3-phase AC voltage controller with R load - 1-phase step up and step down cyclo converters. 3-phase cyclo converter with R- RL loads.

Lecture: 45   Tutorial: 15   Total Hrs.: 60

Text Books

1. Muhammad H. Rashid- *"Power Electronics - Circuits- Devices and Applications"*- Prentice Hall of India- New Delhi- Third Edition- 2005.

2. Ned Mohan, *"Power Electronics-Converter Applications and Design"*, Wiley, 3rd Edition, Reprint 2009.

Reference Books

1. Dr. P.S.Bhimbra., *"Power Electronics"* Khanna Publishers, 3rd edition, 2006.

2. Singh. M.D and Khanchandani. K.B *"Power Electronics"* Tata McGraw Hill Publishing Co. Ltd. - New Delhi- 3rd Reprint 2008.

3. Dubey- G.K., Doradla.S.R., Joshi.A., Sinha.R.M.K- " *Thyristorised Power Controllers*"- New Age International Publishers Ltd.-1st Edition, Reprint 2010.

4. Vedam Subramaniam- *"Power Electronics"*- New Age International (P) Publishers Ltd. - 2nd Edition, Reprint 2011.

12E604 POWER SYSTEM ANALYSIS AND STABILITY

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INTRODUCTION TO POWER SYSTEM (09)

One line diagram and impedance diagram – Per-unit systems- Power network equation – Nodal formulation – Constructing bus admittance matrix –Building of bus Impedance matrix.

LOAD FLOW STUDIES (09)

Formulation of load flow equations using Y-bus – Computer analysis through Gauss-Seidal method – Newton - Raphson method – Fast Decoupled Load Flow method – Comparison of load flow methods

SYMMETRICAL AND UNSYMMETRICAL FAULT ANALYSIS (09)

Transient on a transmission line – Short circuit of a loaded and unloaded synchronous machine – Selection of circuit breaker –Symmetrical component analysis of Single line to ground (LG) fault, line to line (LL) fault, double line to ground (LLG) fault, Open conductor faults –bus impedance –Bus impedance matrix method for analysis of unsymmetrical shunt faults.

STEADY STATE AND TRANSIENT STABILITY (09)

Classification of Stability- Steady State Stability-Two machine system with negligible losses – Clarke diagram for two machine system with negligible losses – Two machine system with losses – Clarke diagram for two machine system with resistance – Steady state stability with automatic voltage regulators. Transient Stability- Swing equation and its solution- Power angle Equation – Swing equation for synchronous machine – Numerical solution of swing equation – Multi machine stability –Voltage regulator capability to improve transient stability- Factors affecting transient stability.

EQUAL AREA CRITERION AND EXCITATION SYSTEM (09)

Concepts of equal area criterion – Application of equal area criterion to stability studies under fault conditions – Determination of critical clearing angle – Reduction of a power system to a single equivalent machine connected to infinite bus – Modern trends in excitation systems — Super-excitation for stability – Two axis excitation control – High initial response excitation systems – Exciter response - Determination by graphical integration – Point by point method of calculation.

Lecture: 45   Tutorial: 15 Total Hrs.: 60

Text Books

1. Gangadhar K.A, *"Electric Power System – Analysis, Stability and Protection"*, Khanna Publishers, New Delhi, 8th reprint 2009.

2. Kimbark E.W., *"Power System Stability"*, Volume III, Wiley – IEEE Press Third Reprint.

Reference Books

1. Wadhwa C.L, *"Electrical Power Systems"*, Wiley Eastern Ltd., New Delhi, 6th Edition, 2010.

2. P. Kundur, *"Power System Stability and Control"*, Tata Mc Graw Hill, 5th reprint, 2008.

12E608 POWER ELECTRONICS AND DRIVES LABORATORY

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1. V-I characteristics of SCR and TRIAC
2. V-I characteristics of MOSFET and IGBT
3. Power electronic devices triggering circuits
4. Single phase half-wave and full-wave controlled rectifiers
5. Single phase fully controlled bridge rectifier
6. Thyristorised DC chopper
7. Single phase thyristorised inverter
8. Series inverter
9. AC phase control using SCRs
10. AC phase control using TRIAC and DIAC
11. Speed control of separately excited chopper fed DC drive
12. V/f speed control method of the three-phase Induction Motor
13. Speed control of BLDC Motor.
14. Speed control of Switched Reluctance Motor.

Total Hrs : 45

12E503 MICROPROCESSORS AND MICROCONTROLLERS PROGRAMMING

(Common to EEE and EIE)

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8085 ARCHITECTURE, INTERRUPTS AND DMA (09)

Architecture and addressing modes of 8085 processors -Instruction set of 8085 - Timing diagrams - Execution timing: Hardware and software interrupts - Multiple interrupts – Methods of serving interrupts - 8259 interrupt controller - DMA operations – 8257 DMA Controller- Memory mapped I/O and isolated I/O

PERIPHERAL INTERFACING & APPLICATION (09)

Programmable Peripheral Interface (8255), keyboard display controller (8279), ADC, AC Interface, Programmable Timer Controller (8254), Programmable interrupt controller (8259), Serial Communication Interface (8251).

8051 MICROCONTROLLER ARCHITECTURE – INSTRUCTION SET (09)

Architecture –Internal and External Memories- Counters and Timers-Synchronous Serial-cum-asynchronous serial communication USART interface- - interrupts – instruction set- 8051 Programming in C.

REAL TIME INTERRUPTS AND TIMERS (09)

Interrupt handling structure of an MCU-interrupt latency and interrupt deadline-multiple sources of the interrupts-non maskable interrupt sources-enabling(un-masking) or disabling of the sources-polling and determine the interrupt sources-programmable timers in the MCUs-free running counter and real time control-interrupt interval and density constraints.

INTERFACING AND MICRO CONTROLLER APPLICATIONS (09)

LEDs, push buttons, relays and latch connection-key board interfacing-interfacing 7-segment displays-LCD interfacing-ADC/DAC Interfacing - Measurement applications-automation and control applications

Lecture: 45   Tutorial: 15 Total Hrs.: 60

Text Books

1. Ramesh. S. Gaonkar, *"Microprocessor Architecture, Programming and Applications of 8085"*, *Penram International Pvt. Ltd., 2004.*

2. Rajkamal *"Microcontrollers (Architecture, programming, interfacing and system design)"*, *Dorling Kindersley Pvt Ltd, 2009.*

3. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. M CKinlay *"The 8051 Microcontroller and Embedded Systems"*, *Second Edition, Pearson Education 2009.*

Reference Books

1. Deshmhmukh L M, *"Microcontrollers (Theory and applications)"*, Tata McGraw-Hill Publishing Co. Ltd, New Delhi, 2008.

2. Vijayendran.V, *"Fundamentals of Microprocessor-8085: Architecture, Programming & Interface"*, Vijay Nicole Pvt. Ltd, 2004.

3. John Crisp, *"Introduction to Microprocessors and Microcontrollers"*, Newnes publications (Imprint of Elsevier), 2nd Edition, 2004.

12E505 POWER GENERATION AND UTILIZATION

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CONVENTIONAL ENERGY GENERATION (09)

Different types of conventional energy sources – Prediction of load and energy requirements – Hydro electric plant – Large hydro plants – Mini Hydel schemes – Pumped storage plant – Thermal energy production – Heating value – Coal combustion mechanism – Thermal power plant – Super thermal plant – Nuclear power plant – Fast breeder reactors – Gas power plant- Co generation.

TRACTION ENGINEERING (09)

Traction mechanics – Tractive effort – Speed time curves – Power output and maximum speed – Specific energy output – Traction motors – Control of motors – electric braking – Traction supply system – Negative boosters.

ILLUMINATION (09)

Definitions and lighting calculations – Interior and exterior illumination systems – Design of lighting schemes – Energy efficient Lightning system.

HEATING WELDING AND ELECTROLYTIC PROCESSES (09)

Direct and indirect heating methods – Types of furnaces – Heat control – High frequency heating methods – Induction furnace – Dielectric heating – Welding and its classification – Electric arc welding – Electronic welding control - Review of electrolytic process principle – Laws of electrolysis – Current and energy efficiency – Extraction and refining of metals – Electron – deposition

ENERGY CONSERVATION AND ENERGY AUDIT (09)

Introduction: Energy audit strategy – Instruments for energy audit – energy audit of Illumination system, electrical systems, heating, ventilations air conditioning systems, compressed air system – Buildings, steam generation, distribution and utilization system – economic analysis -Energy conservation principles and planning – energy conservations in heating industries, small scale industries, electrical generators, transmission and distribution system – household and commercial sector – transport and agricultural sector – energy conservations – legislations – Power Analyser.

Total Hrs: 45

Text Books

1. Soni M.L., Gupta P.V., Bhatnagar U.S., *"A Course in Electric Power"*, Dhanpat Rai and Sons, New Delhi, 2005.

2. B.R. Gupta, *"Generation of Electrical Energy"*, Eurasia Publishing House (Pvt.) Ltd. New Delhi, Reprint, 2009.

Reference Books

1. Despande M.V., *"Elements of Electrical Power Station Design"*, Pitman, 2010.

2. Taylor E.O. and VVL Rao, *"Utilization of Electric Energy"*, Orient Longman, New Delhi, 2007.

3. Uppal S.L., *"Electric Power"*, Khanna Publishers, New Delhi, 2004.

4. Garg G.C., *"Utilisation of Electric Power and Electric Traction"*, Khanna Publishers, New Delhi, 2004.

5. Rajput R.K., *"Utilization of Electrical Power"*, Laxmi Publications Pvt. Ltd, New Delhi, 2008.

12E506 POWER SYSTEMS - I

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INTRODUCTION (09)

Introduction to transmission and distribution - Influence of working voltage on size of feeders and distributors - Effect of system voltage, economy, drop and efficiency of transmission and distribution - Comparison of different systems of power transmission and distribution - Kelvin's law and its limitations.

DISTRIBUTION (09)

Feeders, distributors and service mains - Distributors fed at single end and both ends - Calculation of voltages in distributors with distributed and concentrated loads - AC Distribution.

LINE PARAMETERS (09)

Resistance of conductors - Inductance and capacitance of single phase and three phase system with symmetrical and unsymmetrical spacing - Transposition - Effect of earth on capacitance.

LINE PERFORMANCE (09)

Regulation and efficiency - Short lines, medium lines represented by nominal Pi and T networks and long lines - Power circle diagrams of constant voltage lines (both sending and receiving end) - Power factor improvement by synchronous modifier - Maximum power transmitted.

CORONA AND VOLTAGE CONTROL (09)

Formation of corona - Critical voltages - Losses - Effect on line performance - Different methods of voltage control of transmission lines - Inductive interference between power and communication lines - Radio interference.

Total Hrs: 45

Text Books

1. Uppal S.L., *"Electric Power"*, Khanna Publishers, New Delhi, 2004.

2. Soni M.L, Gupta P.V. and Bhatnagar A., *"A Course in Electrical Power"*, Dhanpat Rai and Sons, Reprint 2005.

Reference Books

1. D.P.Kothari, *"Power System Engineering"*, Tata McGraw Hill, Second Edition 2009.

2. Mehta V.K., Rohit Mehta, *"Principles of Power Systems"*, S.Chand and Co., Reprint 2009.

3. C.L.Wadhwa., *"Electrical Power Systems"*, New Age International Publishers, New Delhi, Reprint 2005.

4. Singh, *"Electric Power Generation Transmission and Distribution"*, PHI Learning, Second Edition, 2010.

12E701 INDUSTRIAL MANAGEMENT AND ECONOMICS

(Common to EEE and EIE)

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(09)

MICRO ECONOMICS

Definition of Economics, Scope; Demand – Curve, Schedule, Factors affecting demand, Elasticity of Demand; Supply – Curve, Factors influencing supply, Elasticity, Supply behavior in different time periods.

(09)

MACRO ECONOMICS

Money – Evolution, Functions: Central Bank and Commercial Banks Functions; Inflation – Definition, Types, Methods of correcting, Impact; Deflation – Definition, Methods of correcting, Impact.

(09)

BASICS OF MANAGEMENT THOUGHT

Evolution of Management, Management – Definition, Levels, Principles, Differences with administration, Roles of Managers, Contributions of Henry Fayol, Taylor and Ducker to Management, External environment of business, Social responsibility of business.

(09)

FUNCTIONS OF MANAGEMENT

Planning – Premises, Process, Types of Plans; Organizing – Departmentation, Authority – Responsibility relationship, Span of Management; Staffing – Manpower Planning (Manpower Planning Chart and Process), Staffing (Systems approach to staffing), Directing – Leadership theories, Motivation theories and Communication (Process, Barriers, Guidelines for effective communication).

(09)

ORGANIZATIONAL BEHAVIOUR

Individual behavior – Values (Types, Formation), Personality, Learning; Group behavior – (Types of groups, Stages of group formation, Reasons for joining groups); Organization culture (Origin, Modes of transmission).

Total Hrs: 45

Text Books

1. Koontz, **"Essentials of Management"**, McGraw Hill, 2006
2. Prasad L.M., **"Principles and Practice of Management"** Sultan Chand and Sons, 7th Edition 2008.
3. Varshney.R.I, Maheshwary K.L, **"Managerial Economics"**, Sultan Chand and Sons, 2006.

Reference Books

1. Stephen P Robbins, **"Organizational Behavior"**, Prentice Hall of India, New Delhi, 2007.
2. Samuelson and Nordhaus, **"Economics"**, McGraw Hill Ltd., 2009.

12E603 DIGITAL SIGNAL PROCESSING AND PROCESSORS

(Common to EEE and EIE)

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INTRODUCTION (09)

Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect. Digital signal representation, analog to digital conversion

DISCRETE TIME LINEAR SYSTEMS (09)

Discrete linear systems- Time invariance - Causality, stability, difference equations Z-transforms and inverse Z-transforms - Transfer function of linear discrete systems- Impulse response, step response, frequency response- Recursive, non-recursive filters - Digital filter realization- Direct, canonic, cascade, parallel and ladder realizations.

DIGITAL FILTERS (09)

Approximation of analog filters-Butterworth and Chebyshev - Frequency transformation - Properties of IIR filters - IIR filter design – Bilinear transformation and impulse invariant methods - Digital transformation - Characteristics of FIR filters - Frequency response of linear phase FIR filters - Design of FIR filters - Fourier series method - Window function.

DISCRETE FOURIER TRANSFORM (09)

DFT - Definition – Properties - Convolution of sequences - Linear convolution - Introduction to radix-2 FFT- Properties- Decimation in time-Decimation in frequency- Data shuffling and bit reversal- Computation of IDFT using DFT.

HARDWARE FOR DSP (09)

Harvard architecture – Pipelining - Hardware MAC unit- Special instructions of DSP - Architecture of TMS320C5X – Replication - On-Chip memory- Assembly language instructions of TMS320C5X - Simple programs.

Lecture: 45 Tutorial: 15 Total Hrs.: 60

Text Books

1. *John G. Proakias, Dimitris G. Manolakis, "**Digital Signal Processing: Principles, Algorithms and Applications**", Pearson Education Pvt. Ltd., New Delhi, 3rd Edition 2009.*

2. *Venkatramani B. and Bhaskar M., "**Digital Signal Processors: Architecture and Programming**", Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2008*

Reference Books

1. *Sanjit K. Mitra, "**Digital Signal Processing - A Computer Based Approach**", Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 3rd Edition 2009.*

2. *Oppenheim and Schafer, "**Discrete Time Signal Processing**", Prentice Hall of India Pvt. Ltd., New Delhi, 3rd Edition 2007*

3. *Ludeman L. C., "**Fundamentals of Digital Signal Processing**", John Wiley and Sons,   New York, 1986.*

12E605 POWER SYSTEMS - II

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LINE INSULATORS AND CABLES (09)

Types - Voltage distribution in a string of suspension insulators - Grading rings - arcing horns - String efficiency - Testing of line insulators.

Introduction to cables – Classification - Cable construction - Cable insulation -Capacitance of cable - Dielectric stress - Grading of cables - Thermal resistance of cables- Current rating of cables - Overhead lines versus underground cables.

LINES, SUPPORTS AND TARIFF CALCULATION (09)

Stress and sag calculations - Effect of wind and ice - supports at different levels -Stringing chart - Conditions at erection - Sag template - Design of poles, cross arms and strays - Principle and design of transmission towers - Tariff calculation - Vibration and vibrating dampers.

SUBSTATION DESIGN (09)

Classification - Design of substation - Equipments in a substation – Bus bar arrangement in high and low voltage side for a substation - Bus arrangement - Location of a substation.

HIGH VOLTAGE GENERATION (09)

Generation of high d.c. voltages - Generation of high alternating voltages - generation of impulse voltages - Generation of impulse currents - Tripping and control of impulse generators - Parallel operation of dc link with ac network.

HIGH VOLTAGE MEASUREMENT AND TESTING (09)

Measurement of high d.c. voltages - Measurement of high a.c. and impulse voltages - measurement of high voltage d.c., a.c. and impulse currents - Cathode ray oscillographs for impulse voltage and current - Testing of insulators and bushings - Testing of isolators and circuit breakers - Testing of cables - Testing of transformers - Testing of surge diverters.

Total Hrs: 45

Text Books

1. Soni M.L., Gupta P.V., Bhatnagar U.S., *"A Course in Electric Power"*, Dhanpat Rai and Sons, New Delhi, 2005

2. Ashok Chakrabthi, Soni M.L., Gupta P.V., Bhatnagar U.S., *"Power System Engineering"* Dhanpat Rai and Sons, New Delhi, 1997

3. Uppal, S.L., *"Electric Power"*, Khanna Publishers, New Delhi, 13th Edition, 2003.

4. Naidu M.S. and Kamaraju V., *"High Voltage Engineering"*, 4th Edition., Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2009.

Reference Books

1. D.P.Kothari and I.J.Nagrath, *"Power System Engineering"*, Tata McGraw Hill, Third Reprint 2008.

2. Wadhwa C.L, *"High Voltage Engineering"*, New Age International Pvt. Ltd., New Delhi, 3rd edition, 2010.

3. Subir Ray, *"An Introduction to High Voltage Engineering"*, PHI Learning, Fourth Printing, 2008.

4. Mehta V.K., Rohit Mehta.,*"Principles of Power Systems"*, S.Chand and Co., Fourth Revised Edition, 2008.

12E708 POWER SYSTEM LABORATORY

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1. Electromechanical Relays

2. Microcontroller based Relays

3. AC Tranmission line Analyser

4. DC network analyser

5. Cable fault analysis

6. Three Phase fault analysis

7. Generator protection simulation

8. Feeder protection simulation

9. Study of FACTS devices in power systems

10. Study of unbalanced circuits using Symmetrical components

11. Computation of Parameters and Modeling of Transmission Lines

12. Formation of Bus Admittance and Impedance Matrices

13. Load Flow Analysis Using Gauss-Seidel Method

14. Load Flow Analysis Using Newton- Raphson and Fast-Decoupled Methods

15. Fault Analysis

16. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System

17. Transient Stability Analysis of Multi-machine Power Systems

18. Electromagnetic Transients in Power Systems

19. Load – Frequency Dynamics of Single- Area and Two-Area Power Systems

20. Economic Dispatch in Power Systems.

Total Hrs: 45

12E702 ELECTRICAL MACHINE DESIGN

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INTRODUCTION (09)

Standard specifications – Electrical Engineering materials – Magnetic Circuits – Carter's Coefficient – Magnetisation and Loss Curves – MMF and Leakage Reactance calculations.

DC MACHINES (09)

Output Equation – Choice of Specific Loadings – Choice of Poles and Speed – Design of Conductors, Windings, Slot, Air Gap, Field Poles and Field Coils.

TRANSFORMERS (09)

Output Equations – Design of Core, Coils, Tank and Cooling Tubes – Calculation of circuit parameters, Magnetising current .

INDUCTION MOTORS (09)

Output Equation – Choice of Specific loadings – main dimensions – design of Stator, Rotor, Windings and Slots – Equivalent Resistance of Cage Rotor – Calculation of Circuit Parameters – Magnetising Current – Circle Diagram from Design Data.

SYNCHRONOUS MACHINES (09)

Rating and Dimensions – Low Speed Machines – Turbo Alternators – Choice of Specific Loadings – Main Dimensions – Design of Field Poles and Field Coils of Salient Pole Machines – Ventilation, Cooling methods and media.

Lecture: 45   Tutorial: 15   Total Hrs.: 60

Text Books

1. A.K Sawhney and A Chakrabarthi, *"A Course in Electrical Machine Design"*, Dhanpat Rai and Co, New Delhi, Sixth Reprint, 2012.

2. Sen S.K., *"Principles of Electrical Machine Design"*, Oxford and IBH Publishing Company, 2nd Edition, Reprint 2009.

Reference Books

1. Clayton A.E., *"Performance and Design of DC Machines"*, ELBS Pitman and Sons Ltd., London, 1964.

2. Say M.G., *"The Performance and Design of AC Machines"*, Pitman and Sons Ltd., London, 1995

3. Shanmuga Sundaram A., Gangadharan G., and Palani R., *"Electrical Machine Design Data Book"*, New Age International Publishers, Reprint 2005.

12E703 POWER SYSTEM PROTECTION AND SWITCHGEAR

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PROTECTIVE RELAYS (09)

Introduction - Types of electromagnetic relays-Construction, operation, and applications- Differential relay-Distance Relay-Over current relay-Impedance relay-Principles of operation of static relays-Static over current relays.

APPARATUS PROTECTION (09)

Protective relays for the protection of generators – Motors – Transformers – Bus and Lines including parallel feeders – Effect of current and potential transformers on the performance of relays.

CIRCUIT BREAKERS (09)

Elementary principles of arc extinction – Arc control devices – Restriking and recovery voltages – Bulk oil, minimum oil, air blast, vacuum circuit breakers – SF_6 – Rating – speed of operation – Selection and testing of circuit breakers – Fuses – HRC fuses.

PROTECTION AGAINST OVER VOLTAGES (09)

Lightning – Switching – Insulation failure – arcing grounds – Methods of protection – ground line – Peterson coil – surge absorbers and diverters – Location of protective apparatus

SUBSTATION PROTECTION (09)

Substation types – General arrangement of equipments – Earthing – Backup protection – Isolating schemes – Power line carrier communication.

Total Hrs.:45

Text Books

1. Sunil S.Rao, *"Switchgear protection and power systems"* 11th Edn., Khanna Pub., 13th Edition, 2008

2. Soni M.L., Gupta P.V. and Bhatnagar U.S. and Bhatacharya, *"Power system Protection"*, 1998.

3. Ravindranath B. and Chander M., *"Power System Protection and Switchgear"*, 1st Edition Reprint 2005.

Reference Books

1. Uppal S.L. *"Electric Power"*, Khanna Publishers, New Delhi, 13th edn, 2003.

2. Mason C.R. *"The Art and Science of Protective Relaying"*, John Wiley and Sons, 1956

12E6E0 PRINCIPLES OF VIRTUAL INSTRUMENTATION

(Common to EEE and EIE)

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INTRODUCTION (09)

Virtual Instrumentation and LabVIEW - Evolution of LabVIEW - Difference between LabView and conventional languages - Sequencing and data flow - Graphical programming.

LabVIEW ENVIRONMENT (09)

Front panel - Block diagram - Icon and Connector - Control Palette - Function Palette-Tools Palette - Creating, editing, wiring, debugging and saving VIs - sub-VIs - creating sub-VIs - simple examples-Looping: For loop, while loop-Shift registers - case and sequence; structures, formula nodes.

PROGRAMMING TECHNIQUES (09)

Arrays - clusters, charts and graphs, - local and global variables - property node, string and file I/O.

DATA ACQUISITION AND INSTRUMENT CONTROL (09)

DAQ – Components - Buffers: Buffered and ñon buffered I/O - Triggering - Analog I/O-Digital I/O - Counters and timers-Instrument control: VISA, GPIB, VXI and PXI.

ADVANCED Lab VIEW AND APPLICATIONS (09)

Connectivity in LabVIEW: an introduction - IVI - Labwindows/CVI - Applications of Lab VIEW: process control, physical, biomedical, Image acquisition and processing.

Total Hrs: 45

Text Books

1. Sanjay Gupta and Joseph John, *"Virtual Instrumentation using LabVIEW "* Tata McGraw-Hill, Second edition 2010

2. Gary Johnson, Richard Jennings *"Lab view graphical programming"*, Tata McGraw Hill, 2011.

Reference Books

1. Lisa K Wells and Jeffrey Travels, *"Labview for everyone"*, Prentice Hall, 3rd Edition 2009.

2. S. Gupta, J.P. Gupta, *"PC interfacing for data acquisition and process control"*, 2nd Ed., Instrument Society of America, 1994.

3. Jovitha Jerome, *"Virtual Instrumentation Using LabVIEW"* PHI Learning Pvt. Ltd 1st Edition, 2010.

12E6E1 NEURAL AND FUZZY SYSTEMS

(Common to EEE and EIE)

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INTRODUCTION TO NEURAL NETWORKS (09)

Introduction – Biological and Artificial neural networks - Learning rules – Training - ADALINE - MADALINE – BAM – Discrete Hopfield networks.

ARTIFICIAL NEURAL NETWORKS (09)

Theory, Architecture and Applications of Back propagation network – Counter propagation network – Kohenen's Self Organising Maps.

INTRODUCTION TO FUZZY (09)

Fuzzy sets and membership – Chance Vs ambiguity – Classical sets – Fuzzy sets – Fuzzy relations – Tolerance and Equivalence relations – Value assignments.

FUZZIFICATION AND DEFUZZIFICATION (09)

Fuzzification – Membership value assignments – Fuzzy to Crisp conversions -Lambda – Cuts for Fuzzy sets and relations – Defuzzification methods.

FUZZY ARITHMETIC, NUMBERS, VECTORS AND EXTENSION PRINCIPLE (09)

Extension principle – Fuzzy numbers – Interval analysis in arithmetic – Approximate methods of extension: Vertex method, DSW algorithm, Restricted DSW algorithm – Fuzzy vectors – Classical predicate logic – Approximate reasoning – Fuzzy tautologies, contradictions, Equivalence and Logical proofs.

Total Hrs. : 45

Text Books

1. Laurene Fausett, *"Fundamentals of Neural Networks"*, Prentice Hall, New Jersey, 2004

2. Timothy J.Ross, *"Fuzzy logic with Engineering Applications"*, Wiley India Pvt. Ltd., 3rd Edition, 2010

Reference Books

1. Robert .J.Schalkoff," *Artificial Neural Networks"*, McGraw Hill, Singapore, 2011.

2. Driankov D., Helledorn H., M.Reinframe, *"An Introduction to fuzzy control"*, Narosa Publishing Co., New Delhi, 1996

3. Kosko.B," *Neural Network and fuzzy systems"*- Prentice Hall of India Pvt. Ltd., New Delhi, 2007

4. S N Sivanandam, and S N Deepa, *"Principles of Soft Computing"*, Wiley India Pvt. Ltd., 2nd Edition, 2011.

12E6E2 OPTIMIZATION TECHNIQUES

(Common to EEE and EIE)

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CLASSICAL OPTIMIZATION TECHNIQUES (09)

Single variable optimization - Multivariable optimization with no constraints: Semi definite case, Saddle point - Multivariable optimization with Equality constraints: Solution by direct substitution, Solution by the method of constrained variation, Solution by the method of Lagrange Multipliers - Multivariable optimization with Inequality constraints: Kuhn-Tucker conditions, constraint qualification.

SIMPLEX METHOD (09)

Standard form of a Linear programming problem-Geometry of linear programming problems - Definitions and theorems - Solution of a system of linear simultaneous equations - Pivotal reduction of a general system of equations-Motivation of the simplex method - Simplex algorithm - Revised simplex method.

UNCONSTRAINED & CONSTRAINED OPTIMIZATION TECHNIQUES (09)

Unconstrained optimization techniques: Gradient of a function -Steepest descent (Cauchy) method - Newton's method - Marquardt method -Quasi-Newton methods – Broydon – Fletcher – Goldfarb - Sanno method.Constrained optimization techniques: Characteristics of a constrained problem-Generalized reduced gradient method - Sequential quadratic programming-Augmented Lagrange Multiplier method - Checking convergence of constrained optimization problems.

GENETIC ALGORITHMS (09)

Working principles - Differences between GAs and traditional methods-Similarities between GAs and traditional methods - GAs for constrained optimization-Other GAs operators - Real-coded GAs - Advanced GAs - Simulated annealing.

MATLAB AND OPTIMIZATION TOOLBOX (09)

Matlab Basics: Introduction - Matrices and vectors - Matrix and array operations - Built-in functions - Saving and loading data - Script files - Function files.Optimization Toolbox: Linear least squares with linearity constraints - Nonlinear curve fitting via least square with bounds - Linear programming - Quadratic programming - Nonlinear zero finding.

Total Hrs.: 45

Text Books

1. Singiresu S.Rao, *"Engineering Optimization – Theory and Practice"*, John Wiley & Sons, 4th Edition 2009.

2. Kalyanmoy Deb, *"Optimization For Engineering Design"*, Prentice Hall of India, New Delhi, 2000.

3. Rudra Pratap, *"Getting Started with MATLAB 5"*, Oxford University Press, 1999.

4. *"Optimization Toolbox Manual"*, The Mathworks Inc., 2000, www.mathworks.com

12E6E3 COMPUTER SYSTEM ARCHITECTURE

(Common to EEE and EIE)

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DATA REPRESENTATION, MICRO-OPERATIONS AND ORGANIZATION (09)

Data representation - data types - complements – fixed point representation – floating point representation- other binary codes - error detection codes - register transfer and micro operations - Register transfer language - register transfer- bus and memory transfers- arithmetic micro-operations - logic micro-operations - shift micro-operations - arithmetic logic shift unit - basic computer organization and design - instruction codes - computer registers - computer instructions - timing and control - instruction cycle - memory reference instructions - input-output - interrupt - design of accumulator logic.

CONTROL AND CENTRAL PROCESSING UNIT (09)

Micro programmed control - control memory - address sequencing- micro-program example - design of control unit. Central processing unit: general register organization - stacks organization - instruction formats - addressing modes - data transfer and manipulation - program control - reduced instruction set computer.

PIPELINE, VECTOR PROCESSING AND COMPUTER ARITHMETIC (09)

Parallel processing – pipelining - arithmetic pipeline - instruction pipeline - RISC pipeline - vector processing - array processors - addition and subtraction algorithms - multiplication algorithms - division algorithms- floating-point arithmetic operations - decimal arithmetic unit - decimal arithmetic operations.

INPUT-OUTPUT ORGANIZATION (09)

Input-output organization- Peripheral devices- input-output interface- asynchronous data transfer- modes of transfer- priority interrupt- direct memory access- input-output processor- serial communication.

MEMORY ORGANIZATION (09)

Memory organization: Memory hierarchy- main memory- auxiliary memory- associative memory- cache memory- virtual memory- memory management hardware.

Total Hrs.: 45

Text Book

1. Morris Mano M, **"Computer System Architecture"**, 3rd Edition, Pearson Education, 2007

Reference Books

1. Vincent P.Heuring and Harry F.Jordan, **"Computer Systems Design and Architecture"**, Pearson Education Asia Publications, Second Edition, 2008.

2. John P.Hayes, **"Computer Architecture and Organization"**, Tata McGraw Hill, Fourth edition, 2003.

3. Andrew S.Tanenbaum, **"Structured Computer Organization"**, 5th Edition, Pearson Education, 2006.

4. William Stallings, **"Computer Organization and Architecture"**, 7th Edition, Pearson Education, 2009.

12E6E4 BIOMEDICAL INSTRUMENT TECHNOLOGY

(Common to EEE and EIE)

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BASIC HUMAN PHYSIOLOGY
(09)

Resting and action potential, Bioelectric potentials - Heart and Blood circulation - Respiratory system Nervous system - Muscular system.

ELECTRODES AND TRANSDUCERS
(09)

Basic electrode theory - Micro electrodes-Skin surface electrodes, Needle electrodes, Equivalent circuit, Electrode materials, Chemical electrodes, Reference electrodes, The pH electrode, Blood gas electrode - Active transducers and passive transducers - Strain gauge – Thermistor - Biomedical applications.

BIO POTENTIAL RECORDERS
(09)

Electrical and mechanical activities of the human heart- Typical Electrocardiograph (ECG), Electrocardiograph Bipolar and unipolar leads, Einthoven triangle - Electrical activities of the brain, Electroencephalograph - Various rhythms, EEG equipment - Muscle response - Electromyograph (EMG), Nerve Conduction velocity measurements.

BIOTELEMETRY AND PATIENT SAFETY
(09)

Need for biotelemetry - Elements of telemetry system, Radio telemetry system, Physiological signals used in telemetry, TDM and FDM, Implantable units - Physiological effects of electrical current - Shock hazards from electrical equipments, Electrical accidents and their prevention.

COMPUTER APPLICATIONS
(09)

Data acquisition systems - Analysis of ECG signals - Computerized Axial Tomography (CAT) Scanner, Ultrasonic scanner, Magnetic resonance imaging - Computer based patient monitoring system, Introduction to expert system and hospital management.

Total Hrs: 45

Text Books

1. Arumugam M, *"Biomedical Instrumentation"*, Anuradha Agencies Publishers, Chennai, 2010.

2. Joseph J. Carr and John M. Brown, " *Introduction To Biomedical Equipment Technology"*, Pearson Education Asia, New Delhi, Fourth Edition, 2003

3. Leslie Cromwell, Fred J. Webell, Erich A. Pfeffer, *"Bio-medical Instrumentation and Measurements"*, Prentice Hall of India, New Delhi, 2001.

Reference Books

1. Khandpur, *"Handbook on Biomedical Instrumentation"*, Tata McGraw Hill Company, New Delhi, 2003

2. John G. Webster, Ed, *"Medical Instrumentation Application and Design"*, Fourth Edition, JohnWiley & Son's, Singapore, 2007

12E7E0 PROFESSIONAL ETHICS

(Common to EEE ,ECE and EIE)

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ENGINEERING ETHICS (09)

Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

ENGINEERING AS SOCIAL EXPERIMENTATION (09)

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study.

SAFETY (09)

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and chernobyl case studies.

RESPONSIBILITIES AND RIGHTS (09)

Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

GLOBAL ISSUES (09)

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE),India

Total Hrs.:45

Text Books

1. *Mike Martin and Roland Schinzinger, "**Ethics in Engineering**", McGraw-Hill, New York 1996.*

2. *Govindarajan M, Natarajan S, Senthil Kumar V. S, "**Engineering Ethics**", Prentice Hall of India, New Delhi, 2004.*

Reference Books

1. *Charles D. Fleddermann, "**Engineering Ethics**", Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint)*

2. *Charles E Harris, Michael S. Protchard and Michael J Rabins, "**Engineering Ethics – Concepts and Cases**", Wadsworth Thompson Learning, United States, 2000 (Indian Reprint now available)*

3. *John R Boatright, "**Ethics and the Conduct of Business**", Pearson Education, New Delhi, 2003.*

4. *Edmund G Seebauer and Robert L Barry, "**Fundamentals of Ethics for Scientists and Engineers**", Oxford University Press, Oxford, 2001.*

12E7E1 POWER PLANT INSTRUMENTATION

(Common to EEE and EIE)

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METHODS OF POWER GENERATION (09)

Power generation - types - importance of instrumentations in power generation - basic building block for all types of power generation plants - details of boiler processes - P&I diagram of boiler - cogeneration.

PARAMETERS OF POWER PLANT AND ITS MEASUREMENT (09)

Electrical and non electrical parameter measurement -correction factor for steam temp and - steam pressure - drum level measurement -radiations detector - smoke density measurement -dust monitor - speed vibration, shell temp monitoring & control - steam pressure control lubricant temp control of turbines.

ANALYZERS IN POWER PLANTS (09)

Fluegas oxygen analyzer - analysis of impurities in feedwater and steam - dissolved oxygen analyzer -chromatography - PH Meter - Fuel analyser -pollution monitoring instruments.

CONTROL LOOPS IN BOILER (09)

Combustion Control-air/fuel ratio control - furnace draft control - drum level control - main steam and reheat steam temp control - super heater control - attemperator - deaerator control -distributed control system in power plants -interlocks in boiler operation.

NUCLEAR POWER PLANT INSTRUMENTATION (09)

P&I diagram of different types of nuclear power plant - radiations detection instruments - process sensors for nuclear power plants - Spectrum Analyzer - nuclear reactor control systems and allied instrumentation.

Total Hrs: 45

Text Book

1. Liptak B.G., *"Instrumentation in Process Industries"*, Chilton, 1973

Reference Books

1. Sam .G Duke low, *"The Control of boilers"*, ISA press, 2nd Edition 1991.

2. A.Sherryetal, *"Modern Power Station Practice"* - Vol.6 - Pergamon Press, 1971.

3. Sam G. Dukelow, *"The Control of Boilers"*, Instrument Society of America, 1991.

4. P.K. Nag, *"Power Plant Engineering"*, Tata McGraw Hill, 2nd Edition 2002

12E7E2 POWER SYSTEM ECONOMICS

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CHARACTERISTICS AND OPERATION OF POWER PLANTS (09)

Characteristics operation of Power Plants – Choice of Power Plants – Hydro, thermal and Nuclear- Size of Plant – Input / Output Curves – Review of Economic dispatch and loss formula calculations.

OPTIMAL SYSTEM OPERATION OF POWER PLANTS (09)

Economics Scheduling – Cost and Loss Calculation for Optimum Economy – Practical Calculation – Evaluation and application of Generation – Simple problems.

HYDRO THERMAL COORDINATION (09)

Long range and short range hydro scheduling – A gradient approach – hydro units in series – Evaluation and applications of Economic Scheduling of generation – Thermal and Hydro Thermal Stations.

UNIT COMMITMENT (09)

Constraints in unit commitment – thermal unit constraints – hydro constraints – solution methods – priority list methods – dynamic programming solution.

GENERATION SYSTEM RELIABILITY ANALYSIS (09)

Load forecasting and system reliability – load Forecasting – Generation system reliability – Co-ordination methods – economic operation of power systems – Simple problems.

Total Hrs.:45

Text Books

1. Kirchmayer E. K, *"Economic Operation of Power Systems"*, John Wiley and sons, New Delhi, 1985.

2. Elgerd O.I, *"Electric Energy System Theory an Introduction"*, Tata McGraw Hill, New Delhi, 2008.

3. Murthy P.S.R., *"Power System Operation and Control"*, Tata McGraw Hill Book Co., New Delhi, 1984.

Reference Books

1. Sullivan R.L., *"Power System Planning"*, McGraw Hill, New York, 1977.

2. Hawany E.L., and Christensen G.S., *"Optimal Economic Operation of Electric Power Systems"*, Academic Press, New York, 1979.

3. Allen Wood J. and Wollenberg B.F., *"Power Generation Operation and Control"*, John Wiley and sons, New Delhi, 2007.

12E7E3 POWER QUALITY ENGINEERING

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INTRODUCTION TO POWER QUALITY
(09)

Terms and definitions: Overloading- under voltage- sustained interruption- sags and swells; waveform distortion- Total Harmonic Distortion (THD) - Computer Business Equipment Manufacturers Associations (CBEMA) curve.

VOLTAGE SAGS AND INTERRUPTIONS
(09)

Sources of sags and interruptions- estimating voltage sag performance- motor starting sags- estimating the sag severity-, mitigation of voltage sags- active series compensators- static transfer switches and fast transfer switches.

OVERVOLTAGES
(09)

Sources of over voltages: Capacitor switching- lightning- ferro resonance- mitigation of voltage swells- Surge arresters- low pass filters- power conditioners – Lightning protection- shielding- line arresters- protection of transformers and cables- computer analysis tools for transients- PSCAD and EMTP.

HARMONICS
(09)

Harmonic distortion: Voltage and current distortion- harmonic indices- harmonic sources from commercial and industrial loads- locating harmonic sources- power system response characteristics- resonance- harmonic distortion evaluation- devices for controlling harmonic distortion- passive filters- active filters- IEEE and IEC standards.

POWER QUALITY MONITORING
(09)

Monitoring considerations: Power line disturbance analyzer- power quality measurement equipment- harmonic / spectrum analyzer- flicker meters- disturbance analyzer- applications of expert system for power quality monitoring.

Total Hrs.:45

Text Books

1. Roger.C.Dugan, Mark.F.McGranagham, Surya Santoso, H.Wayne Beaty, *"Electrical Power Systems Quality"* McGraw Hill, 2003.

2. PSCAD User Manual

Reference Books

1. Kusko Alexander Thomson Marc. T, *"Power Quality in Electrical Systems"*, McGraw Hill, Professional, 2007.

2. Mat H. J. Bollen and Ireen G.U, *"Signal Processing of Power Quality Disturbance"*, Willey, IEEE press, 2006.

12E7E4 HVDC TRANSMISSION

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GENERAL ASPECTS OF HVDC AND HVAC TRANSMISSIONS (09)

Introduction - Comparison between ac and dc transmissions - DC links - DC cables and line insulators - Comparison between ac and dc cables - Important HVDC projects- Components of a HVDC system.

CONVERTER CIRCUITS AND ANALYSIS (09)

Three Phase bridge converter using SCRs - Operating principles - Waveforms - Gate control and overlap – Voltage, current and power factor relations – Commutating resistance – Inversion – Equivalent circuits – Analysis and charts only for overlap less than 60° - Simple problems.

CONVERTER CONTROL (09)

Principle of control – Manual control – Desirable features of control - Control characteristics – Constant minimum firing angle control – Constant current control – Constant extinction angle control – Tap changer control – Power and frequency control – Stability control – Compounding control and regulation – Reactive power requirement – Simple problems.

FAULTS AND PROTECTION (09)

Bypass valve – SCR valves malfunctions – Over voltage and current oscillations – DC circuit breakers – DC lightning arrestors – Simple problems.

HARMONICS, FILTERS AND GROUND RETURN (09)

Characteristic and uncharacteristic harmonics – Harmonic ac and dc filters – Interference with communication systems – Ground return – land, shore and sea electrodes – Cathodic protection – DC corona.

Total Hrs.:45

Text Books

1. Kimbark E.W., **"Direct Current Transmission"**, Vol I, Wiley – Interscience,New york,1971.

2. Padiyar K.R, "**HVDC Transmission Systems**", New Age International Pvt.Ltd, 2008.

Reference Books

1. Adamson and Hingorani H.G., "**High Voltage DC Power Transmission**", Garaway Ltd. England 1960.

2. Wadhwa C.L.,"**Electrical Power Systems**", New Age International Pvt. Ltd, New Delhi, 1995.

3. Arillaga J., "**High Voltage Direct Current Transmission**", Peter Peregrinus, London, 1998.

12E7E5 EXTRA HIGH VOLTAGE AC TRANSMISSION

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INTRODUCTION TO EHV TRANSMISSION (10)

Standard Transmission Voltages-Average Values of Line Parameters-Power Handling Capacity and Line Losses –Cost of Transmission Lines and Equipments-Mechanical Consideration in Line Performance.

TRAVELLING WAVE THEORY (08)

Single conductor lossless line – Heavy side solution for propagation – Voltages and current waves- Surge impedance – Energy in travelling waves - Distortionless lines – Lines with small losses-Short lines with R, L and C –Long lines and harmonic case – Attenuation and distortion- Transition point – Reflection and refraction - Successive reflection - Bewley's diagram – Effect of insulation capacitance.

SWITCHING SURGES IN EHV SYSTEMS (09)

Origin of over voltages and their types – Over voltages due to interruption of inductive and capacitive currents- Ferro resonance over voltages – Calculation of switching surges –Generalized equations for single phase and three phase systems.

POWER FREQUENCY VOLTAGE CONTROL (09)

Problems at power frequency – Generalized Constants – No Load Voltage Conditions and Charging Currents- Shunt and Series Compensation- Static Reactive Compensation Systems.

DESIGN OF EHV LINES (09)

Introduction- Design Factors Under Steady State Conditions – Line Insulation- Design Based on Transient Over Voltages.

Total Hrs. : 45

Text Book

1. R D Begamudre, *"Extra High Voltage AC Transmission Engineering"*, New Age International Pvt. Ltd, 3rd Edition, 2007.

Reference Books

1. Bewley L.V., *"Travelling Waves on Transmission Systems"*, Dover Publications, 2nd Edition 1963.

2. Kuffel E. and Abdullah M., *"High Voltage Engineering"*, Pergamon Press, 1984.

12E7E6   ENERGY AUDITING AND MANAGEMENT

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BASIC PRINCIPLES OF ENERGY AUDIT   (09)

Energy audit – definition, concept, type of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes – Energy audit of industries – energy saving potential, energy audit of process industry, thermal power station, building energy audit.

ENERGY MANAGEMENT   (09)

Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting –Energy Auditor and Energy Manager – Eligibility, Qualification and functions - Questionnaire and check list for top management.

ENERGY EFFICIENT MOTORS   (09)

Factors affecting efficiency - Energy efficient motors - constructional details, characteristics – variable speed, variable frequency drives - voltage variation –voltage unbalance – over motoring – motor energy audit.

POWER FACTOR IMPROVEMENT, LIGHTING AND ENERGY INSTRUMENTS   (09)

Power factor - methods of improvement, location of capacitors, p.f with non linear loads, effect of harmonics on p.f,- p.f motor controllers –Energy efficient lighting system design and practice- lighting control– Measuring Instruments – wattmeter, data loggers, thermocouples, pyrometers, lux meters, tong testers, application of PLCs.

ECONOMIC ASPECTS AND ANALYSIS   (09)

Economics analysis – Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis - Calculation of simple payback method, net present worth method.

Total Hrs.:45

Text Book

1.   Murphy W.R. and G.Mckay Butter worth , **"Energy Management"**, Heinemann Publications 2007.

Reference Books

1.   Paul o' Callagham, **"Energy Management"**,Mc-Graw Hill Book Company – 1st edition; 1998

2.   John.C.Andreas, **"Energy Efficient Electric Motors"**, Marcel Dekker Inc Ltd – 3rd edition; 2005

3.   W.C.Turner Steve Doty, **"Energy Management Handbook"**, John Wiley and Sons, 7th Edition 2009.

4.   **"Energy Management and Good Lighting Practice: fuel efficiency"** – booklet 12 – EEO

12E7E7 POWER ELECTRONICS APPLICATIONS TO POWER SYSTEMS

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HIGH POWER DEVICES AND THREEPHASE CONVERTERS
(09)

High power devices for power system controllers – Characteristics - Converters configurations for large power control. Properties of three phase converters - Current and voltage harmonics - Effects of source and load impedance - choice of best circuit of power system

CONVERTER CONTROL
(09)

Gate control - Basic means of control - Control characteristics – stability of control- Reactive power control

HVDC SYSTEMS
(08)

Application of converters in HVDC system - Static VAR control - Sources of reactive power -Harmonics and filters.

WIND ENERGY AND PV ENERGY CONVERSION SYSTEM
(10)

Basic components - Generator control – Harmonics - Power factor improvement. Different schemes for PV energy conversion - DC and AC power conditioners - Synchronized operation with grid supply - Harmonic problems.

POWER FLOW ANALYSIS
(09)

Component models - Converter model - Analysis of converter - Transient and Dynamic stability analysis - Protection.

Total Hrs: 45

Text Book

1. Padiyar.K.R., *"HVDC Power Transmission System"*, New Age International Publishers, 2nd Edition, Reprint 2010.

Reference Books

1. Rai.G.D, *"Solar Energy Utilization"*, Khanna Publishers, New Delhi, 10th Reprint 2011.

2. Daniel, Haunt.V., *"Wind Power-A Handbook of WECS"*, Van Nostrand Co.,New York, 1981.

3. Begamudre R.D., *"Extra High Voltage AC Transmission Engineering"*, New Age International (p) Limited, 3rd Edition 2007.

12E7E8 RENEWABLE ENERGY SOURCES

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CONVENTIONAL SOURCES OF ENERGY (09)

Energy - Conventional, renewables, non-conventional and alternate sources of energy - Energy supply system in India. Coal and Coal technologies - Petroleum and natural gas - nuclear fuels and power plants - Hydro sources and power plants - Energy strategies - energy conservation - energy audit - cost of energy.

SOLAR POWER (09)

Application of Solar Energy - Various solar energy systems and their applications, radiations, solar spectra-latitude and longitude, Declination angle, solar window, cosine law, seasonal variations, daily variation, hour angle, calculation of angle of incidence, angstroms equation and constants, solar radiation data, daily global radiation calculations.

WIND POWER (09)

Wind energy - energy chains, application - historical background, merits and limitations, nature of wind, planetary and local day / night winds, wind energy quantum, variables and units used in calculations, wind power density (Pw), Power calculations, power in wind, power by turbine, efficiency, kinetic energy, incoming velocity (Vi), exit velocity (Ve), Power, torque thrust calculations, velocity at different heights, site selection, favourable wind speed range, wind energy wind velocity duration, energy pattern factor.

BIOMASS ENERGY (09)

Biomass energy resources : Photosynthesis and origin of biomass energy, biomass energy resources, cultivated biomass resources, waste to biomass resources, Terms and definitions, Incineration, wood and wood waste, Harvesting super trees and energy forests, phyrolysis, Thermo chemical biomass conversion to energy, gasification, Anaerobic digestion, Fermentation, Gaseous fuel from biomass.

OCEAN AND TIDAL ENERGY (09)

Ocean and Tidal energy conversion, Energy sources in ocean - Ocean tidal, wave and thermal energy, Ocean saline gradient concept, ocean currents, ocean chemical energy, ocean energy conversion routes, electrical and non electrical routes, Bipolar, mono polar HVDC cable transmission, Advantages and merits of ocean energy technologies, limitation, preconditions for commercial installation. Tides - spring tide, neap tide, daily and monthly variation, Tidal range, Tidal Power, Types of tidal power plants, single basin and double basin schemes, main requirements in tidal power plants, energy storage, prospects of tidal power, economic factors.

Total Hrs.: 45

Text Books

1. Rao. S. and Dr. Pamlekar B.B. *"Energy Technology"* Khanna Publishers, Second Edition 1997.

2. Pai and Ramaprasad, *"Power Generation through Renewal sources"*, Tata McGraw Hill – 1991.

Reference Books

1. Rai , G.D., *"Non Conventional sources of Energy"*, Khanna Publishers , IV Edition, 2009.

2. Bansal NK, Kleeman and Meliss, M *"Renewable Energy Sources and Conversion Techniques"*, Tata Mc Graw Hill, 1996.

<div align="center">**12E7E9 SOLID STATE RELAYS**</div>

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INTRODUCTION TO STATIC RELAYS (09)

Advantages of Static Relays - Generalized characteristics and operational equations of relays - steady state and transient performance of signal driving elements - Signal mixing techniques and measuring techniques - CT's and PT's in relaying schemes - Saturation effects.

STATIC RELAY CIRCUITS I (09)

Static relay circuits (Using Analog and Digital IC's) for over current, inverse - time characteristics, differential relay and directional relay.

STATIC RELAY CIRCUITS II (09)

Static relay circuits for generator loss of field, under frequency, distance relays, impedance, reactance, mho, reverse power relays.

CARRIER CURRENT PROTECTION AND TESTING (09)

Static relay circuits for carrier current protection - Steady state and transient behaviour of static relays - Testing and maintenance - Tripping circuits using thyristors

MICROPROCESSOR BASED RELAYS (09)

Hardware and software for the measurement of voltage, current, frequency, phase angle - Microprocessor implementation of over current relays - Inverse time characteristics - Impedance relay - Directional Relay - Mho Relay.

<div align="right">**Total Hrs. : 45**</div>

Text Books

1. Rao T.S.M., **"Power System Protection- Static Relays"**, *Tata McGraw Hill, Reprint 2010.*

2. Rao, **"Digital Numerical Relays"**, *McGraw Hill, First Edition 2005.*

Reference Books

1. Van C. Warrington, **"Protective Relays - Their Theory and Practice"**, *Chapman and Hall*

2. Ravindranath B. and Chander M., **"Power System Protection and Switchgear"**, *Wiley Eastern, 2007.*

12E8E0 INDUSTRIAL DRIVES AND CONTROL

(Common to EEE and EIE)

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SPEED CONTROL OF DC MOTORS (09)

Concept of Electric Drive – Classification of Electric Drives– Speed/Torque characteristics – Braking methods – Methods of speed control – Ward Leonard drives – Dual converter – Thyristor converter fed dc drives – Single, Two and Four quadrant operations – Plugging – Regenerative braking.

DIGITAL CONTROL OF DC MOTORS (09)

Digital technique in speed control of DC motors – Advantages – Limitations – Closed loop DC control – Analog, Digital and Hybrid speed control – Stepper motor and it's applications – Microprocessor applications to DC motor speed control.

SPEED CONTROL OF AC MOTORS (09)

Speed control of AC motors – Speed / Torque characteristics – Braking methods – Thyristor control – Pulse Width Modulation – Current Source Inverter, Cycloconverter fed Induction motors.

FREQUENCY CONTROLLED INDUCTION MOTOR DRIVES (09)

Frequency control for constant Torque and Constant Power operation of Induction motors – Rotor side control of Slip ring Induction motor with thyristor chopper – Static control of Rotor resistance – Slip-Energy recovery scheme – Static Scherbius and Kramer systems – Applications of Microprocessor to AC motor speed control – Interfacing Microprocessor with I / O devices.

INDUSTRIAL APPLICATIONS (09)

Choice of selection of motors – Electric drive applications – Steel rolling mills – Cement mills – Paper mills – Textile mills – Sugar mills – Coal mines – Machine Tools.

Total Hrs : 45

Text Books

1. Dubey G.K., **"Fundamentals of Electrical Drives"**, Narosa Publishing House, New Delhi, 2nd Edition 2002.

2. Sen, P.C. **"Thyristor DC Drives"**, Krieger Publishing Company 1991.

Reference Books

1. Vedam Subramaniam, **"Electrical Drives and Applications"**, Tata McGraw Hill, New Delhi, 2nd Edition 2010.

2. Murphy J.M.D., **"Thyristor Control of AC Motors"**, Pergamon Press, New York, 1973.

3. Krishnan R., **"Electric Motor and Drives: Modeling, Analysis and Control"**, Pearson Education, New Delhi, 2001.

4. Pillai S.K., **"A First Course on Electrical Drives"**, 2nd Edition, Wiley Eastern Ltd., Bombay, 2nd Edition 2007.

12E8E1 AUTOMOTIVE ELECTRONICS

(Common to EEE and EIE)

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INTRODUCTION (08)

Evolution of electronics in automobiles – emission laws – introduction to Euro I, Euro II, Euro III, Euro IV, Euro V standards – Equivalent Bharat Standards, Charging systems: Working and design of charging circuit diagram – Alternators – Requirements of starting system - Starter motors and starter circuits.

IGNITION AND INJECTION SYSTEMS (10)

Ignition systems: Ignition fundamentals - Electronic ignition systems - Programmed Ignition– Distribution less ignition - Direct ignition – Spark Plugs. Electronic fuel Control: Basics of combustion – Engine fuelling and exhaust emissions – Electronic control of carburetion – Petrol fuel injection – Diesel fuel injection.

SENSOR AND ACTUATORS (08)

Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall Effect, Throttle angle, temperature, exhaust gas oxygen sensors – study of fuel injector, exhaust gas recirculation actuators, stepper motor actuator, vacuum operated actuator.

ENGINE CONTROL SYSTEMS (10)

Control modes for fuel control-engine control subsystems – ignition control methodologies – different ECU's used in the engine management – block diagram of the engine management system. In vehicle networks: CAN standard, format of CAN standard – diagnostics systems in modern automobiles.

CHASSIS AND SAFETY SYSTEMS (09)

Traction control system – Cruise control system – electronic control of automatic transmission –antilock braking system – electronic suspension system – working of airbag and role of MEMS in airbag systems – centralized door locking system – climate control of cars.

Total Hrs.: 45

Textbooks

1. Tom Denton, *"Automobile Electrical and Electronics Systems"*, Edward Arnold Publishers, 4th Edition 2012.

2. William B. Ribbens, *"Understanding Automotive Electronics"*, Newnes Publishing, 6th Edition 2003.

Reference Books

1. Barry Hollembeak, *"Automotive Electricity, Electronics & Computer Controls"*, Delmar Publishers, 2001.

2. *"Fuel System and Emission controls"*, Check Chart Publication, 2000.

3. Ronald. K. Jurgon, *"Automotive Electronics Handbook"*, McGraw-Hill, 1999

12E8E2 PRINCIPLES OF EMBEDDED SYSTEMS

(Common to EEE and EIE)

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FUNDAMENTALS AND BUS PROTOCOLS
(09)

Classification of Embedded Systems - Embedded System on Chip - Structural Units in a Processor - Processor Selection - Memory Selection - Allocation of Memory to Segment - Block Memory Map of a System - Serial Communication using PC bus and CAN bus - Parallel Communication using ISA and PCI busses.

INTERRUPTS AND SOFTWARE ARCHITECTURES
(09)

Interrupt Basics - Shared Data Problem - Interrupt Latency - Round Robin Architecture - Round Robin with Interrupts - Function - Queues - Scheduling Architecture - Real Time Operating System Architecture - Selecting an Architecture.

REAL TIME OPERATING SYSTEMS
(09)

Tasks and Task States - Tasks and Data - Semaphores and Shared Data - Message Queues, Mailboxes and Pipes - Timer Functions – Events -Memory Management - Interrupt Routines in RTOS Environment.

DESIGN USING RTOS
(09)

Overview - Principles - Encapsulating Semaphores and Queues - Hard Real-time Scheduling Consideration - Saving Memory Space - Saving Power.

EMBEDDED SOFTWARE DEVELOPMENT TOOLS
(09)

Host and Target Machines-Linker / Locators for Embedded Software - Getting Embedded Software into Target - Testing on Host Machine - Instructions Set Simulators.

Total Hrs.: 45

Text Books

1. David E. Simon, *"An Embedded Software Primer"*, Pearson Education, Reprint 2008.

2. Navabi, *"Embedded Core Design with FPGA's"*, Tata McGraw-Hill, First Edition 2008.

Reference Books

1. Frank Vahid and Tony Givragis, *"Embedded Systems Design - A Unified Hardware/Software Introduction"*, Wiley India Pvt. Ltd., 1st edition, 2009.

2. Sriram Iyer, *"Embedded Real Time System Programming"*, Tata McGraw-Hill, First Edition 2008.

3. Raj Kamal, *"Embedded Systems"*, Tata McGraw-Hill, Second Edition 2008.

4. K.V.K Prasad, *"Embedded Real Time System Programming"*, Wiley India Pvt. Ltd., 1st edition, 2008.

12E8E3 VHDL BASED DIGITAL SYSTEM DESIGN

(Common to EEE and EIE)

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BASIC MODELLING CONSTRUCTS (09)

Introduction to VHDL-Capabilities-Hardware abstraction-Basic Terminology-Data Objects-Data types-Operators-Entities-Architecture-Concurrent signal assignment-Sequential signal assignment-Selected signal assignment-Concurrent statements-Sequential statements-Behavioral dataflow modeling.

STRUCTURAL MODELING AND CONFIGURATIONS (09)

Structural modeling – Components - Declaration and instantiation - Generics-Configuration - Specification and declaration - Default rules-Conversion functions - Direct instantiation - Incremental binding.

SUBPROGRAMS AND PACKAGES (09)

Procedure-Functions-Overloading-Packages-Declaration and Package body-Design file-Design libraries-Order of analysis-Implicit visibility-Explicit visibility-Type conversion-Generate statements-Signature-Aliases.

FILE HANDLING AND MODEL SIMULATION (09)

File declaration-Reading-Writing-Explicit open and close operations-Variable file names-Writing a test bench-Modeling entity interfaces-Styles of modeling-Modeling delays-Modeling control operations.

PLDs AND ADVANCED PROGRAM CONCEPTS (09)

PLDs-Basic concepts-Programmable Logic element-Programmable Logic Array-Programmable array Logic-Complex PLDs-Structure of standard PLDs-Concepts-Clock divider-Pulse counter-Seven segment display and Barrel Shifter.

Total Hrs.: 45

Text Book

1. Bhasker.J, *"A VHDL Primer"*, Pearson Education, India, 3rd Edition, 2003.

Reference Books

1. James O Hamblen and tyron S. Hall,springerlink, **"Rapid Prototyping of Digital Systems-   SOPC Edition"**, *Kluwer Academic Publishers, 1st International Edition, 2012.*

2. Navabi.Z, **"VHDL:Analysis and Modeling of Digital Systems"**, *Mcgraw Hill Book Co., 1st   Edition, 1998.*

3. Stephen Brown and Zvonko Vranesic, **"Fundamentals of Digital Logic with VHDL   Design"**, *Tata McGraw Hill Publishing Co. New Delhi, 3nd Edition, 2008.*

12E8E4 TOTAL QUALITY MANAGEMENT

(Common to Mechanical, EEE,ECE,EIE and Production)

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INTRODUCTION (09)

Definition of quality, dimensions of quality, quality planning, quality costs concepts - basic concepts of total quality management, principles of TQM, leadership concepts - quality council, quality statements, strategic planning- steps in strategic planning- Deming philosophy, barriers to TQM implementation.

TQM PRINCIPLES (09)

Customer satisfaction - customer perception of quality - customer retention, employee involvement - motivation, empowerment, performance appraisal, continuous process improvement – Juran trilogy, PDSA cycle, 5S concept, kaizen, supplier partnership - supplier rating – performance measures- Malcom Balridge National Quality Award.

STATISTICAL PROCESS CONTROL (SPC) (09)

Seven old and new tools of quality - statistical fundamentals - population and sample – normal curve - control charts for variables and attributes- state of control and out of control - process capability - concept of six sigma.

TOOLS AND TECHNIQUES (09)

Benchmarking - benchmarking process - quality function deployment (QFD) - house of quality - Taguchi quality loss function - total productive maintenance (TPM)- pillars of TPM - Failure Mode Effective Analysis (FMEA)- Failure rate- types of FMEA - stages of FMEA.

QUALITY SYSTEMS (09)

Need for ISO 9000 and other quality system - ISO 9000: 2008 quality system – elements - implementation of quality system - documentation - quality auditing - QS 9000, ISO 14000 - concept, requirements and benefits- integrating ISO 14000 with ISO 9000.

Total Hrs.:45

Text Books

1. Dale H.Besterfield, et al., **"Total Quality Management"**, *Pearson Education Asia,1999(Indian reprint 2002).*

2. Subburaj Ramasamy, **"Total Quality Management"**, *Tata McGraw Hill, 2008.*

Reference Books

1. James R.Evans & William M.Lidsay, **"The Management and Control of Quality"**,*(5thEdition), South-Western (Thomson Learning), 2002 .*

2. Feigenbaum.A.V. **"Total Quality Management"**, *McGraw-Hill, 1991.*

3. Zeiri. **"Total Quality Management for Engineers"** *Wood Head Publishers, 1991.*

12E8E5 COMPUTER NETWORK ENGINEERING

(Common to EEE and EIE)

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PROTOCOLS OF ARCHITECTURE (09)

Data communication - Protocols and standards - Basic concepts - Line configuration – Topology - Transmission mode - Categories of networks - Inter networks - OSI model - Functions of the layers - MAC protocols - IEEE 802 standards.

PHYSICAL LAYER (09)

Circuit switching - Packet switching - Message switching repeaters – Bridges – Routers - Gateways - X-25 layers - IPV6. Signals - Digital Transmissions - Analog Transmissions -Multiplexing- Transmission- Media Circuit Switching and Telephone Network - High Speed Digital Access: DSL, Cable Modems and SONET.

DATA LINK LAYER (09)

Data Link Control and Protocols - Point-to-Point Access: PPP - Wired LANs: Ethernet - Wireless LANs - Connecting LANs, Backbone Networks, and Virtual LANs -Wireless WANs: Cellular Telephone and Satellite Networks - SONET/ SDH - Virtual-Circuit Networks: Frame Relay and ATM

UPPER OSI LAYERS (09)

Network Layer: Logical Addressing - Network Layer: Internet Protocol - Network Layer: Address Mapping, Error Reporting and Multicasting H3 - Network Layer: Delivery, Forwarding and Routing Transport layer: Process-to-Process Delivery: UDP, TCP, and SCTP - Congestion Control and Quality of Service. Application Layer: Domain Name System - Remote Logging, Electronic Mail and File Transfer- Network Management: SNMP – Multimedia.

SWITCHING NETWORK MANAGEMENT (09)

Architecture - Fault management - Congestion control security managements - Switching Fabrics - Crossbar switch - Knockout switch - Banyan switch.

Total Hrs: 45

Text Books

1. Andrew S. Tanenbaum "**Computer networks**", 4th edition, Prentice Hall, 2010.

2. Behrouza. Forouzan, "**Data Communication and Networking**", 2th Edition Tata McGraw Hill, 2002.

Reference Books

1. Larry L Peterson, Bruce S Davie "**Computer networks**", 5th Edition, Morgan kaufmann, 2012.

2. Stallings, "**Computer Communicaton: Architectures, Protocols and Standard**", IEEE computer Society, 2007.

3. Kernel Texpian A.S. "**Communication Network Management**", Prentice Hall, 1992.

4. Uylers Black, "**Network Management Standards**", McGraw Hill, 1995.

5. Commer and Stevens, "**Internetworking with TCP/IP VOL.III: Client Server programming and Application**", Pearson Hall-2001.

12E8E6 MEMS AND APPLICATIONS

(Common to EEE and EIE)

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FUNDAMENTALS OF MEASUREMENT SYSTEMS (09)

Basic principles of measurement systems- Primary Transduction Mechanisms Physical variables -Sensor defects - Sensing mechanisms -Enabling Technologies - Silicon -Thick film – Optical.

TRANSDUCER MODELLING (09)

Electronic Techniques - Bridge circuits - Amplifiers - Data conversion - Noise and recovery of signal from noise -Sensor Networks and Protocols

SMART TRANSDUCERS (09)

Concepts - Software structures - Hardware structures - Fundamentals and limitations of photolithography - Pattern transfer with etching techniques - Pattern transfer with other physical and chemical techniques.

MICROMACHINING (09)

Bulk micromachining - Surface micromachining - Other micromachining techniques - Packaging techniques - Micro scaling considerations

APPLICATIONS (09)

Applications in automotive industry - Applications in biomedical industry – DNA sensors, Electronic noise - Future developments-Nanotechnology - Carbon Nano Tube (CNT).

Total Hrs: 45

Text Books

1. Chang Liu, *"Foundations of MEMS,"* Prentice Hall, 2006.

2. Marc Madou, *"Fundamental of Microfabrication,"* CRC Press, 2002.

Reference Books

1. Richard C. Jaeger, *"Introduction to Microelectronic Fabrication,"* Addison- Wesley, 2002.

2. Edited by Gad-El-Hak, *"MEMS Handbook,"* CRC Press, 2002.

3. N.T. Nguyen and S.Wereley, *"Fundamentals and Applications of Microfluidics"*, Artech House, 2002.

4. Nitaigour Premchand Mahalik, *"MEMS"*, TMH, I Reprint, 2007.

5. Tai Ran Hsu, *"MEMS and Microsystems Design and Manufacture"*, TMH, VII Reprint, 2012.

12E8E7 LOGIC AND DISTRIBUTED CONTROL SYSTEMS

(Common to EEE and EIE)

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PROGRAMMABLE LOGIC CONTROLLER (PLC) BASICS   (09)

Definition – Overview of PLC systems – Input and output modules – Power supplies – Isolators – General PLC programming procedures – Programming on-off outputs – Auxiliary commands and functions – Creating ladder diagrams from process control descriptions – Register basics – Timer functions – Counter functions.

PLC INTERMEDIATE AND ADVANCED FUNCTIONS   (09)

Arithmetic functions – Number comparison functions – Skip and MCR functions – Data move systems – PLC advanced intermediate functions – Utilising digital bits – Sequencer functions – Matrix functions – Alternate programming languages – Analog PLC operation – Networking of PLC – PID control of continuous processes – PLC installation – Troubleshooting and maintenance – Controlling a Robot.

INTERFACE AND BACKPLANE BUS STANDARDS FOR INSTRUMENTATION SYSTEMS   (09)

Field bus: Introduction – Concept – International field bus standards – HART protocol: Method of operation – Structure – Operating conditions – Applications.

DISTRIBUTED CONTROL SYSTEMS OPERATION   (09)

Evolution of DCS – Building blocks – Detailed descriptions and functions of field control units – Operator stations – Data highways – Redundancy concepts – DCS – Supervisory computer tasks and configuration – DCS – System Integration with PLC and computers.

COMMUNICATION IN DCS   (09)

Special requirement of networks used for control – Protocols – Link access mechanisms – Manufacturers automation protocols – Link access mechanisms – Manufacturers automation protocols – Case studies in DCS.

Total Hrs.: 45

Text Books

1. John. W. Webb and Ronald A. Reis, "**Programmable Logic Controllers – Principles and Applications**", 4th Edition, Printice Hall Inc., New Jersy, 5th Edition 2002.

2. Frank D. Petruzella, "**Programmable Logic Controllers**", McGraw Hill Book Company   Book, third Edition 2005.

3. Lukcas M.P., "**Distributed Control Systems**", Van Nostrand Reinhold Company, New York, 1986

Reference Books

1. Krishna Kant, "**Computer based Industrial Control**", Prentice Hall of India, 10th Printing 2009.

2. Curtis D.Johnson, "**Process control Instrumentarion Technology**", 8th Edition Pearson   Education, 2006.

12E8E8 COMPUTER AIDED DESIGN OF ELECTRICAL MACHINES

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INTRODUCTION (09)

Conventional design methodology overview – computer aided design aspects – need for CAD – nature of design problems-analysis and synthesis approaches-advantages.

FINITE ELEMENT ANALYSIS (09)

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

CAD PACKAGES (09)

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

CAD SOFTWARE (09)

Program files – Installation – Screen menu structure - Fixing the size of a drawing – set up option- on line help- text fonts, shapes – Blocks – copy – array- Erasing facilities - editing – fill – zoom pan – hatching – isoplane – elevation – view point – dimension techniques – introduction to 3D drawing.

DESIGN EXAMPLES (09)

Design of actuator – solenoid - transformer - induction motor – synchronous machines - switched reluctance motor

Total Hrs: 45

Textbooks

1. M Ramamoorthy, **"Computer Aided, Analysis and Design of Electrical Equipment"**, *East West Press Pvt. Ltd. Madras 1988.*

2. C G Veinott, **"Computer Aided Design of FHP Motors"** *Tata McGraw Hill Publishing Company limited, New Delhi.*

Reference Books

1. P.P. Silvester and Ferrari, **"Finite Element for Electrical Engineers"**, *Cambridge University Press, 3rd Edition 1996.*

2. M.V.K. Chari and P.P. Silvester, **"Finite Elements in Electric and Magnetic Field Problems"**, *John Wiley, 1980.*

3. D.A. Lowther and P.P. Silvester, **"Computer Aided Design in Magnetics"**, *Springer Verlag, Newyork, 1986.*

4. George, Omura, **"Mastering AutoCAD-2012"**, *BPB Publications, New Delhi, 2012.*

5. Sham Tickoo, **"AutoCAD 2002 with Applications"** *Tata McGraw Hill Publishing Company limited, New Delhi, 4th Edition 2002.*

Note: To offer this elective, multi-user licensed copy of CAD software should be available.

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12E8E9 SPECIAL MACHINES AND CONTROLLERS

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STEPPING MOTORS (09)

Constructional features - Principle of operation - Modes of excitation - Torque production in Variable Reluctance (VR) stepping motor - Dynamic characteristics - Drive systems and circuit for open loop control - Closed loop control of stepping motor.

SWITCHED RELUCTANCE MOTORS (09)

Constructional features - Principle of operation - Torque equation - Power controllers - Characteristics and control - Microprocessor based controller.

PERMANENT MAGNET DC MOTORS (09)

Fundamentals of permanent magnets - Kinds of permanent magnets - Structure of field system - Armature structure - Brushes and commutator. Moving coil motors : classification – Types - Characteristics-Disc motors.

PERMANENT MAGNET BRUSHLESS DC MOTORS (09)

Commutation in DC motors - Difference between mechanical and electronic commutators - Hall sensors - Optical sensors - Multiphase Brushless motor - Square wave permanent magnet brushless motor drives - Torque and emf equation - Torque –Speed characteristics - Controllers-microprocessor based controller.

PERMANENT MAGNET SYNCHRONOUS MOTORS (09)

Principle of operation - EMF, power input and torque expressions - Phasor diagram - Power controllers – Torque - Speed characteristics - Self control - Vector control - Current control schemes.

Total Hrs: 45

Text Books

1. Miller ,T.J.E. *"Brushless Permanent Magnet and Reluctance Motor Drives"*, Clarendon   Press, Oxford, 1989.

2. Kenjo.T and Naganori S. *"Permanent Magnet and Brushless DC Motors"*, Clarendon Press, Oxford ,1989.

3. Kenjo.T, *"Stepping Motors and their Mcroprocessor Control"*, Clarendon Press, Oxford,   1989.

Reference Books

1. Ramakrishnan, *"Switched Reluctance Motor Drives"*, CRC press, 2001.

2. Jacek F Gieras and Micheal Wing, *"Permanent Magnet Motor Technology"*, CRC press, 2002.

3. P. P. Acarnely, *"Stepping Motors"*, 4th edition, IFT Publishers, 2002.