ANURAG ENGINEERING COLLEGE
(AUTONOMOUS)
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Definitions of Key Words:

Academic Year: Two consecutive (one odd + one even) semesters constitute one academic year.

Choice Based Credit System (CBCS): The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses).

Course: Usually referred to, as 'papers' is a component of a programme. All courses need not carry the same weight. The courses should define learning objectives and learning outcomes. A course may be designed to comprise lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study etc. or a combination of some of these.

Credit Based Semester System (CBSS): Under the CBSS, the requirement for awarding a degree or diploma or certificate is prescribed in terms of number of credits to be completed by the students.

Credit Point: It is the product of grade point and number of credits for a course.

Credit: A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.

Cumulative Grade Point Average (CGPA): It is a measure of overall cumulative performance of a student over all semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

Letter Grade: It is an index of the performance of students in a said course.

Grades are denoted by letters O, A+, A, B+, B, C, P and F.

Programme: An educational programme leading to award of a Degree, Diploma or Certificate.

Semester Grade Point Average (SGPA): It is a measure of performance of work done in a semester. It is ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places.

Semester: Each semester will consist of 15-18 weeks of academic work equivalent to 90 actual teaching days. The odd semester may be scheduled from July to December and even semester from January to June.

Transcript or Grade Card or Certificate: Based on the grades earned, a grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (code, title, number of credits, grade secured) along with SGPA of that semester and CGPA earned till that semester.

Types of Courses: The Courses in a programme may be of three kinds: Core, Elective and Foundation.

Core Course:-

There may be a Core Course in every semester. This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

Elective Course:-

Elective course is a course which can be chosen from a pool of papers. It may be:

- Supportive to the discipline of study
- Providing an expanded scope
- Enabling an exposure to some other discipline/domain
- Nurturing student's proficiency/skill.

An elective may be "Generic Elective" focusing on those courses which add generic proficiency to the students. An elective may be "Discipline centric" or may be chosen from an unrelated discipline. It may be called an "Open Elective."

Foundation Course:-

The Foundation Courses may be of two kinds: Compulsory Foundation and Elective foundation. "Compulsory Foundation" courses are the courses based upon the content that leads to Knowledge enhancement. They are mandatory for all disciplines. Elective Foundation courses are value-based and are aimed at man-making education.

ACADEMIC REGULATIONS FOR B. TECH. (REGULAR)

Applicable for the students of B.Tech. (Regular) from the Academic Year 2015-16 onwards

1. Title and Duration of the Progamme.

1.1 The programme shall be called the degree programme in Bachelor of Technology, abbreviated as B.Tech.

1.2 The programme shall be of four academic years duration divided into eight semesters, each semester having duration of minimum 16 weeks of instruction.

1.3 The calendar of events in respect of the programme shall be fixed by the College from time to time.

1.4 The external examination in all the courses (subjects) shall be conducted at the end of each semester for all the eight semesters.

1.5 Students joining the B.Tech. Programme shall have to complete the programme within a stipulated time frame of 8 years from the year of joining and Students joining the B.Tech. Programme in the third semester directly through Lateral Entry Scheme (LES) shall have to complete the programme within a stipulated time frame of 6 years from the year of joining. Otherwise, they shall forfeit their seat in B.Tech Programme and their admission shall stand cancelled.

2. Admission Procedure

2.1 Admissions will be done as per the norms prescribed by the Government of Telangana State.

2.2 The Government orders in vogue shall prevail.

2.3 The candidate should have passed the prescribed qualifying examination on the date of admission.

3. Award of B. Tech. Degree

A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic requirements:

3.1 The candidate shall pursue a course of study for not less than four academic years and not more than eight academic years.

3.2 The candidate shall register for 192 credits and secure all the 192 credits by securing a minimum CGPA of 5.0.

3.3 The students, who fail to fulfill the academic requirements for the award of the degree within eight academic years from the year of admission, shall forfeit their seats in B.Tech. Programme.

4. Courses of Study

The following B. Tech. Programmes are offered at present:

Branch	Branch Code
Civil Engineering	01
Electrical and Electronics Engineering	02
Mechanical Engineering	03
Electronics and Communication Engineering	04
Computer Science and Engineering	05

and any other course as approved by the Authorities from time to time.

5. Credits

	Semester	
	Contact Periods / week	**Credits**
Theory	04	04
	03	03
	02	02
Practical	03	02
Drawing	00+04 02+02 00+06	02 03 03
Mini project	--	02
Comprehensive Viva Voce	--	02
Seminar	6	02
Project	15	10

***Note on Tutorials:- No Credits for < 2 periods /week**

6. Distribution and Weightage of Marks:

6.1 The performance of a student in a semester shall be evaluated course-wise for a maximum of 100 marks each for a theory and practical course. In addition, industry-oriented mini-project, seminar, Comprehensive Viva-Voce and Project work shall be evaluated for 100, 100, 100 and 200 marks respectively.

6.2 For theory courses the distribution shall be 25 marks for Continuous Internal Evaluation (CIE) and 75 marks for the Semester End- Examination (SEE).

6.3 For theory courses, during the semester there shall be 2 midterm examinations. Each mid term examination consists of Part-A (Short Answers) for 5 marks and Part-B (Long Answers) for 15 marks with duration of 90 Minutes and an assignment carrying 5 marks.

Part-B shall contain 3 questions with internal choice, each carries 5 marks. First mid term examination shall be conducted for 2.5 units of syllabus and second mid term examination shall be conducted for remaining 2.5 units. First Assignment should be submitted before the conduct

of the first mid term exam, and the second assignment should be submitted before the conduct of the second mid term exam.

The total marks secured by the student in each mid term examination for 25 marks is considered and the average of the two mid term examinations shall be taken as the final marks secured by each student**.** If he/she is absent for any test / assignment, he/she is awarded zero marks for that test / assignment.

6.4 The Semester End Examination will be conducted for 75 marks which consist of two parts viz. i). Part-A for 25 marks, ii). Part –B for 50 marks.

6.5 Part-A is compulsory, which consists of ten questions (numbered from 1 to 10) two from each unit carrying 2 / 3 marks each.

6.6 Part-B consists of five questions (numbered from 11 to 15) carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an “either” “or” choice (that means there will be two questions from each unit and the student should answer any one question).

6.7 For practical courses, there shall be a continuous internal evaluation during a semester for 25 sessional (internal) marks. Out of the 25 marks for internal evaluation, day-to-day work in the laboratory shall be evaluated for 15 marks and midterm practical examination shall be evaluated for 10 marks conducted by the laboratory teacher concerned. Semester End Examinations carries 75 marks.

6.8 The practical Semester End Examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed by the Principal from the panel of examiners recommended by Chairman, Board of Studies in respective branches.

6.9 For the courses having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 25 marks for internal evaluation (15 marks for day-to-day work and 10 marks for midterm examination) and 75 marks for end examination. There shall be two midterm examinations in a semester and the average of the two shall be considered for the award of marks for midterm examinations.

6.10 There shall be an industry-oriented mini-Project, to be taken up during the vacation after III year II Semester examination. However, the mini project and its report shall be evaluated in IV year I Semester. The industry oriented mini project shall be submitted in report form and should be presented before the committee, which shall be evaluated for 100 marks. The committee consists of an external examiner, Head of the Department, the Supervisor of Mini Project and a Senior Faculty member of the department. There shall be no internal marks for industry oriented mini project.

6.11 There shall be a seminar presentation in IV year II Semester. For the seminar, the student shall collect the information on a specialized topic and prepare a technical report, showing his understanding of the topic, and submit it to the department. It shall be evaluated by the departmental committee consisting of Head of the Department,

Supervisor of Seminar and a Senior Faculty member of the department. The seminar report shall be evaluated for 100 marks. There shall be no external examination for the seminar.

6.12 There shall be a Comprehensive Viva-Voce in IV year II semester. The Comprehensive Viva-Voce will be conducted by a committee consisting of Head of the Department and two Senior Faculty members of the department. The Comprehensive Viva-Voce is intended to assess the students understanding of the courses he studied during the B. Tech. course of study. The Comprehensive Viva-Voce shall be evaluated for 100 marks. There are no external marks for the Comprehensive Viva-Voce.

6.13 Out of a total of 200 marks for the Project work, 50 marks shall be for Internal Evaluation and 150 marks for the Semester End Examination. The Semester End Examination (viva-voce) shall be conducted by the committee. The committee consists of an external examiner, Head of the Department, the Supervisor of Project and a Senior Faculty member of the department. The topics for industry oriented mini project, seminar and project work shall be different from each other. The evaluation of Project work shall be conducted at the end of the IV year II Semester. The internal evaluation shall be on the basis of two seminars given by each student on the topic of his project.

6.14 The Laboratory marks and the sessional marks awarded by the faculty are subject to scrutiny and scaling by the Institution whenever/wherever necessary. In such cases, the sessional and laboratory marks awarded by the teacher will be referred to a College Standing Committee/ Academic Committee. The Committee will arrive at a scaling factor and the marks will be scaled accordingly. The recommendations of the Committee are final and binding. The laboratory records and internal test papers shall be preserved as per the University rules and produced before the Committees of the University as and when asked for.

6.15 Candidates shall be permitted to apply for recounting/revaluation of SEE scripts within the stipulated period with payment of prescribed fee.

7. Attendance Requirements

7.1 A student is eligible to write the Semester End Examinations only if he / she acquires a minimum of 75% of attendance in aggregate of all the courses.

7.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted on medical grounds with a documentary evidence approved by the Academic Council.

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

7.4 Shortage of attendance below 65% in aggregate shall not be condoned under any circumstances.

7.5 Students whose shortage of attendance is not condoned are not eligible to write Semester End Examinations of that semester. Such students are detained and their registration for examination stands cancelled.

7.6 A student detained due to shortage of attendance in a semester may seek re-admission into that semester, as and when offered, within four weeks from the date of

the commencement of class work with the academic regulations of the batch into which he/she gets admitted.

7.7 A student will be promoted to the next semester if he/she satisfies the attendance requirement of the present semester and shall not be eligible for readmission into the same semester.

7.8 For all mandatory, non-credit courses offered in a semester, a "Satisfactory Participation Certificate" shall be issued to the student, only after securing minimum 75% of attendance in such a course. No marks or Letter Grade shall be allotted for these activities.

8. Minimum Academic Requirements

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.7.

8.1 A student is deemed to have satisfied the minimum academic requirements if he has earned the credits allotted to each theory/practical/design/drawing course/project and secured not less 35% marks in Semester End Examination (SEE), and minimum 40% marks when the total of the internal evaluation and semester end examinations taken together.

8.2 The student has to pass the failed course by appearing the supplementary examination as per the requirement for the award of degree.

8.3 Students who fail to earn 192 credits as indicated in the course structure within eight academic years from the year of their admission, shall forfeit their seat in B. Tech. Programme and their admission stands cancelled.

8.4 A student shall be promoted from I Year to II Year only if he/she fulfills the academic requirements of securing 50% of average credits (24 credits out of 48 credits) upto I year II Semester, from all the examinations, whether or not the candidate takes the examinations.

8.5 A student shall be promoted from II Year to III Year only if he/she fulfills the academic requirements of securing 50% of average credits (36 credits out of 72 credits) up to II year I semester, from all the examinations, whether or not the candidate takes the examinations.

8.6 A student shall be promoted from III year to IV year only if he/she fulfills the academic requirements of securing 50% of average credits (60 credits out of 120 credits) up to III year I semester, from all the examinations, whether or not the candidate takes the examinations.

8.7 A student shall register and put up minimum attendance in all 192 credits and earn all 192 credits for the award of degree.

8.8 When a Student is detained due to shortage of attendance in any semester, no Grade Allotments or SGPA/CGPA calculations will be done for that entire Semester in which he got detained.

8.9 When a Student is detained due to lack of Credits in any year, he may be readmitted after fulfillment of the Academic Requirements, with the Academic Regulations of the

Batch into which he gets readmitted subject to 3.3.

8.10 For readmitted candidates, if there are any Professional Electives / Open Electives, the same may also be re-registered if offered. However, if those Electives are not offered in later Semesters, then alternate Electives may be chosen from the SAME set of Elective Courses offered under that category.

8.11 After securing the necessary 192 Credits as specified for the successful completion of the entire UGP, an exemption of 8 secured Credits (in terms of two of their corresponding Courses (Subjects)) may be permitted for optional drop out from these 192 Credits earned; resulting in 184 Credits for UGP performance evaluation, i.e., the performance of the Student in these 184 Credits shall alone be taken into account for the calculation of 'the final CGPA (at the end of UGP, which takes the SGPA of the IV Year II Semester into account)' , and shall be indicated in the Grade Card of IV Year II Semester; however, the Student's Performances in the earlier individual Semesters, with the corresponding SGPA and CGPA for which already Grade Cards are given, will not be altered. Further, optional drop out for such 8 secured Credits shall not be allowed for Courses listed as … i) Laboratories/ Practicals, ii) Industrial Training/ Mini-Project, iii) Seminar, iv) Comprehensive Viva Voce v) Major Project.

8.12 If a Student registers for some more 'extra courses' (in the parent Department or other Departments/Branches of Engg.) other than those listed courses totalling to 192 Credits as specified in the Course Structure of his Department, the performances in those 'extra courses' (although evaluated and graded using the same procedure as that of the required 192 Credits) will not be taken into account while calculating the SGPA and CGPA. For such 'extra courses' registered, % marks and Letter Grade alone will be indicated in the Grade Card, as a performance measure, subject to completion of the Attendance and Academic Requirements as stated in Items 7 and 8.1 – 8.11 above.

9. Program Structure

S. No.	Classification		Course Work - Subject Area	Range of Total Credits (%)	
	AICTE	UGC		Min	Max
1	HS	Foundation Courses	Humanities and Social Sciences including Management; (HS).	5	10
2	BS		Basic Sciences(BS) including Mathematics, Physics, Chemistry,	15	20
3	ES		Engineering Sciences (ES), including Materials, Workshop, Drawing, Basics of Electrical/ Electronics/ Mechanical/Computer Engineering	15	20
4	PC	Core Courses	Professional Subjects-Core (PC), relevant to the chosen specialization/branch; (May be split into	30	40
5	PW		Project Work, Seminar and/or Internship in Industry or elsewhere.	10	15
6	PE	Elective Courses	Professional Subjects – Electives (PE), relevant to the chosen specialization/	10	15
7	OE		Open Subjects- Electives (OE), from other technical and/or emerging	5	10

10. Course pattern

10.1 The entire course of study is for four academic years in semester pattern.

10.2 A student eligible to appear for Semester End Examinations in a course, but absent from it or failed in that examination, may write the exam in that course during supplementary exams.

10.3 A student eligible to appear in the Semester End Examination in any Course, but absent at it or failed (thereby failing to secure P Grade or above), may reappear for that Course at the supplementary examination as and when conducted. In such cases, his Continuous Internal Evaluation (CIE) marks assessed earlier for that Course will be carried over, and added to the marks to be obtained in the supplementary examinations, for evaluating his performance in that course.

11. Minimum Instruction Days

The minimum instruction days for each semester shall be 90 days.

12. Grade Points

12.1 Marks will be awarded to indicate the performance of each student in each theory course, or Lab/Practicals, or Seminar, or Project, or Mini-Project, Minor Course etc., based on the % of marks obtained in CIE+SEE(Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 6 above, and a corresponding Letter Grade shall be given.

12.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed.

Letter Grade	Grade Points	% of marks Secured (Class Intervals)
O (Out Standing)	10	80% and above (≥80%, ≤100%)
A+ (Excellent)	9	Below 80% but not less than 70% (≥70%, <80%)
A (Very Good)	8	Below 70% but not less than 60% (≥60%, < 70%)
B+ (Good)	7	Below 60% but not less than 55% (≥55%, < 60%)
B (Above Average)	6	Below 55% but not less than 50% (≥50%, < 55%)
C (Average)	5	Below 50% but not less than 45% (≥45%, < 50%)
P (Pass)	4	Below 45% but not less than 40% (≥40%, < 45%)
F (Fail)	0	Below 40% (< 40%)
Ab (Absent)	0	--

12.3 A student obtaining F Grade in any Course shall be considered 'failed' and will be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when offered. In such cases; his Continuous Internal Evaluation (CIE) marks in those Course(s) will remain same as those he obtained earlier.

12.4 A Letter Grade does not imply any specific % of Marks.

12.5 In general, a student shall not be permitted to repeat any Course (s) only for the sake of 'Grade Improvement' or 'SGPA/CGPA Improvement'. However, he has to repeat all the Courses pertaining to that Semester, when he is detained (as listed in items 8.10 - 8.11).

12.6 A student earns Grade Point (GP) in each Course, on the basis of the Letter Grade obtained by him in that Course (excluding Mandatory non-credit Courses). Then the corresponding 'Credit Points' (CP) are computed by multiplying the Grade Point with Credits for that particular Course. **Credit Points (CP) = Grade Point (GP) x Credits of that Course.**

12.7 The Student passes the Course only when he gets GP ≥ 4 (P Grade or above).

13. Registration/Dropping

13.1 Each student has to compulsorily register for course work at the beginning of each semester as per the schedule mentioned in the Academic Calendar. It is absolutely necessary for the student to register for courses in time.

13.2 The student has to register for a minimum of 20 credits and may register up to a maximum of 28 credits based on the advice of the Faculty Advisor. On an average, a student is expected to register for 24 credits.

13.3 A student at the end of II year II semester either having the CGPA of ≥ 7.0 or having passed all previous courses in first attempt with a minimum CGPA ≥ 5.0 is allowed to register an additional course / credits from the offered open electives. However mandatory non credit courses can be register during the course of study with the consent of the faculty advisor.

13.4 Open Electives are offered to students in IV year I semester and II semester, which can be registered by the students during III year and IV year I semester. Prior permission for registration of Open Electives as additional course is compulsory.

13.5 A student would be allowed to register in an additional course only if he/she satisfies the prerequisites.

13.6 Departments will notify at the time of registration about the minimum number of students to be enrolled for a particular open elective to be offered.

13.7 Any student may be barred from registering for any course for specific reasons like disciplinary reasons, non- payment of fees, etc.

13.8 Dropping of Courses: Within four weeks after the commencement of the semester, the student may, in consultation with his / her faculty advisor, can drop one or more courses without prejudice to the minimum number of credits as specified in 13.2. The dropped courses are not recorded in the Grade Card.

13.9 After Dropping, minimum credits registered shall be 20.

14 Earning of Credit

A student shall be considered to have completed a Course successfully and earned the credits if he/she secures an acceptable letter grade in the range ‘O’ to ‘P’. Letter grade 'F' in any Course implies failure of the student in that Course and no credits earned.

15 Passing Standards:

15.1 A student shall be declared successful or ‘passed’ in a Semester, only when he/she gets a SGPA ≥ 5.00 (at the end of that particular Semester); and a student shall be declared successful or ‘passed’ in the entire UGP, only when he/she gets a CGPA ≥ 5.00; subject to the condition that he/she secures a GP ≥ 4 (P Grade or above) in every registered Course in each Semester (during the entire UGP) for the award of Degree, as required.

15.2 In spite of securing P Grade or above in some (or all) Courses in any Semester, if a Student receives a SGPA < 5.00 and/ or CGPA < 5.00 at the end of such a Semester, then he ‘may be allowed’ (on the ‘specific recommendations’ of the Head of the Department and subsequent approval from the Principal) -

(i) to go into the next subsequent Semester (subject to fulfilling all other attendance and academic requirements as listed under Items 7-8);

(ii) to 'improve his SGPA of such a Semester (and hence CGPA) to 5.00 or above', by reappearing for ONE or MORE (as per Student's choice) of the same Course(s) in which he has secured P Grade(s) in that Semester, at the Supplementary Examinations to be held in the next subsequent Semester(s). In such cases, his Continuous Internal Evaluation Marks (CIE Marks) in those Course(s) will remain same as those he obtained earlier.

In these considerations, the newly secured Letter Grades will be recorded and taken into account for calculation of SGPA and CGPA, only if there is an improvement.

15.3 A Student shall be declared successful or 'passed' in any Non-Credit Course, if he secures a 'Satisfactory Participation Certificate' for that Mandatory Course.

15.4 After the completion of each Semester, a Grade Card or Grade Sheet (or Transcript) *(are all theses 3 are same?)* shall be issued to all the Registered Students of that Semester, indicating the Letter Grades and Credits earned. It will show the details of the Courses Registered (Course Code, Title, No. of Credits, Grade Earned etc.), Credits earned, SGPA, and CGPA.

16 Vertical Progression

It shall also be necessary to lay down uniform minimum standards for SGPA and CGPA together with the minimum number of *credits* to be earned in a semester for the *vertical progression* of students. This shall be used in facilitating the mobility of students from one College to another and also in avoiding any confusion among the students. The

a) Minimum Standard for SGPA =5.0;
b) Minimum Standard for CGPA =5.0; (at the end of each semester)

However, failure to secure a minimum CGPA = 5.0 at the end of any semester for the first time, shall **attract a warning** before approval of the student to continue in the following semester and will be required to register for courses having a GPA of 4.0 to improve the SGPA to 5.0 or above.

17 Eligibility for Award of B.Tech. Degree

A student shall be eligible for award of the B.Tech degree if he/she fulfils all the following conditions;

17.1 Registered and successfully completed all the components prescribed in the Programme of study (*Course of study* mentioned in all earlier occasions) to which he/she is admitted,

17.2 Obtained CGPA greater than or equal to 5.0 (Minimum requirements for Pass),

17.3 Has no dues to the College, hostels, Libraries, NCC / NSS etc., and

17.4 No disciplinary action is pending against him/her.

18 Award of Class

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

classes:

CGPA	Class Awarded	
≥8.00	First Class with Distinction	**From the CGPA secured from 192 credits**
≥6.50 - <8.00	First Class	
≥5.50 - <6.50	Second Class	
≥5.00 - <5.50	Pass Class	

18.1 The marks obtained in Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) will not be shown in the memorandum of marks.

18.2 For the purpose of awarding First Class with Distinction (CGPA ≥ 8.0), the student must obtain the minimum required CGPA within 4 academic years or within 3 academic years in case of Lateral Entry candidates by clearing all the courses.

18.3 Candidates detained / prevented from writing the Semester End Examinations due to any reason in any semester are not eligible for the award of First Class with Distinction. Such candidates even if the CGPA ≥ 8.0, shall be placed in first class.

18.4 For the purpose of awarding First, Second and Pass Class, CGPA obtained in the examinations appeared within the maximum period allowed for the completion of Programme shall be considered as per the regulations.

18.5 A student with final CGPA < 5.00 (at the end of the UGP) will not be eligible for the Award of the Degree.

18.6 The CGPA can be converted to equivalent percentage of marks by using the following equation:

(CGPA - 0.5) X 10

19 Consolidated Grade Card

A consolidated grade card containing credits & grades obtained by the candidates will be issued after completion of the four years B. Tech Programme.

20 Withholding of Results

If the student has not paid the dues, if any, to the College or if any case of indiscipline is pending against him, the result of the student will be withheld and he will not be allowed into the next semester. His degree will be withheld in such cases the matter will be referred to the Academic Council. The decision of the Academic Council is final.

21 Transitory Regulations

21.1 Discontinued, detained, or failed candidates are eligible for readmission as and when next offered as per the college admission procedure.

21.2 Students on transfer shall complete the prescribed courses of the concerned programme not covered earlier and however he/she should take the remaining programme along with others.

21.3 There shall be no branch transfers after the cut off date of admissions in the academic year.

22 Transcripts

After successful completion of the total Programme of study, a Transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued if required after the payment of requisite fee.

23 Supplementary Examinations

In addition to the Regular Final Examinations held at the end of each semester, Supplementary Final Examinations will be conducted during the academic year. Candidates taking the Regular / Supplementary examinations as Supplementary candidates may have to take more than one Semester End Examination per day. A student can appear for any number of supplementary examinations till he/she clears all courses which he/she could not clear in the first attempt. However the maximum stipulated period cannot be relaxed under any circumstances.

24 Graduation Ceremony

24.1 The College shall have its own annual Graduation Ceremony for the award of degree to students completing the prescribed academic requirements in each case, in consultation with the University and by following the provisions in the Statute.

24.2 The College shall institute Prizes and Awards to meritorious students, for being given away annually at the Graduation Ceremony.

25 Termination from the Program

The admission of a student to the program may be terminated and the student asked to leave the College in the following circumstances:

25.1 The student fails to satisfy the requirements of the program within the maximum period stipulated for that program.

25.2 The student fails to satisfy the norms of discipline specified by the College from time to time.

26 Non-Credit Courses (Mandatory Courses)

26.1 All the courses designated as mandatory course is a compulsory requirement for all students for the award of degree.

26.2 These activities carry no credits and are evaluated as Satisfactory/ Unsatisfactory.

26.3 Minimum attendance requirement as per the regulations is compulsory for completing the mandatory courses.

27 Amendments

The regulations hereunder are subject to amendments as may be made by the Academic Council of the College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates (including those already undergoing the program) as may be decided by the Academic Council.

28 General

28.1 Wherever the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.

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

28.3 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.

ACADEMIC REGULATIONS FOR B. TECH. (LATERAL ENTRY SCHEME)

Applicable for the students admitted into II year B. Tech. (Lateral Entry Scheme) from the Academic Year 2016-17 and onwards

1. **Eligibility for award of B. Tech. Degree (LES)**
   1.1 The LES candidates shall pursue a course of study for not less than three academic years and not more than six academic years.
   1.2 The candidate shall register for 144 credits and secure 144 credits by securing a minimum CGPA of 5.0 from II to IV year B.Tech. Program (LES) for the award of B.Tech. degree.
   1.3 The students, who fail to fulfill the requirement for the award of the degree in **six** academic years from the year of admission, shall forfeit their seats.
   1.4 The attendance regulations of B. Tech. (Regular) shall be applicable to B.Tech.(LES).

2. **Promotion Rule**

A student shall be eligible for promotion in B.Tech programme, if he/she acquires the minimum number of credits as given below:

2.1 A student shall be promoted from II Year to III Year only if he/she fulfills the academic requirements of securing 50% of average credits (12 credits out of 24 credits) up to II year I semester, from all the examinations, whether or not the candidate takes the examinations.

2.2 A student shall be promoted from III year to IV year only if he/she fulfills the academic requirements of securing 50% of average credits (36 credits out of 72 credits) up to III year I semester, from all the examinations, whether or not the candidate takes the examinations.

2.3 A student shall register and put up minimum attendance in all 144 credits and earn all 144 credits to be eligible for award of degree.

2.4 Students who fail to earn 144 credits as indicated in the course structure within six academic years, shall forfeit their seat in B.Tech. Programme and their admission stands cancelled.

3. **Award of Class**

After a	**Class Awarded**	**From the CGPA secured from 144 credits**
≥8.00	First Class with Distinction	
≥6.50 - <8.00	First Class	
≥5.50 - <6.50	Second Class	
≥5.00 - <5.50	Pass Class	

4. All the other regulations as applicable to B. Tech. 4-year degree course (Regular) will hold good for B.Tech. (Lateral Entry Scheme).

--*

ANNEXURE - I

1 Grade Point Average

1.1 SGPA and CGPA

The *credit index* can be used further for calculating the Semester Grade Point Average *(SGPA)* and the Cumulative Grade Point Average *(CGPA),* both of which being important performance indices of the student. While *SGPA* is equal to the *credit index* for a semester divided by the total number of *credits* registered by the student in that semester, *CGPA* gives the sum total of *credit indices* of all the previous semesters divided by the total number of *credits* registered in all these semesters. Thus,

The Grade Point Average (GPA) will be calculated according to the formula:

$$GPA = \frac{\sum CiGi}{\sum Ci}$$

Where Ci = number of credits for the course i,

Gi = grade points obtained by the student in the course.

1.2 Semester Grade Point Average (SGPA) is awarded to candidates considering all the courses of the semester. Zero grade points are also included in this computation. SGPA is rounded off to TWO Decimal Places.

SGPA will be computed as follows;

∑ [(Course *credits*) X (*Grade points*)] (for all Courses passed in that semester)

∑ [(Course *credits*)] (for all courses registered in that semester)

1.3 To arrive at Cumulative Grade Point Average (CGPA), the formula is used considering the student's performance in all the courses taken in all the semesters completed up to the particular point of time. CGPA is rounded off to TWO Decimal Places.

CGPA will be computed as follows:

∑ [(Course *credits*) X (*Grade points*)] (for all Courses passed upto that semester)

∑ [(Course *credits*)] (for all Courses registered until that semester)

CGPA is thus computed from the I Year First Semester onwards, at the end of each Semester, as per the above formula. However, the SGPA of I year I Semester itself may be taken as the CGPA, as there are no cumulative effects

1.4 Illustrative Example

An illustrative example given in below Table below indicates the use of the above two equations in calculating SGPA and CGPA, both of which facilitate the declaration of academic performance of a student, at the end of a semester and at the end of successive semesters respectively .

Both of them shall be normally calculated up to the second decimal position, so that the *CGPA,* in particular, can be made use of in rank ordering the student's performance in a class. If two students get the same *CGPA*, the tie should be resolved by considering the number of times a student has obtained higher *SGPA;* But, if it is not resolved even at this stage, the number of times a student has obtained higher grades like O, A, B etc shall be taken into account in rank ordering of the students in a class.

Year and Semester	Course No.	Credits	Grade	Grade Points	Credit Points
I Year I sem	XX101	5	A	8	40
I Year I sem	XX102	4	F	0	00
I Year I sem	XX103	3	A+	9	27
I Year I sem	XX104	4	F	0	00
I Year I sem	XX105	5	C	5	25
I Year I sem	XX106	5	P	4	20
Total		**26 (18*)**			**112**
SGPA = 112/26 = 4.31			**CGPA = 4.31**		
I Year II Sem	XX107	5	B+	7	35
I Year II Sem	XX108	4	A	8	32
I Year II Sem	XX109	3	C	5	15
I Year II Sem	XX110	5	P	4	20
I Year II Sem	XX111	4	A+	9	36
I Year II Sem	XX112	2	F	0	00
I Year II Sem	Xx113	2	A	8	16
Total		**25 (23*)**			**154**
SGPA = 154/25 = 6.16		**CGPA = 266/51 = 5.22**			

* Total No. of credits excluding those with 'F'; this is particularly important to keep track of the number of credits earned by a student up to any semester;

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the course (subject) of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that course (subject) only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester. The Hall Ticket of the candidate is to be cancelled.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the courses of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all END examinations. The continuation of the course by the candidate is course to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will

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

		semester. The candidate is also debarred for two consecutive semesters from class work and all END examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that semester examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the PRINCIPAL for further action to award suitable punishment.	

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

Electrical & Electronics Engineering

I YEAR I SEMESTER **COURSE STRUCTURE**

S. No.	Course Code	Course	Course Category	Lectures	T/P/D	Credits	Internal Marks	External Marks	Total Marks
1	A51001	English-I	HS	2	0	2	25	75	100
2	A51002	Mathematics-I	BS	3	1	3	25	75	100
3	A51003	Engineering Physics-I	BS	2	1	2	25	75	100
4	A51005	Computer Programming-I	ES	3	1	3	25	75	100
5	A51008	Electrical Circuits	ES	3	1	3	25	75	100
6	A51009	Engineering Graphics	ES	0	6	3	25	75	100
7	A51205	English Language Communication Skills Lab-I	HS	0	3	2	25	75	100
8	A51206	Computer Programming- I Lab	ES	0	3	2	25	75	100
9	A51207	Engineering Physics Lab	BS	0	3	2	25	75	100
10	A51208	Engineering Workshop	ES	0	3	2	25	75	100
Total				13	22	24	250	750	1000

I YEAR II SEMESTER **COURSE STRUCTURE**

S. No.	Course Code	Course	Course Category	Lectures	T/P/D	Credits	Internal Marks	External Marks	Total Marks
1	A52001	English-II	HS	2	0	2	25	75	100
2	A52002	Mathematics-II	BS	3	1	3	25	75	100
3	A52003	Engineering Physics-II	BS	2	1	2	25	75	100
4	A52006	Computer Programming-II	ES	3	1	3	25	75	100
5	A52008	Mathematics-III	BS	3	1	3	25	75	100
6	A52009	Engineering Chemistry	BS	3	1	3	25	75	100
7	A52205	English Language Communication Skills Lab-II	HS	0	3	2	25	75	100
8	A52206	Computer Programming- II Lab	ES	0	3	2	25	75	100
9	A52207	Engineering Chemistry Lab	BS	0	3	2	25	75	100
10	A52208	IT Workshop	ES	0	3	2	25	75	100
Total				16	17	24	250	750	1000

T – Tutorial **P – Practical** **D – Drawing** Note: All End Examinations (Theory and Practical) are of three hours duration.

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

Electrical & Electronics Engineering

II YEAR I SEMESTER **COURSE STRUCTURE**

S. No.	Course Code	Course	Course Category	Lectures	T/P/D	Credits	Internal Marks	External Marks	Total Marks
1	A53007	Mathematics-IV	BS	4	1	4	25	75	100
2	A53008	Switching Theory and Logic Design	ES	3	1	3	25	75	100
3	A53009	Electronic Devices and Circuits	PC	3	1	3	25	75	100
4	A53010	Network Theory	PC	3	1	3	25	75	100
5	A53011	Electromagnetic Fields	PC	3	1	3	25	75	100
6	A53012	Electrical Machines-I	PC	4	1	4	25	75	100
7	A53204	Electrical Circuits Lab	ES	0	3	2	25	75	100
8	A53205	Electronic Devices and Circuits Lab	PC	0	3	2	25	75	100
9	A53206	Gender Sensitization	MC	0	3	0	25	75	100
Total				20	15	24	225	675	900

II YEAR II SEMESTER **COURSE STRUCTURE**

S. No.	Course Code	Course	Course Category	Lectures	T/P/D	Credits	Internal Marks	External Marks	Total Marks
1	A54007	Electronic Circuits	ES	3	1	3	25	75	100
2	A54008	Managerial Economics and Financial Analysis	HS	3	1	3	25	75	100
3	A54009	Power Systems-I	PC	3	1	3	25	75	100
4	A54010	Control Systems	PC	4	1	4	25	75	100
5	A54011	Electrical Machines-II	PC	4	1	4	25	75	100
6	A54006	Environmental Studies	HS	3	1	3	25	75	100
7	A54204	Electrical Machines-I Lab	PC	0	3	2	25	75	100
8	A54205	Control Systems Lab	PC	0	3	2	25	75	100
9	A54206	Human Values and Professional Ethics	MC	0	3	0	25	75	100
Total				20	15	24	225	675	900

T – Tutorial P – Practical D – Drawing

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

Electrical & Electronics Engineering

III YEAR I SEMESTER **COURSE STRUCTURE**

S.No.	Course Code	Course	Course Category	Lectures	T/P/D	Credits	Internal Marks	External Marks	Total Marks
1	A55009	Linear IC Applications	PC	3	1	3	25	75	100
2	A55010	Management Science	HS	3	0	3	25	75	100
3	A55011	Power Electronics	PC	4	1	4	25	75	100
4	A55012	Power Systems-II	PC	3	1	3	25	75	100
5	A55013	Electrical Machines-III	PC	4	1	4	25	75	100
6		**PE-1**							
	A55014	Renewable Energy Sources	PE	3	0	3	25	75	100
	A55015	Computer Organization							
	A55016	Signals & Systems							
7	A55203	Power Electronics Lab	PC	0	3	2	25	75	100
8	A55204	Electrical Machines-II Lab	PC	0	3	2	25	75	100
Total				20	10	24	200	600	800

III YEAR II SEMESTER **COURSE STRUCTURE**

S. No	Course code	Course	Course Category	Lectures	T/P/D	Credits	Internal Marks	External Marks	Total Marks
1	A56008	Switchgear and Protection	PC	4	1	4	25	75	100
2	A56009	Computer Methods in Power Systems	PC	3	1	3	25	75	100
3	A56010	Electrical Measurements	PC	4	1	4	25	75	100
4	A56011	Power Semiconductor Drives	PC	3	1	3	25	75	100
5		**PE-2**							
	A56012	Special Electrical Machines	PE	3	1	3	25	75	100
	A56013	Advanced Power Electronics							
	A56014	Electrical Distribution Systems							
6		**OPEN ELECTIVE-I**	OE	3	1	3	25	75	100
7	A56203	Electrical Measurements Lab	PC	0	3	2	25	75	100
8	A56204	Advanced English Communication Skills Lab	HS	0	3	2	25	75	100
Total				20	12	24	200	600	800

T – Tutorial P – Practical D – Drawing

ANURAG ENGINEERING COLLEGE

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Electrical & Electronics Engineering

IV YEAR I SEMESTER **COURSE STRUCTURE**

S. No.	Course Code	Course	Course Category	Lectures	T/P/D	Credits	Internal Marks	External Marks	Total Marks
1	A57010	Micro Processors and Micro Controllers	PC	3	1	3	25	75	100
2	A57011	Power System Operation and Control	PC	4	1	4	25	75	100
3	A57012	Utilization Of Electrical Energy	PC	3	1	3	25	75	100
4		**PE-3**							
	A57013	Instrumentation	PE	3	1	3	25	75	100
	A57014	High Voltage Engineering							
	A57015	Optimization Techniques							
5		**PE-4**							
	A57016	Advanced Control Systems	PE	3	1	3	25	75	100
	A57017	Neural Networks and Fuzzy Logic							
	A57018	Linear system Analysis							
6		**OPEN ELECTIVE-II**	OE	3	1	3	25	75	100
7	A57204	Electrical Simulation Lab	PC	0	3	2	25	75	100
8	A57205	Micro Processors and Micro Controllers Lab	PC	0	3	2	25	75	100
9	A57206	Mini Project	PW	-	-	2	-	100	100
Total				19	12	25	200	700	900

IV YEAR II SEMESTER **COURSE STRUCTURE**

S. No.	Course Code	Course	Course Category	Lectures	T/P/D	Credits	Internal Marks	External Marks	Total Marks
1		**PE-5**							
	A58007	HVDC Transmission & FACTS	PE	3	1	3	25	75	100
	A58008	Smart Grid							
	A58009	Power Quality							
2		**PE-6**							
	A58010	EHV AC Transmission	PE	3	1	3	25	75	100
	A58011	Power System Reliability							
	A58012	Digital Signal Processing							
3		**OPEN ELECTIVE-III**	OE	3	1	3	25	75	100
4	A58204	Seminar	PW	–	6	2	100	–	100
5	A58205	Project Work	PW	–	15	10	50	150	200
6	A58206	Comprehensive Viva-Voce	PW	–	–	2	100	–	100
Total				9	24	23	325	375	700

T – Tutorial P – Practical D – Drawing

List of Open Electives

OPEN ELECTIVE- I			
S.No	**Course code**	**Course**	**Offering Department**
1	A56301	Construction Materials	Civil Engineering
2	A56302	Waste Management	
3	A56303	Solar Photovoltaic Systems	Electrical & Electronics Engineering
4	A56304	Maintenance of Electrical Systems	
5	A56305	Advanced Engineering Materials	Mechanical Engineering
6	A56306	Mechatronics	
7	A56307	Principles of Communication Systems	Electronics & Communication Engineering
8	A56308	Electronic Measuring Instruments	
9	A56309	Java Programming	Computer Science & Engineering
10	A56310	Computer Networks	

OPEN ELECTIVE- II			
S.No.	**Course code**	**Subject**	**Offering Department**
1	A57301	Disaster Management and Mitigation	Civil Engineering
2	A57003	Geological Information System & Remote Sensing	
3	A57302	Energy Storage Systems	Electrical & Electronics Engineering
4	A57303	Electrical Engineering Materials	
5	A57022	Power Plant Engineering	Mechanical Engineering
6	A57304	Industrial Robotics	
7	A57305	Computer Organization	Electronics & Communication Engineering
8	A57306	Principles of Signal Processing	
9	A57307	Database Management Systems	Computer Science & Engineering
10	A57308	Web Technologies	

OPEN ELECTIVE- III			
S.No	**Course code**	**Subject**	**Offering Department**
1	A58301	Construction Technology and Project Management	Civil Engineering
2	A58302	Safety Engineering	
3	A58303	Energy conservation and Audit	Electrical & Electronics Engineering
4	A58304	Artificial Neural Networks	
5	A58305	Renewable Energy Sources	Mechanical Engineering
6	A58306	Automobile Engineering	
7	A58306	Nanotechnology	Electronics & Communication Engineering
8	A58308	Biometric System	
9	A58309	Game Theory with Engineering Applications	Computer Science & Engineering
10	A58310	Software Engineering	

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

I Year B.Tech. EEE – I Sem

L	**T/P/D**	**C**
2	**0**	**2**

ENGLISH - I

1. INTRODUCTION:

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competencies of Engineering students. The prescribed books and the exercises are meant to serve broadly as students' handbooks.

In the English classes, the focus should be on the skills of reading, writing, listening and speaking and for this the teachers should use the text prescribed for detailed study. For example, the students should be encouraged to read the texts/selected paragraphs silently. The teachers can ask comprehension questions to stimulate discussion and based on the discussions students can be made to write short paragraphs/essays etc. The text for non-detailed study is for extensive reading/reading for pleasure. Hence, it is suggested that they read it on their own the topics selected for discussion in the class. The time should be utilized for working out the exercises given after each section, as also for supplementing the exercises with authentic materials of a similar kind for example, from newspaper articles, advertisements, promotional material etc.. *However, the stress in this syllabus is on skill development, fostering ideas and practice of language skills.*

2. OBJECTIVES:

- To improve the language proficiency of the students in English with emphasis on LSRW skills.
- To equip the students to study academic subjects more effectively using the theoretical and practical components of the English syllabus.
- To develop the study skills and communication skills in formal and informal situations.

LEARNING OUTCOMES:

1. Usage of English Language, written and spoken.
2. Enrichment of comprehension and fluency
3. Gaining confidence in using language in verbal situations.

SYLLABUS:

Listening Skills:

Objectives

1. To enable students to develop their listening skill so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and regions

Students should be given practice in listening to the sounds of the language to be able to recognize them, to distinguish between them to mark stress and recognize and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills:

Objectives

1. To make students aware of the role of speaking in English and its contribution to their success.
2. To enable students to express themselves fluently and appropriately in social and professional contexts.

• Oral practice
• Describing objects/situations/people
• Role play – Individual/Group activities (Using exercises from the five units of the prescribed text: ***Skills Annexe - Functional English for Success)***
• Just A Minute(JAM) Sessions.

Reading Skills:

Objectives

1. To develop an awareness in the students about the significance of silent reading and comprehension.
2. To develop the ability of students to guess the meanings of words from context and grasp the overall message of the text, draw inferences etc.

• Skimming the text
• Understanding the gist of an argument
• Identifying the topic sentence
• Inferring lexical and contextual meaning
• Understanding discourse features
• Scanning
• Recognizing coherence/sequencing of sentences

NOTE : *The students will be trained in reading skills using the prescribed text for detailed study. They will be examined in reading and answering questions using 'unseen' passages which may be taken from*
authentic texts, such as magazines/newspaper articles.

Writing Skills :

Objectives

1. To develop an awareness in the students about writing as an exact and formal skill
2. To equip them with the components of different forms of writing, beginning with the lower order ones.

• Writing sentences
• Use of appropriate vocabulary
• Paragraph writing
• Coherence and cohesiveness
• Narration / description
• Note Making
• Formal and informal letter writing
• Describing graphs using expressions of comparison.

TEXTBOOKS PRESCRIBED:

For Detailed study:

First Textbook: ***"Skills Annexe -Functional English for Success***", Published by Orient Black Swan, Hyderabad

For Non-detailed study:
Second text book *"Epitome of Wisdom",* Published by Maruthi Publications, Guntur

UNIT –I
Chapter 1: **'Wit and Humour'** from 'Skills Annexe' -Functional English for Success, Published by Orient Black Swan, Hyderabad 2 hrs
L-Listening For Sounds, Stress and Intonation 1
S-Greeting and Taking Leave, Introducing Oneself and Others (Formal and Informal Situations) 1
R- Reading for Subject/ Theme 1
W- Writing Paragraphs 1

UNIT –II
Chapter 2:**'Mokshagundam Visvesvaraya'** from "Epitome of Wisdom", Published by Maruthi Publications, Hyderabad. 3 hrs
G-Types of Nouns and Pronouns 1
V- Homonyms, homophones synonyms, antonyms 2

UNIT-III
Chapter 3: **"Cyber Age"** from "Skills Annexe -Functional English for Success" Published by Orient Black Swan, Hyderabad. 2 hrs
L – Listening for themes and facts 1
S – Apologizing, interrupting, requesting and making polite conversation 1
R- For theme and gist 1
W- Describing People, Places, Objects, Events 1

UNIT-IV
Chapter 4:**'Three Days To See'** from "Epitome of Wisdom", Published by Maruthi Publications, Hyderabad 2 hrs
G- Verb forms 2
V- noun, verb, adjective and adverb 2

UNIT-V
Chapter 5**'Risk Management'** from "Skills Annexe -Functional English for Success" Published by Orient Black Swan, Hyderabad 2 hrs
L – for main points and sub-points for note taking 1
S – giving instructions and directions; Speaking of hypothetical situations 1
R – reading for details 1
W – note-making, information transfer, punctuation 1

REFERENCES:

1. Contemporary English Grammar Structures and Composition by David Green, MacMillan Publishers, New Delhi.2010.
2. Innovate with English: A Course in English for Engineering Students, edited by T Samson, Foundation Books.
3. English Grammar Practice, Raj N Bakshi, Orient Longman.
4. Technical Communication by Daniel Riordan. 2011. Cengage Publications. New Delhi.
5. Effective English, edited by E Suresh Kumar, A RamaKrishna Rao**,** P Sreehari, Published by Pearson
6. Handbook of English Grammar& Usage, Mark Lester and Larry Beason, Tata Mc Graw – Hill.

7. Spoken English, R.K. Bansal & JB Harrison, Orient Longman.
8. Technical Communication, Meenakshi Raman, Oxford University Press
9. Objective English Edgar Thorpe & Showick Thorpe, Pearson Education
10. Grammar Games, Renuvolcuri Mario, Cambridge University Press.
11. Murphy's English Grammar with CD, Murphy, Cambridge University Press.
12. Everyday Dialogues in English, Robert J. Dixson, Prentice Hall India Pvt Ltd.,
13. ABC of Common Errors Nigel D Turton, Mac Millan Publishers.
14. Basic Vocabulary Edgar Thorpe & Showick Thorpe, Pearson Education
15. Effective Technical Communication, M Ashraf Rizvi, Tata Mc Graw –Hill.
16. An Interactive Grammar of Modern English, Shivendra K. Verma and Hemlatha Nagarajan , Frank Bros & CO
17. A Communicative Grammar of English, Geoffrey Leech, Jan Svartvik, Pearson Education
18. Enrich your English, Thakur K B P Sinha, Vijay Nicole Imprints Pvt Ltd.,
19. A Grammar Book for You And I, C. Edward Good, MacMillan Publishers

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

I Year B.Tech. EEE – I Sem	**L**	**T/P/D**	**C**
	3	**1/-/-**	**3**

MATHEMATICS-I

(Calculus and Matrices)

Objectives:

- *Able to know the Mean value theorems and determine the maxima and minima for function of several variables,Concepts of matrix algebra and methods of solving system of linear equations.*
- *Determine eigen values and eigen vectors of a matrix, cayeley hamilton theorem and inverse by cayley Hamilton theoremand sol of higher order differential equations.*
- *Develop a strategy for finding a solution of given arbitrary differential equation, using different methods and application of ODE in Bending of beams, electrical circuits and simple harmonic motion.*

UNIT-I: Functions of Single Variable and Functions of several variables:

Rolle's Theorem – Lagrange's Mean Value Theorem – Cauchy's mean value Theorem – Generalized Mean Value theorem (all theorems without proof) – Geometrical interpretation of Mean value theorems. Functions of several variables – Partial Differentiation and total differentiation - Functional dependence-Jacobian Determinent- Maxima and Minima of functions of two variables with constraints and without constraints.

UNIT-II: Matrices and Linear System of Equations:

Matrices and Linear systems of equations: Real matrices – Symmetric, skew - symmetric, orthogonal, Linear Transformation – Orthogonal Transformation. Complex matrices: Hermitian, Skew – Hermitian and Unitary. Elementary row transformations-Rank-Echelon form, Normal form – Solution of Linear Systems – Direct Methods (Gauss Elimination, Gauss Jordan).

UNIT-III: Eigen Values and Eigen Vectors:

Eigen values, Eigen vectors – properties, Cayley-Hamilton Theorem (without Proof) - Inverse and powers of a matrix by Cayley-Hamilton theorem – Diagonolization of matrix.

UNIT-IV: Differential Equations of first order and their Applications:

Differential equations of first order and first degree: exact, linear and Bernoulli, Applications to Newton's law of cooling, law of natural growth and decay, orthogonal trajectories.

UNIT-V: Higher Order Linear Differential Equations and their Applications:

Linear differential equations of second and higher order with constant coefficients, RHS term of the type f(X) $= e^{ax}, \sin ax, \cos ax \; and \; x^k, e^{ax}V(x), x^kV(x)$. Method of variation of parameters. Applications - Bending of beams, Electrical circuits, simple harmonic motion.

Outcomes:

- *Understand Rolle's and the Mean value theorems and to verify the Mean value theorems, derivatives to study maxima and minima of functions of two variables.*

- *Define rank and elementary transformations of a matrix and Non homogeneous and homogeneous system of equations and Compute eigen values and corresponding eigen vectors of a square matrix.*
- *Specify standard methods for solving differential equations and their applications in geometrical and physical problems, different types of higher order differential equations and their applications in engineering problem solving.*

TEXT BOOKS:

1. Grewal B.S (2007), Higher Engineering Mathematics, 40th Edition, New Delhi, Khanna Publishers.
2. Iyengar T.K.V., Krishna Gandhi B. & Others (2011), Engineering Mathematics Vol - I, 10th Revised Edition, New Delhi, S. Chand & Company Limited.
3. Iyengar T.K.V., Krishna Gandhi B. & Others (2011), Mathematical Methods, 10th Revised Edition, New Delhi, S. Chand & Company Limited.
4. Advanced Engineering Mathematics: Erwin Kreyszig, Wiley.

REFERENCE BOOKS:

1. Jain R. K., and Iyengar S. R. K (2008), Advanced Engineering Mathematics, 3rd Edition, New Delhi, Narosa Publication House.
2. Shahanaz Bathul (2007), Engineering Mathematics-I, 3rd Edition, Hyderabad, Right Publishers.
3. Ramana B.V (2010), Engineering Mathematics, New Delhi, Tata McGraw Hill Publishing Co. Limited
4. Mathematical Methods: S.R.K. Iyengar and R.K. Jain, Narosa Publishing House. Mathematical Methods of Science and Engineering (Aided with Matlab) Kanti B.Datta (2012), Seventh Edition, CENGAGE Learning.

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

I Year B.Tech. EEE – I Sem	**L**	**T/P/D**	**C**
	2	**1**	**2**

ENGINEERING PHYSICS – I

Objectives:

- *To appraise the students about the importance and role of chemistry in the field of Engineering by explaining the relevant topics and the properties of engineering materials.*
- *To provide the students with the necessary knowledge to solve the problems and make decisions with regards to the application of materials in a variety of engineering disciplines.*
- *To equip the students with the required fundamentals of engineering chemistry to carry out in the interdisciplinary research such that the findings benefit the common man.*

UNIT- I

INTERFERENCE AND DIFFRACTION:

Superposition principle, resultant amplitude, coherence, methods to obtain coherent sources, interference, Young's double slit experiment (Qualitative), interference in thin films by reflection, Newton's rings Experiment, Distinction between Fraunhofer and Fresnel diffraction, Diffraction at single slit, Diffraction grating (Qualitative), Introduction to polarization, Brewster's law and Double refraction.

UNIT - II

CRYSTAL STRUCTURES:

Space lattice – Unit cell – Lattice parameter – Crystal systems – Bravais lattices, Atomic radius – Co-ordination number - Structures d Packaning fractions of Simple Cubic – Body Centered Cubic – Face Centered Cubic crystals.

DIRECTIONS, PLANES AND X-RAY DIFFRACTION:

Miller Indices for Crystal planes and directions – Inter planar spacing of orthogonal crystal systems –Diffraction of X-rays by crystal planes and Bragg's law–Powder method – Applications of X-ray diffraction.

UNIT - III

ELEMENTS OF STATISTICAL MECHANICS:

Introduction, Phase space, Definition of Ensembles, Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics – Photon gas –Planck's law of black body radiation – Deduction of Wien's law and Rayleigh-Jeans law from Plank's law.

UNIT – IV

MAGNETIC PROPERTIES :

Introduction – Basic definitions - Origin of magnetic moment, Bohr magneton – Classification of magnetic materials (Dia, Para and Ferro)- Domain theory of ferromagnetism, Hysteresis curve – Soft and Hard magnetic materials – properties of Anti ferro and Ferri magnetic materials .

SUPERCONDUCTIVITY: Introduction, Meissner effect – Critical fields, Type I and Type II superconductors-Applications of super conductors.

UNIT - V

DIELECTRIC PROPERTIES:

Electric dipole, Dipole moment, Dielectric constant – Parallel plate Capacitor, Electronic, Ionic and Orientation Polarization – Calculation of Polarizibilities – Internal fields – Claussius – Mossotti equation – Basic concepts of Piezo, Pyro and Ferro electricity.

Outcomes:

- *Finally the students may be familiar with the topics of crystals, dielectrics, optics etc… which will be useful in various branches of technology.*
- *There will be a chance for them use the subject as a mathematical tool to solve their real life problems.*
- *Understand the students with the necessary knowledge to solve the problems and make decisions with regards to the application of materials*

TEXT BOOKS:

(1) Modern Engineering Physics by, Dr.K. Vijay Kumar & Dr.S.Chandralingam:S .Chand.Co
(2) Eengineering Physics by P K Palanisamy :Scietech publication
(3) Solid State Physics by M Armugam; Anuradha Publications

REFERENCE BOOKS:

(1) Introduction to Solid State Physics by Charles Kittel : John Wiley & Sons
(2) Engineering Physics by R.K.Gaur and S.L.Gupta; Dhanpat Rai and Sons
(3) Engineering Physics by V Rajendran; McGraw hill education private ltd.
(4) A Text book of Engineering Physics by M N Avadhanulu, P G Kshirsagar; S Chand
(5) Engineering Physics by K Malik, A K Singh; Tata Mc Graw hill book publishers
(6) Engineering Physics by M.R.Srinivasan, New Age Publishers

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

I Year B.Tech. EEE – I Sem	**L**	**T/P/D**	**C**
	3	**1/-/-**	**3**

COMPUTER PROGRAMMING - I

Objectives*:*

- *To explain representation of numbers, alphabets and other characters in computer system, the basic concepts in C Programming Language and selection and repetition statements in 'C' Language*
- *To explain software development tools like algorithm, pseudo codes and programming structure.*
- *To explain arrays to solve problems and strings and string operations, modular programming in 'C' Language.*

UNIT - I

Introduction to Computers – Computer Systems, Computing Environments, Computer Languages, operating system functions, language processor concepts.

Overview of C Language : Program structure and simple programs using scanf and printf functions.

Data representations- Binary, octal, hexa number systems, ASCII and EBCDIC, data types, Identifiers, Variables, Constants, declarations.

UNIT - II

Operators, Expressions, Precedence and Associativity, evaluation of expressions, sample programs using expressions, Type conversions, unformatted I/O.

Algorithms- control structure – grouping, selectors, repetitions.

Step wise refinement, flowchart.

UNIT - III

Statements- Selection Statements – if and switch statements, algorithm and program example using selectors.

Repetition statements (loops)-while, for, do-while statements, algorithm development using repetition and programs using repetition, break, continue, goto, exit, Simple C Program examples.

UNIT - IV

Arrays – Introduction, declaration, reading and printing arrays , programs using arrays, two – dimensional arrays,

Multidimensional arrays, C program examples.

Strings – Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, C program examples.

UNIT – V

Functions- procedural abstraction, function declarations, function calls and parameter passing Standard functions, Storage classes- recursion- recursive functions, example C programs.

Outcomes:

Upon completion of this course the students will have an:

- *Ability to design algorithmic solutions to problem*
- *Ability to convert algorithms to C-Programs*

- *Ability to write, compile and debug programs in C Language*

TEXT BOOKS:

1. Computer Science: A Structured Programming Approach Using C, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Programming in C. P. Dey and M Ghosh , Oxford University Press.

REFERENCE BOOKS:

1. C& Data structures – P. Padmanabham, Third Edition, B.S. Publications.
2. C for All, S. Thamarai Selvi, R.Murugesan, Anuradha Publications.
3. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, 7th Edition, Pearson education.
4. Programming in C, Ajay Mittal, Pearson.
5. Programming with C, B.Gottfried, 3rd edition, Schaum's outlines, TMH.
6. Problem solving with C, M.T.Somasekhara, PHI
7. Programming with C, R.S.Bickar, Universities Press.
8. Computer Programming & Data Structures, E.Balagurusamy, 4th edition, TMH.

ANURAG ENGINEERING COLLEGE

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I Year B.Tech. EEE – I Sem

L	T/P/D	C
3	1	3

ELECTRICAL CIRCUITS

Objective:

- *This course introduces the basic concept of circuit analysis which is the fundamental for all subjects of the Electrical engineering discipline.*
- *The emphasis of this course if laid on the basic analysis of circuit which includes single phase circuits, magnetic circuits and theorems.*
- *This course introduces various types of connections of R-L, R-C,R-L-C and their solutions, concept of resonance of A.C circuits.*

UNIT-I: Introduction to Electrical Circuits:

Circuit concept, R-L-C parameters, voltage and current sources, dependent and independent sources, source transformations, relationship for passive elements for different input signals (square, ramp, saw- tooth, triangular).

KCL, KVL, network reduction technique, series, parallel, series-parallel, Star-Delta, Delta-Star transformations. Nodal analysis, Mesh analysis - super node and super mesh for DC excitations.

UNIT-II: Magnetic circuits:

Magnetic circuits, Faraday's laws of electro magnetic induction - concept of self and mutual inductance. Dot convention, coefficient of coupling, composite magnetic circuits, analysis of series and parallel magnetic circuits.

UNIT-III: Single Phase AC Circuits:

R.M.S, average values and form factor for different periodic wave forms – steady state analysis of R,L,C (in different combination) with sinusoidal excitation - concept of reactance, impedance, susceptance and admittance. Phase and phase difference, concept of power factor, real and reactive power, J – notation , complex and polar forms of representation, complex power.

UNIT-IV: Locus diagram and Resonance:

Locus diagram: Series R-L, R-C, R-L-C and parallel combination with variation of various parameters. **Resonance**: Series, parallel circuits, concept of bandwidth and Q-factor.

UNIT –V: Network Theorems(with A.C and D.C Excitations):

Super position, Norton's, Reciprocity, Thevenin's, Maximum power transfer, Milliman's, and compensation theorems. Problems on all above theorems.

Outcomes:

- *To develop a basic concepts of electrical components, energy sources, their various types of connections and solutions of D.C circuits, basic concepts of magnetic circuits, Faraday's Laws and analysis of series and parallel magnetic circuits.*
- *To develop a To develop a basic concept of different periodic wave forms, complex power, J-notation, basic concepts of various types of connections of R-L, R-C,R-L-C and their solutions, concept of resonance of A.C circuits.*
- *To develop a solutions of various complex circuit connections by using different theorems of D.C & A.C excitations.*

TEXT BOOKS:

1. Engineering circuits analysis by William Hayt and Jack E. Kemmerly, McGraw Hill company, 6th edition.
2. Network Analysis by A. sudhakar and Shyammohan S Palli, Tata McGraw-Hill.
3. Electrical circuits by A. Chakrabarthy, Dhanpat Rai & Sons.

REFERENCE BOOKS:

1. Network Analysis by M.E Van Valkenberg.
2. Linear circuits analysis(time domain, phasor and laplace transform approaches) Second edition by Raymond A. Decarlo and Penmin-Lin, Oxford University Press. Second edition, 2004.
3. Electrical circuits theory by K. Rajeswaran, Pearson Education, 2004.
4. Basic circuits analysis by D.R.Cunningham & J.A. Stuller, Jaico publications.

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

I Year B.Tech. EEE – I Sem	**L**	**T/P/D**	**C**
	0	**-/6/-**	**3**

ENGINEERING GRAPHICS

Objectives:

- *To visualize and communicate geometrical elements like Polygons, Curves, Conic Sections, Cycloids and Involutes*
- *To understand the fundamentals of geometry like Orthographic Projections and its applications in design and manufacturing of various engineering components and the fundamentals of geometry like Principles involved in Planes and Solids and its applications in design and manufacturing of various engineering components.*
- *To understand the fundamentals of geometry like Isometric Projections and its applications in design and manufacturing of various engineering components, the fundamentals of geometry like Conversion of Orthographic Views to Isometric Views and its applications in design and manufacturing of various engineering components.*

UNIT – I

Introduction to Engineering Drawing: Drawing Instruments and their uses, types of lines, use of pencils, Lettering, Rules of dimensioning.
Construction of polygons: Inscription and superscription of polygons given the diameter of circle.
Curves used in Engineering Practice and their Constructions:
Conic Sections: Ellipse, Parabola, Hyperbola including the Rectangular Hyperbola - General method only.
Cycloidal curves - Cycloid, Epicycloid and Hypocycloid
Involutes

UNIT – II

Drawing of Projections or Views (Orthographic Projection in First Angle Projection Only): Principles of Orthographic Projections – Conventions – First and Third Angle Projections, Projection of Points, Projection of Lines - inclined to both planes, True lengths. (Mid points & Traces are eliminated).

UNIT – III

Projections of Planes: Projections of regular Planes – Inclined to both planes.
Projections of Solids: Projections of Regular Solids – Regular Polyhedra, solids of revolution, Axis inclined to both planes – Change of position.

UNIT –IV

Isometric Projections/views: Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines.

UNIT –V

Conversion of Orthographic Views to Isometric Views of simple objects.
Transformation of Projections: Conversion of isometric views to orthographic views of simple objects.

Outcomes:

- *To Know the importance of Engineering Graphics and to represent the various Polygons,Curves,Conic Sections, Cycloids and Involutes used in Engineering Graphics.*
- *To Draw and understand the Principles involved in Orthographic Projections and to represent the Principles involved in Points, Lines and Traces, Conversion of Orthographic Views to Isometric Views and also represent it's Transformation of Projections.*
- *To Draw and understand the construction Principles involved in Planes and Solids and the construction Principles involved in Isometric Projections.*

TEXT BOOKS:

1. Engineering Drawing, N.D. Bhatt / Charotar publishers
2. Engineering Drawing, K.L.Narayana and Kannaiah / Scietech publishers.

REFERENCES:

1. Engineering Drawing, K.Venugopal/G.Sreekanjana, New Age International Publishers.

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

I Year B.Tech. EEE – I Sem

L	T/P/D	C
0	-/3/-	2

English Language Communication Skills Lab-I

The **Language Lab** focuses on the production and practice of sounds of language and familiarises the students with the use of English in everyday situations and contexts.

Objectives:

- *To facilitate computer-aided multi-media instruction enabling individualized and independent language learning*
- *To sensitise the students to the nuances of English speech sounds, word accent, intonation and rhythm and consistent accent and intelligibility in their pronunciation of English by providing an opportunity for practice in speaking*
- *To improve the fluency in spoken English and neutralize mother tongue influence and train students to use language appropriately for interviews, group discussion and public speaking*

Learning Outcomes:

1. Better Understanding of nuances of language through audio- visual experience and group activities
2. Neutralization of accent for intelligibility
3. Speaking with clarity and confidence thereby enhancing employability skills of the students

Syllabus: English Language Communication Skills Lab shall have two parts:

a. Computer Assisted Language Learning (CALL) Lab
b. Interactive Communication Skills (ICS) Lab

The following course content is prescribed for the English Language Communication Skills Lab:

Exercise-I

CALL Lab: Introduction to Sounds of English Language
Speech Sounds
Vowels and Consonants

Exercise-II

ICS Lab: Ice-Breaking activity and Articles, Prepositions, Word formation- Prefixes & Suffixes, Synonyms & Antonyms

Exercise-III

CALL Lab: Structure of Syllables
Past Tense Marker and Plural Marker
Weak Forms and Strong Forms
Consonant Clusters.

Exercise-IV

ICS Lab: Situational Dialogues -Role-Play- (Self-introduction and introducing others-Greetings-Apologies- Requests), JAM Session.

Exercise-V

ICS Lab: Social and Professional Etiquette and Telephone Etiquette-Tenses-Non-Verbal Communications.

Minimum Requirement of infra structural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab: the Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners. **System Requirement (Hardware component):**

(computers with suitable configuration as per the purchased software demands)
Computer network with Lan with minimum 60 multimedia systems with the following

specifications:
i) P – IV Processor
a) Speed – 2.8 GHZ
b) RAM – 512 MB Minimum
c) Hard Disk – 80 GB
ii) Headphones of High quality

2. Interactive Communication Skills (ICS) Lab:

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V., a digital stereo –audio & video system and camcorder etc. **Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):**

1. Suresh Kumar, E. & Sreehari, P. 2009. A Handbook for English Language Laboratories. New Delhi: Foundation
2. **Strengthen Your Steps -** Dr. M. Hari Prasad and others, Maruthi Publications
3. Speaking English Effectively 2nd Edition by Krishna Mohan and N. P. Singh, 2011. Macmillan Publishers India Ltd. Delhi. 4. Kumar, V & Dhamija, P.V. How to Prepare for Group Discussion and Interviews. Tata McGraw Hill 5. Hancock, M. 2009. English Pronunciation in Use. Intermediate. Cambridge: CUP
6. Spoken English: A Manual of Speech and Phonetics by R. K. Bansal & J. B. Harrison. 2013. Orient Blackswan. Hyderabad. 7. Hewings, M. 2009. English Pronunciation in Use. Advanced. Cambridge: CUP
8. Marks, J. 2009. English Pronunciation in Use. Elementary. Cambridge: CUP
9. Nambiar, K.C. 2011. Speaking Accurately. A Course in International Communication. New Delhi: Foundation
10. Soundararaj, Francis. 2012. Basics of Communication in English. New Delhi: Macmillan
11. **Spoken English** (CIEFL) in 3 volumes with 6 cassettes, OUP.
12. **English Pronouncing Dictionary** Daniel Jones Current Edition with CD.
13. **A textbook of English Phonetics for Indian Students** by T. Balasubramanian (Macmillan)
14. **Lab Manual:** A Manual entitled "**English Language Communication Skills (ELCS) Lab Manual- cum- Work Book**", published by Cengage Learning India Pvt. Ltd, New Delhi. 2013

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

I Year B.Tech. EEE – I Sem	**L**	**T/P/D**	**C**
	0	**-/3/-**	**2**

COMPUTER PROGRAMMING – I LAB

Objectives:

- *To make the student learn Linux commands and learn a programming language.*
- *To teach the student to write programs in C to solve the problems*
- *To make the student to write the programs using control statements, use arrays for solving the problems and write modular programming*

Week 1:

1. Familiarity with Linux Commands – Login, Wild Chars, ls, cp, mv, mkdir, wc, chdir.
2. Creation of text files using vi editor.

Week 2:

Using vi editor – perform operations of pattern search, insertion, deletion and substitution operations

Week 3:

Write simple programs using scanf and printf functions and familiarity with format strings.

Week 4 & 5:

Write programs to illustrate the Assignment Operators

Week 6:

Write programs to illustrate the Logical Operators

Week 7:

Write programs to illustrate the Relational Operators

Week 8:

Write programs using If Statement

Week 9:

Write programs using while, do-while loops

Week 10:

Write programs using for loop

Week 11:

Write programs to illustrate one dimensional arrays

Week 12:

Write programs to illustrate two dimensional arrays

Week 13:

Write programs to illustrate String concepts.

Week 14:

Write programs using functions

Week 15:

Review

ANURAG ENGINEERING COLLEGE

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I Year B.Tech. EEE – I Sem	L	T/P/D	C
	0	-/3/-	2

ENGINEERING PHYSICS LAB

1. Diffraction Grating with sodium vapor lamp

2. Single Slit with laser source
3. Newton's Rings
4. Energy gap of a semiconductor material
5. Torsional Pendulum Expt. to determine the rigidity modulus of material of a wire
6. Seebeck Effect
7. Decay of charge - R C circuit and time constant
8. L C R Series circuits
9. Dispersive Power of the material of a Prism using Spectrometer
10. Stewart & Gee's experiment
11. LED Characteristics
12. Numerical Aperture of an Optical Fibre & Bending losses of an Optical Fibre
13. Diffraction Grating with laser source

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

I Year B.Tech. EEE – I Sem	**L**	**T/P/D**	**C**
	0	**-/3/-**	**2**

ENGINEERING WORKSHOP

Objectives:

- *To impart the knowledge regarding the various techniques, skills and tools necessary for engineering workshop practice.*
- *To provide the students with hands on experience on different trades of engineering workshop like carpentry, tin-smithy, fitting, welding and house wiring.*
- *To learn about the machines in view of constructions details, different operations to be performed on the machines and different tools and introduce the concepts of power tools in constructions , wood working, electrical engineering and mechanical engineering in manufacturing applications*

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

1. Carpentry
2. Fitting
3. Tin-smithy and development of jobs carried out and soldering.
4. House-wiring
5. Welding

2. TRADES FOR DEMONSTRATION&EXPOSURE:

1. Plumbing
2. Machine shop
3. Power tools in construction, wood working, electrical engineering and mechanical engineering.

Outcomes:

1. To make a lap joint.
2. To make a dovetail- joint.
3. To make a T-briddle joint.
4. To prepare a flat filing.
5. To prepare a step cutting.
6. To prepare a angular cutting.
7. To prepare a open scoop.
8. To prepare a rectangular tray.
9. To prepare a square tin.
10. To understand and to give the connections for one light point control by one single pole switch.
11. To understand and to give the connections for one light point control by two-two way switchs (parallel connections).
12. To understand and to give the connections for to-connect a electrical bell by using bell-push.
13. To understand and to give the connections for two light point controlled by one single pole switch.
14. To prepair a pipe joint,tap and pressing- connections by using pluming.
15. To apply different operations to be performed on the lathe machines.

16. To prepare a switch boards , wood drilling and threading different various sizes.

TEXT BOOKS:

1. Work shop manual - P.Kannaiah/K.L Narayana/scitech publishers.
2. Workshop manual by Venkat Reddy

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

I Year B.Tech. EEE – II Sem	**L**	**T/P/D**	**C**
	2	**0**	**2**

English-II

1. INTRODUCTION:

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competencies of Engineering students. The prescribed books and the exercises are meant to serve broadly as students' handbooks.

In the English classes, the focus should be on the skills of reading, writing, listening and speaking and for this the teachers should use the text prescribed for detailed study. For example, the students should be encouraged to read the texts/selected paragraphs silently. The teachers can ask comprehension questions to stimulate discussion and based on the discussions students can be made to write short paragraphs/essays etc. The text for non-detailed study is for extensive reading/reading for pleasure. Hence, it is suggested that they read it on their own the topics selected for discussion in the class. The time should be utilized for working out the exercises given after each section, as also for supplementing the exercises with authentic materials of a similar kind for example, from newspaper articles, advertisements, promotional material etc.. *However, the stress in this syllabus is on skill development, fostering ideas and practice of language skills.*

2. OBJECTIVES:

- *To improve the language proficiency of the students in English with emphasis on LSRW skills.*
- *To equip the students to study academic subjects more effectively using the theoretical and practical components of the English syllabus.*
- *To develop the study skills and communication skills in formal and informal situations.*

LEARNING OUTCOMES:

- Usage of English Language, written and spoken.
- Enrichment of comprehension and fluency
- Gaining confidence in using language in verbal situations.

SYLLABUS:

Listening Skills:

Objectives

1. To enable students to develop their listening skill so that they may appreciate its role in the LSRW Skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and regions

Students should be given practice in listening to the sounds of the language to be able to recognise them, to distinguish between them to mark stress and recognise and use the right intonation in sentences.

• Listening for general content
• Listening to fill up information
• Intensive listening
• Listening for specific information

Speaking Skills:

Objectives

1. To make students aware of the role of speaking in English and its contribution to their

success.
2. To enable students to express themselves fluently and appropriately in social and professional contexts.

- Oral practice
- Describing objects/situations/people
- Role play – Individual/Group activities (Using exercises from the five units of the prescribed text: ***Skills Annexe - Functional English for Success)***
- Just A Minute(JAM) Sessions.

Reading Skills:

Objectives

1. To develop an awareness in the students about the significance of silent reading and comprehension.
2. To develop the ability of students to guess the meanings of words from context and grasp the overall message of the text, draw inferences etc.

- Skimming the text
- Understanding the gist of an argument
- Identifying the topic sentence
- Inferring lexical and contextual meaning
- Understanding discourse features
- Scanning
- Recognizing coherence/sequencing of sentences

NOTE : *The students will be trained in reading skills using the prescribed text for detailed study. They will be examined in reading and answering questions using 'unseen' passages which may be taken from authentic texts, such as magazines/newspaper articles.*

Writing Skills :

Objectives

1. To develop an awareness in the students about writing as an exact and formal skill
2. To equip them with the components of different forms of writing, beginning with the lower order ones.

- Writing sentences
- Use of appropriate vocabulary
- Paragraph writing
- Coherence and cohesiveness
- Narration / description
- Note Making
- Formal and informal letter writing
- Describing graphs using expressions of comparison

TEXTBOOKS PRESCRIBED:

For Detailed study:

First Textbook: ***"Skills Annexe -Functional English for Success***", Published by Orient Black Swan, Hyderabad

For Non-detailed study:

Second text book ***"Epitome of Wisdom",*** Published by Maruthi Publications, Guntur

UNIT-I

Chapter 1:**'Leela's Friend'** by R.K. Narayan from "Epitome of Wisdom", Published by Maruthi Publications, Hyderabad 2 hrs
G – Present Tense 2
V – Synonyms and Antonyms 2

UNIT-II

Chapter 2: **'Human Values and Professional Ethics'** from "Skills Annexe -Functional English for Success" Published by Orient Black Swan, Hyderabad 2 hrs
L -Listening for specific details and information 1
S- Narrating, expressing opinions and telephone interactions 1
R -Reading for specific details and information 1
W- Writing formal letters and CVs 1

UNIT-III

Chapter 3: **'The Convocation Speech'** by N.R. Narayanmurthy' from "Epitome of Wisdom", Published by Maruthi Publications, Hyderabad 2 hrs
G- Past and future tenses 2
V- Vocabulary - idioms and Phrasal verbs 2

UNIT-IV

Chapter 4: **'Sports and Health'** from "Skills Annexe -Functional English for Success" Published by Orient Black Swan, Hyderabad 2 hrs
L- Critical Listening and Listening for speaker's tone/ attitude 1
S- Group discussion and Making presentations 1
R- Critical reading, reading for reference 1
W-Project proposals; Technical reports, Project Reports and Research Papers 1

UNIT-V

Chapter5: '**The Secret of Work'** from "Epitome of Wisdom", Published by Maruthi Publications Hyderabad. 2 hrs
G- Adjectives, Prepositions and Concord 2
V- Collocations and Technical Vocabulary 2

REFERENCES :

1. Contemporary English Grammar Structures and Composition by David Green, MacMillan Publishers, New Delhi.2010.
2. Innovate with English: A Course in English for Engineering Students, edited by T Samson, Foundation Books.
3. English Grammar Practice, Raj N Bakshi, Orient Longman.
4. Technical Communication by Daniel Riordan. 2011. Cengage Publications. New Delhi.
5. Effective English, edited by E Suresh Kumar, A RamaKrishna Rao**,** P Sreehari, Published by Pearson
6. Handbook of English Grammar& Usage, Mark Lester and Larry Beason, Tata Mc Graw – Hill.
7. Spoken English, R.K. Bansal & JB Harrison, Orient Longman.
8. Technical Communication, Meenakshi Raman, Oxford University Press
9. Objective English Edgar Thorpe & Showick Thorpe, Pearson Education
10. Grammar Games, Renuvolcuri Mario, Cambridge University Press.
11. Murphy's English Grammar with CD, Murphy, Cambridge University Press.
12. Everyday Dialogues in English, Robert J. Dixson, Prentice Hall India Pvt Ltd.,

13. ABC of Common Errors Nigel D Turton, Mac Millan Publishers.
14. Basic Vocabulary Edgar Thorpe & Showick Thorpe, Pearson Education
15. Effective Technical Communication, M Ashraf Rizvi, Tata Mc Graw –Hill.
16. An Interactive Grammar of Modern English, Shivendra K. Verma and Hemlatha Nagarajan , Frank Bros & CO
17. A Communicative Grammar of English, Geoffrey Leech, Jan Svartvik, Pearson Education
18. Enrich your English, Thakur K B P Sinha, Vijay Nicole Imprints Pvt Ltd.,
19. A Grammar Book for You And I, C. Edward Good, MacMillan Publishers

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

I Year B.Tech. EEE – II Sem	L	T/P/D	C
	3	1/-/-	3

MATHEMATICS – II

(Mathematical Techniques)

Objectives:

- *To introduce some special functions like Gamma, Beta and learn how to evaluate definite integrals with the help of special functions.*
- *Able to know the Laplace , Inverse Laplace transform and sol of ODE by using Laplace transforms, the multiple integrals and analyze the DEL properties.*
- *Apply the theorems by using line, surface and volume integrals and Determine the Fourier coefficients of a given function. Analyze the characteristics and properties of Fourier transforms.*

UNIT-I: Laplace transform and its applications to Ordinary differential equations

Laplace transform of standard functions – Inverse transform – first shifting Theorem, Transforms of derivatives and integrals – Unit step function – second shifting theorem – Dirac's delta function – Convolution theorem – Periodic function - Differentiation and integration of transforms – Application of Laplace transforms to ordinary differential equations.

UNIT-II: Gamma and Beta Functions:

Gamma and Beta Functions-Relation between them, their properties – evaluation of improper integrals using Gamma / Beta functions.

UNIT – III: Multiple Integrals

Multiple integrals - double and triple integrals – change of order of integration- change of variables. Gradient- Divergence- Curl and their related properties - Potential function - Laplacian and second order operators.

UNIT-IV: Vector Calculus

Line integral – work done —- Surface integrals - Flux of a vector valued function. Vector integrals theorems: Green's – Stoke's and Gauss's Divergence Theorems (Only Statements & their Verifications).

UNIT-V: Fourier Series

Determination of Fourier coefficients – Fourier series – even and odd functions – Fourier series in an arbitrary interval – even and odd periodic continuation – Half-range Fourier sine and cosine expansions.

Outcomes:

- *Apply Beta and Gamma functions to evaluate many integrals which cannot be expressed in terms of elementary functions and Laplace transform to solve differential equations which will be converted to algebraic*
- *Evaluate double integrals by changing variables , changing order and triple integration Calculate line integrals along piecewise smooth paths, interpret such quantities as work done by a force*
- *Apply Green's theorem to evaluate line integrals along simple closed contours on the plane, Stoke's theorem to give physical interpretation of the curl of a vector field and Divergence theorem to give physical interpretation of the divergence of a vector field and Develop Fourier series of periodic functions.*

TEXT BOOKS:

1. Grewal B.S (2007), Higher Engineering Mathematics, 40th Edition, New Delhi, Khanna Publishers.
2. Iyengar T.K.V., Krishna Gandhi B. & Others (2011), Mathematical Methods, 10th Revised Edition, New Delhi, S. Chand & Company Limited.
3. Iyengar T.K.V., Krishna Gandhi B. & Others (2011), Engineering Mathematics Vol - I, 10th Revised Edition, New Delhi, S. Chand & Company Limited.
4. Advanced Engineering Mathematics: Erwin Kreyszig, Wiley.

REFERENCE BOOKS:

1. Shahanaz Bathul (2007), Mathematical Methods, 3rd Edition, Hyderabad, Right Publishers.
2. Jain R. K., and Iyengar S. R. K (2008), Advanced Engineering Mathematics, 3rd Edition, New Delhi, Narosa Publication House.
3. Dass H.K. and Rajnish Verma Er (2007), Higher Engineering Mathematics, First Edition, New Delhi, S. Chand & Company Limited.
4. Integral Transforms by A.R.Vasista
5. Schaum's outline series on Vector Analysis; Linear Algebra.
6. Larry C. Andrews and Bhimsen K. Shivamoggi, Integral Transforms for Engineers, Prentice – Hall of India Private Limited, New Delhi.
7. Mathematical Methods of Science and Engineering (Aided with Matlab) Kanti B.Datta (2012), Seventh Edition, CENGAGE Learning.

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

I Year B.Tech. EEE – II Sem	**L**	**T/P/D**	**C**
	2	**1**	**2**

ENGINEERING PHYSICS – II

Objectives:

- *To impart the knowledge of mathematics and science to determine the working of semiconductor devices .*
- *Emphasize the study of Quantum mechanics to apply it to solve problems of micro & macro particles.*
- *To have the knowledge of laser technology to know about the working & applications of laser and importance of nanotechnology which has the world wide importance.*

UNIT- I PRINCIPLES OF QUANTUM MECHANICS:
Waves and particles – De Broglie hypothesis - Matter waves - Davisson and Germer experiment – Schrodinger Wave Equation – Wave function and its Physical Significance - Particle in one dimensional potential box(wave functions, probability densities and energy states).

UNIT- II FREE ELECTRON THEORY OF METALS:
Classical Theory, Electrical Conductivity and Ohm's Law – Drawbacks, Sommerfield theory (Qualitative), Density of States, Effect of temperature on the Fermi-Dirac distribution.

BAND THEORY OF SOLIDS: Electron in a periodic potential – Bloch Theorem - Kronig-Penney model (Qualitative) – Origin of energy band formation in solids – Classification of materials into conductors, semiconductors & Insulators - Concept of effective mass of an electron.

UNIT- III SEMICONDUCTOR PHYSICS:
Fermi level in Intrinsic and Extrinsic semiconductors - Intrinsic semiconductor and carrier concentration – Extrinsic semiconductor and carrier concentration – Characteristics of p-n junction diode - Hall effect, LED, Photodiode.

FIBRE OPTICS
Basic principle of optical fibre, Acceptance angle, Acceptance cone, numerical aperture (Quantitative), Types of optical fibre, applications of optical fibre.

UNIT IV LASERS:
Characteristics of Lasers – Spontaneous and Stimulated Emission of radiation, meta stable state, population inversion, lasing action, Einstein's coefficients and relation between them — Ruby Laser – Helium-Neon Laser –Semiconductor Laser – Applications of lasers.

UNIT V BASIC PRINCIPLES OF NANO SCIENCE:
Introduction, surface to volume ratio, quantum confinement – Fabrication of nano materials- Top down fabrication, Bottom up fabrication: sol-gel Technique, CVD method– Characterization (XRD & TEM) - Applications of nanomaterials.

Outcomes:

- *Having the knowledge of semiconductors & fiber optics, there will be a chance to know their applications.*
- *There will be a chance for them to use the subject as a mathematical tool to solve their real life problems.*
- *The students will be able to know the working of different lasers & their real life applications.*

TEXT BOOKS:

1. Engineering Physics by P K palanisamy :Scietech publication
2. Solid State Physics by M Armugam; Anuradha Publications

REFERENCE BOOKS:

1. Introduction to Solid State Physics by Charles Kittel : John Wiley & Sons
2. Engineering Physics by R.K.Gaur and S.L.Gupta; Dhanpat Rai and Sons
3. Engineering Physics by V Rajendran; McGraw hill education private ltd.
4. A Text book of Engineering Physics by M N Avadhanulu, P G Kshirsagar; S Chand
5. Engineering Physics by K Malik, A K Singh; Tata Mc Graw hill book publishers
6. Engineering Physics by M.R.Srinivasan, New Age Publishers

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

I Year B.Tech. EEE – II Sem	L	T/P/D	C
	3	1/-/-	3

COMPUTER PROGRAMMING - II

Objectives:

- *To explain various sorting and searching techniques*
- *To explain structures, unions, and enumeration types and operations on them*

- *To understand dynamic memory management using pointers and basic data structures such as stacks, queues and linked lists.*

UNIT - I

Searching and Sorting – Sorting- selection sort, bubble sort, Insertion sort, Quick Sort, Merge sort, Searching-linear and binary search methods.

UNIT - II

Structures - Declaration, initialization, accessing structures, operations on structures,nested structures, arrays of structures, Unions, Enumerated types, Type Definition(typedef), C programming examples.

UNIT - III

Pointers – Concepts, declarations, usage, pointers to pointers, pointer expressions, Arrays and Pointers, array of pointers,parameter passing of pointers, pointers to void, pointers to functions, structures through pointers, self referential structures, C programming examples

UNIT - IV

Lists- Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks- Push and Pop Operations, Queues- Enqueue and Dequeue operations.

UNIT - V

Input and Output – Concept of a file, streams, text files and binary files, Differences between text and binary files,State of a file, Opening and Closing files, file input / output functions (standard library input / output functions for files), file status functions (error handling), Positioning functions, command –line arguments, C program examples.

Out Comes:

- *Upon completion of this course the students will have an:*
- *Ability to design various sorting and searching technique and data types to solve real world problems*
- *Ability to manage heap memory and implement and use data structures like stacks, queues and linked lists, create and use various types of files in 'C' Language.*

TEXT BOOKS:

1. Computer Science: A Structured Programming Approach Using C, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Programming in C. P. Dey and M Ghosh , Oxford University Press.

REFERENCE BOOKS:

1. C& Data structures – P. Padmanabham, Third Edition, B.S. Publications.
2. C for All, S. Thamarai Selvi, R.Murugesan, Anuradha Publications.
3. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, 7th Edition, Pearson education.
4. Programming in C, Ajay Mittal, Pearson.
5. Programming with C, B.Gottfried, 3rd edition, Schaum's outlines, TMH.
6. Problem solving with C, M.T.Somasekhara, PHI
7. Programming with C, R.S.Bickar, Universities Press.
8. Computer Programming & Data Structures, E.Balagurusamy, 4th edition, TMH.

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I Year B.Tech. EEE – II Sem	L	T/P/D	C
	3	1/-/-	3

MATHEMATICS-III

(Numerical Techniques and Partial Differential Equations)

Objectives:

- *Determination of roots of an equation and calculate some simple methods of obtaining approximate roots of algebraic and transdental equations.*
- *Interpolate the values using the techniques of newtons forward and backward, Gauss forward and backward, lagranges and splines interpolations, calculate numerical differentiation and numerical integration methods.*
- *Calculate sol of ODE using Taylor's, Euler's, Picasrd's, Runga Kutta and Predictor-Corrector method, sol of PDE and calculate boundary value problems.*

UNIT-I: Solution of Non- linear Equations and Linear System of Equations.
Solution of Algebraic and Transcendental Equations – The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method.

Solving system of non-homogeneous equations by L-U Decomposition method(Crout's Method)Jacobi's and Gauss-Seidel Iteration method,

UNIT-II: Interpolation:
Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences-Backward differences –Central differences – Symbolic relations and separation of symbols-Difference Equations - Differences of a polynomial-Newton's formulae for interpolation – Central difference interpolation Formulae – Gauss Central Difference Formulae –Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

UNIT-III: Numerical Differentiation, Numerical Integration & Curve fitting
Numerical Diferentiation, Generalized Quadrature (Newton's Cote's formula), Trapezoidal, Simson's and Weddle's rules and problems. Curve fitting: Fitting a straight line – Second degree curve – exponentional curve-power curve by method of least squares.

UNIT – IV: Numerical solution of IVP's in ODE
Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method-Runge-Kutta Methods –Predictor-Corrector Methods- Adams-Bashforth Method-Milne Thamson Method.

UNIT-V: Partial differential equations
Introduction and Formation of partial differential equation by elimination of arbitrary constants and arbitrary functions, solutions of first order linear (Lagrange) equation and nonlinear (Standard type) equations, Charpits Method, Method of separation of Variables for second order equations. Classification of general second order partial differential equations. Applications of Partial Differential Equations-One dimensional wave equation, Heat equation.

Outcomes:
- *Calculate some simple methods of obtaining approximate roots of algebraic and transdental equations.*
- *Ability to Interpolate the values using the techniques of newtons forward and backward, Gauss forward and backward*
- *Ability to Calculate sol of ODE using Taylor's, Euler's, Picasrd's, Runga Kutta*

TEXT BOOKS:

1. Grewal B.S (2007), Higher Engineering Mathematics, 40th Edition, New Delhi, Khanna Publishers.
2. Iyengar T.K.V., Krishna Gandhi B. & Others (2011), Mathematical Methods, 10th Revised Edition, New Delhi, S. Chand & Company Limited.
3. Advanced Engineering Mathematics: Erwin Kreyszig, Wiley.

REFERENCE BOOKS:

1. Shahanaz Bathul (2007), Mathematical Methods, 3rd Edition, Hyderabad, Right Publishers.
2. Jain R. K., and Iyengar S. R. K (2008), Advanced Engineering Mathematics, 3rd Edition, New Delhi, Narosa Publication House.
3. Introductory Methods of Numerical Analysis. S.S. Sastry, Prentice Hall.
4. Numerical Analysis (Paper IV), First Edition 2010, Telugu Akademi, Hyderabad.
5. Schaum's outline series on Matrices.
6. Mathematical Methods of Science and Engineering (Aided with Matlab) Kanti B.Datta (2012), Seventh Edition, CENGAGE Learning.

ANURAG ENGINEERING COLLEGE

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I Year B.Tech. EEE – II Sem	L	T/P/D	C
	3	1	3

ENGINEERING CHEMISTRY

Objectives:

- *To appraise the students about the importance and role of chemistry in the field of Engineering by explaining the relevant topics.*
- *To provide the students with the necessary knowledge to solve the problems and make decisions with regards to the application of materials in a variety of engineering disciplines.*
- *To equip the students with the required fundamentals of engineering chemistry carry out in the interdisciplinary research such that the findings benefit the common man and polymer chemistry, electrochemistry (including batteries) and advanced engineering materials.*

UNIT I: WATER: Hardness of water, expression of hardness ($CaCO_3$ equivalent), units and types of hardness. Estimation of temporary and permanent hardness of water by EDTA method. Numerical problems based on hardness of water. Potable water: characteristics, treatment of water for domestic supply. Desalination of brackish water: reverse osmosis. Alkalinity of water and its determination. Boiler troubles: priming and foaming, boiler corrosion, scales, sludges and caustic embrittlement. Boiler feed water and its treatment: Internal treatment (colloidal, phosphate calgon conditioning of water). External treatment (zeolite process and ion –exchange process) , Numerical problems on softening of water.

UNIT II: ELECTROCHEMISTRY : Conductance and its types . Electrode, electrode potential, galvanic cell , cell reactions and cell notation, cell EMF , types of electrodes (Normal Hydrogen Electrode , calomel electrode, glass electrode and quinhydrone electrode), Nernst equation Numerical problems. Potentiometric titrations. Concentration cells, classification with examples.

BATTERIES: Introduction to cell and battery, characteristics of a cell. Primary (dry cell and lithium cell) and secondary cells, (lead-Acid cell, Ni-Cd cell and Lithium ion cells,). Solar battery, engineering applications of batteries. Fuel cells – Hydrogen – Oxygen fuel cell, advantages and engineering applications of fuel cells.

UNIT III: CORROSION AND ITS CONTROL Introduction, types of corrosion : chemical and electrochemical corrosion, mechanism of chemical and electrochemical corrosion , galvanic , water line and pitting corrosion, factors affecting the rate of corrosion : nature of the metal , galvanic series, purity of metal, nature of corrosion product , nature of environment : effect of temperature, effect of pH, humidity. Corrosion control methods: Cathodic protection: sacrificial anode method and impressed current cathode method. Protective coatings : metallic coatings (anodic and cathodic), methods of application on metals , hot dipping (galvanizing), cladding, cementation, electroplating(of copper) electroless plating (of nickel) . Organic coatings – paints, its constituents and their functions.

UNIT IV: POLYMER CHEMISTRY : Introduction, classification of polymers, types of polymerization (addition and condensation, *mechanisms not included*). Plastics- types of plastics -thermoplastics and thermosetting plastics. Compounding and moulding of plastics. Preparation, properties and engineering applications of PVC, Teflon and Bakelite. Fibers: Nylon 6, 6 and Terelene (Dacron). Elastomers: natural rubber, structure, vulcanization. Synthetic rubbers: Buna-S, butyl rubber, Thikol rubber. Conducting polymers: classification, mechanism of conduction, Poly acetylene - preparation and effects of doping on conduction. Applications of conducting polymers.

UNIT V: ADVANCED ENGINEERING MATERIALS: Biodegradable polymers, types, examples: Polyhydroxy butyrate (PHB) ,Poly-Hydroxybutyrate-co-b-Hydroxy valerate (PHBV) ,Polyglycolic

acid (PGA) , Polylactic acid (PLA) ,Poly (Î-caprolactone) (PCL). Applications of biodegradable polymers.
Composite materials: Constituents of composite materials. Types of composite materials. Advantages and engineering applications of composite materials.
Nano materials: Introduction, basic methods of preparation and applications of nano meterials.
Insulators- Classification, characteristics of thermal & electrical insulators and applications.
Biofuels – biodiesel, general methods of preparation and advantages

Outcomes:

- *As commences with fundamentals which indeed takes the individual students to be more conversant with apparatus and allied .*
- *Gets equipped with the technical importance of knowing the extent of hardness and consciousness of units anf with fundamentals which indeed takes the individual students to be more conversant with apparatus and allied .*
- *Students gets augmented the adroitness and keep aware of some industrial determination techniques , the adroitness and keep aware of some industrial determination techniques*

TEXT BOOKS:

1. Engineering Chemistry by NYS.Murthy, Pearson, India.
2. Engineering Chemistry by P.C Jain & Monica Jain, Dhanpat Rai Publishing Company

REFERENCE BOOKS:

1.Text Book of Engineering Chemistry by Shasi Chawla, Dhantpat Rai publishing Company,
2. Engineering Chemistry by C.Daniel Yesudian , Anuradha publications

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

I Year B.Tech. EEE – II Sem	**L**	**T/P/D**	**C**
	0	**-/3/-**	**2**

English Language Communication Skills Lab-II

The **Language Lab** focuses on the production and practice of sounds of language and familiarises the students with the use of English in everyday situations and contexts.

Objectives

- *To facilitate computer-aided multi-media instruction enabling individualized and independent language, learning of English speech sounds, word accent, intonation and rhythm.*
- *To bring about a consistent accent and intelligibility in their pronunciation of English by providing an opportunity for practice in speaking English and neutralize mother tongue influence.*
- *To train students to use language appropriately for interviews, group discussion and public speaking*

Learning Outcomes:

1. Better Understanding of nuances of language through audio- visual experience and group activities
2. Neutralization of accent for intelligibility
3. Speaking with clarity and confidence thereby enhancing employability skills of the students

Syllabus: English Language Communication Skills Lab shall have two parts:

1. **Computer Assisted Language Learning (CALL) Lab**
2. **Interactive Communication Skills (ICS) Lab**

The following course content is prescribed for the English Language Communication Skills Lab

Exercise-I

CALL Lab: Minimal Pairs
Word accent and Stress Shifts
Listening Comprehension

Exercise-II

ICS Lab: Descriptions- Narrations- Giving Directions and Guidelines

Question Tags and One-Word Substitutes

Concord (Subject in agreement with verb) and Words often misspelt- confused/misused

Exercise-III

CALL Lab: Intonation and Common Errors in Pronunciation.**-**Neutralization of Mother Tongue Influence and Conversation Practice.

Exercise-IV

ICS Lab: Extempore - Oral Presentation Skills

Active and Passive Voice,

Common Errors in English,

Idioms and Phrases

Exercise-V

ICS Lab: Information Transfer

Public Speaking

Reading Comprehension

Job Application with Resume preparation.

Minimum Requirement of infra structural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab:

The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.

System Requirement (Hardware component):

(computers with suitable configuration as per the purchased software demands)

Computer network with Lan with minimum 60 multimedia systems with the following specifications:

i) P – IV Processor

a) Speed – 2.8 GHZ

b) RAM – 512 MB Minimum

c) Hard Disk – 80 GB

ii) Headphones of High quality

2. Interactive Communication Skills (ICS) Lab:

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V., a digital stereo –audio & video system and camcorder etc.

Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):

1. Suresh Kumar, E. & Sreehari, P. 2009. A Handbook for English Language Laboratories. New Delhi: Foundation

2. Strengthen Your Steps - Dr. M. Hari Prasad and others, Maruthi Publications

3. Speaking English Effectively 2nd Edition by Krishna Mohan and N. P. Singh, 2011. Macmillan Publishers India Ltd. Delhi.

4. Sasi Kumar, V & Dhamija, P.V. How to Prepare for Group Discussion and Interviews. Tata McGraw Hill

5. Hancock, M. 2009. English Pronunciation in Use. Intermediate. Cambridge: CUP

6. Spoken English: A Manual of Speech and Phonetics by R. K. Bansal & J. B. Harrison. 2013. Orient Blackswan. Hyderabad.

7. Hewings, M. 2009. English Pronunciation in Use. Advanced. Cambridge: CUP

8. Marks, J. 2009. English Pronunciation in Use. Elementary. Cambridge: CUP

9. Nambiar, K.C. 2011. Speaking Accurately. A Course in International Communication. New Delhi: Foundation

10. Soundararaj, Francis. 2012. Basics of Communication in English. New Delhi: Macmillan

11. Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.

12. A textbook of English Phonetics for Indian Students by T. Balasubramanian (Macmillan)

13. Lab Manual: A Manual entitled "English Language Communication Skills (ELCS) Lab Manual- cum- Work Book", published by Cengage Learning India Pvt. Ltd, New Delhi. 2013.

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

I Year B.Tech. EEE – II Sem	**L**	**T/P/D**	**C**
	0	**-/3/-**	**2**

COMPUTER PROGRAMMING – II LAB

Objectives:

- *To make the student to implement various sorting and searching techniques*

- *To introduce the student to structures, unions, and enumeration types and operations on them, create various types of files in 'C' Language.*
- *To introduce the student dynamic memory management using pointers, basic data structures such as stacks, queues and linked lists.*

Week 1:

Review of Arrays and functions.

Week 2:

Write programs to illustrate the implementation of Bubble Sort and Selection Sort

Week 3:

Write programs to illustrate the implementation of Insertion Sort and Quick Sort

Week 4:

Write programs to illustrate the implementation of Merge Sort.

Week 5:

Write programs to illustrate the implementation of Binary Search and Linear Search.

Week 6 & 7:

Write programs to illustrate the various concepts of structures

Week 8:

Write programs to illustrate the concepts of accessing variables using pointers

Week 9:

Write programs to illustrate the implementation of call by reference

Week 10:

Write programs to illustrate the implementation of arrays using pointers

Week 11:

Write programs to implement structures using pointers

Week 12:

Write program to illustrate the implementation of Single Linked List

Week 13:

Write programs to illustrate Stack operations using arrays and pointers

Week 14:

Write programs to illustrate Queue operations using arrays and pointers

Week 15:

Write programs to illustrate the various concepts of files.

Week 16:

Review

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

I Year B.Tech. EEE – II Sem	L	T/P/D	C
	0	-/3/-	3

ENGINEERING CHEMISTRY LAB

Objectives:

- *To impart fundamental knowledge in handling the equipment /glassware and chemicals in the chemistry laboratory.*
- *To offer hands on experience on the basic equipment related to engineering chemistry.*
- *For practical understanding of theoretical concepts of chemistry.*

(Any ten experiments out of the following fourteen experiments should be performed)
Titrimetry:

1. Fundamentals of volumetric analysis : (a) Determination of strength of an acid (HCl)
2. Estimation of ferrous iron by dichrometry
3. Estimation of hardness of water by EDTA method.
4. Determination of alkalinity of water.
5. Determination of free chlorine or chlorides in water.
6. Determination of iron by permanganometry.
7. Estimation of copper by colorimetric method.
8. Estimation of HCl by conductometry using standard NaOH solution.
9. Estimation of HCl by potentiometry using standard NaOH solution.
10. Determination of viscosity of sample oil by Redwood/Oswald's viscometer
11. Determination surface tension of lubricants.
12. Determination of the rate constant of acid catalyzed hydrolysis of methyl acetate .
13. Preparation of thiokol rubber and nylon 6,6.
14. Preparation of Biodiesel from Waste Vegetable Oil (WVO).

Outcomes:

- *As commences with fundamentals which indeed takes the individual students to be more conversant with apparatus and allied.*
- *Gets equipped with the technical importance of knowing the extent of hardness and consciousness of units and the adroitness and keep aware of some industrial determination techniques.*
- *Students gets augmented As commences with fundamentals which indeed takes the individual students to be more conversant with apparatus and allied .*

TEXT BOOKS:

1. Vogel's Textbook of Quantitative Chemical Analysis
2. Essentials of experimental engineering chemistry, Shashi Chawla, Dhanpat Rai & Co
3. Laboratory manual of engineering chemistry, S.K.Bhasin and Sudha Rani , Dhanpat Rai & Co.
4. A text book on experiments and calculations. S.S. Dara, S. Chand & Co

REFERENCE BOOKS:

1. Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications.

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I Year B.Tech. EEE – II Sem	L	T/P/D	C
	0	-/3/-	2

IT WORKSHOP

Objectives:

The IT Workshop for engineers is a training lab course spread over 40 hours. The modules include training on PC Hardware, Internet & World Wide Web and Productivity tools including Word, Excel, and Power Point.

PC Hardware introduces the students to a personal computer and its basic peripherals, the process of assembling a personal computer, installation of system software like MS Windows, Linux and the required device drivers. In addition hardware and software level troubleshooting process, tips and tricks would be covered. **The students should work on working PC to disassemble and assemble to working condition and install Windows and Linux on the same PC. Students are suggested to work similar tasks in the Laptop scenario wherever possible.**

Internet & World Wide Web module introduces the different ways of hooking the PC on to the internet from home and workplace and effectively usage of the internet. Usage of web browsers, email.

Productivity tools module would enable the students in crafting professional word documents, excel spread sheets and power point presentations. (**Recommended to use Microsoft office 2007 in place of MS Office 2003)**

PC Hardware

Exercise 1 – Task 1: Identify the peripherals of a computer, components in a System Cabinet and its functions. Draw the block diagram of the compute mother board along with the configuration of each peripheral and submit to your instructor.

Exercise 2 – Task 2 : Every student should disassemble and **assemble the PC back to working condition.** Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Exercise 3 – Task 3 : Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Exercise 4 – Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both windows and Linux. Lab instructors should verify the installation and follow it up with a Viva.

Internet & World Wide Web

Exercise 5 - Task 1 : **Orientation & Connectivity Boot Camp :** Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Exercise 6 - Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

MS Word

Exercise 7&8: The mentor needs to give an overview of Microsoft (MS) word 2007: Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word. Give a task covering to create project certificate. Features to be covered:-Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Inserting table, using Drawing toolbar in word.

MS Excel

Exercise 9&10: The mentor needs to tell the importance of MS office 2007 Excel as a Spreadsheet tool covering Accessing, overview of toolbars, saving excel files, Using help and resources., Also give a task that is covering the features like Gridlines, Format Cells, Summation, auto fill, Formatting Text.

MS Power Point

Exercise 11&12: Students will be working on MS power point which help them create basic power point presentation. Topic covered during this Exercise includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in Power point. Students will be given model power point presentation which needs to be replicated (exactly how it's asked).

REFERENCES:

1. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dream tech
2. The Complete Computer upgrade and repair book,3rd edition Cheryl A Schmidt, WILEY Dreamtech
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. PC Hardware and A+Handbook – Kate J. Chase PHI (Microsoft)
5. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.
6. IT Essentials PC Hardware and Software Labs and Study Guide Third Edition by Patrick Regan – CISCO Press, Pearson Education.

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B.Tech EEE II Year I-Semester

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4	1	0	4

MATHEMATICS IV

Objectives:

- *Series solutions for legendre and Bessel differential equations, analyzing the properties of legendre and Bessel polynomials.*
- *Evaluation of integrals using cahchy's integral formula and Taylor's series, maclaurin's series and laurent's series expansions of complex functions.*
- *Identify the transformations like transalations, magnification, roatation and reflection and inversion.*

UNIT-I: Fourier Transformations

Fourier integral theorem – Fourier sine and cosine integrals. Fourier transforms – Fourier sine and cosine transforms – properties –inverse transforms – Convolution theorem – Finite Fourier transforms.

UNIT-II: Functions of a complex variable

Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions – Milne – Thompson method. Elementary functions: Exponential, trigonometric, hyperbolic functions and their properties – General power Z (c is complex), principal value.

UNIT-III: Complex Integration and Complex Power series

Line integral – evaluation along a path and by indefinite integration – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula.Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series. Singular point –Isolated singular point – pole of order m – essential singularity.

UNIT-IV: Contour Integration

Residue – Evaluation of residue by formula and by Laurent series - Residue theorem.
Evaluation of integrals of the type

(a) Improper real integrals $\int_{-\infty}^{\infty} f(x)dx$ (b) $\int_{C}^{c+2\pi} f(\cos\theta, \sin\theta)d\theta$

(c) $\int_{-\infty}^{\infty} e^{imx} f(x)dx$ (d) Integrals by indentation.

UNIT-V: Conformal mapping

Transformation by $e^{Z}, \ln Z, Z^{2}, Z^{n}$ (n positive integer), Sin z, cos z, z + a/z. Translation, rotation, inversion and bilinear transformation – fixed point – cross ratio – properties – invariance of circles and cross ratio – determination of bilinear transformation mapping 3 given points .

Outcomes:

- *Apply the forbenius method to obtain a series solution for the given linear 2nd ODE.*

- *Identify Bessel equation and legendre equation and solve them under special conditions with the help of series solutions method.Also recurrence relations and orthogonality properties of Bessel and legendre Polynamials*
- *Analyze the complex functions with reference to their analyticity,integration using cauchy's integral theorm and taylor's and Laurent series expansion of complex functions.*

TEXT BOOKS:

1) Grewal B.S (2007), Higher Engineering Mathematics, 40th Edition, New Delhi, Khanna Publishers.
2) Schaum's outline series on Complex Anlysis.
3) S.R.K Iyengar text book of complex variables

REFERENCE BOOKS:

1) A text Book of Engineering Mathematics, C. Sankaraiah, V. G. S. Book Links.
2) A text Book of Engineering Mathematics, P. Nageshwara Rao, Y. Narasimhulu & N.Prabhakar Rao, Deepthi Publications.
3) A text Book of Engineering Mathematics, B. V. Raman, Tata Mc Graw Hill.
4) Advanced Engineering Mathematics, Irvin Kreyszig, Wiley India Pvt. Ltd.
5) A Text Book of Engineering Mathematics, Thamson Book Collection.
6) Mathematical Methods of Science and Engineering (Aided with Matlab) Kanti B.Datta (2012), Seventh Edition, CENGAGE Learning.

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SWITCHING THEORY AND LOGIC DESIGN

Objective:

- *To learn basic tools for the design of digital circuits and fundamental concepts.*
- *To understand number representation in digital electronic circuits.*
- *To design combinational and sequential logic circuits and implement synchronous state machines using flip-flops.*

UNIT I

Number Systems

Number systems, Base Conversion Methods, complement of numbers, Codes-binary codes, Binary coded decimal code and its properties, Unit distance codes, Alpha numeric codes, error detecting & correcting codes.

Boolean algebra: Basic theorems and properties - switching functions–Canonical and Standard forms-Algebraic simplification digital logic gates, properties of XOR gates –universal gates-Multilevel NAND/NOR realizations.

UNIT II

Design of Combinational Circuits

Introduction, The minimization with theorem, The karnaugh Map method, Five and six variable maps, Prime and essential implications, Don't care map entries, using the maps for simplifying, Tabular Method, Partially specified expressions, Multi-output minimization, minimization and combinational design, Arithmetic circuits, Comparator, Multiplexer, Code converters, Wired logic, Tristate bus system, Practical aspects related to combinational logic design, Hazards and hazard free realizations.

UNIT III

Sequential Machines

Introduction, Basic architectural distinctions between combinational and sequential circuits, The binary cell, Fundamentals of sequential machine operation, The flip-flop, The D-latch flip-flop, The "clocked T" flip-flop, "clocked J-K" flip-flop, Design of a clocked flip-flop, Conversion from one type of flip-flop to another, Timing and Triggering consideration, Clock skew.

UNIT IV

Sequential Circuit Design and Analysis

Introduction, State diagram**,** Analysis of synchronous sequential circuits, Approaches to the design of synchronous sequential finite state machines, Design aspects, State reduction, Design steps, Realization using flip-flop counters – Design of single mode counter, Ripple counter, Ring counter, Shift register, Shift register sequences, Ring counter using Shift register.

UNIT V

Sequential Circuits

Finite state machine-capabilities and limitations, Mealy and Moore models-minimization of completely specified and incompletely specified sequential machines, Partition techniques and Merger chart methods-concept of minimal cover table.

Algorithmic state machines**:** Salient features of the ASM chart-Simple examples-System design using data path and control subsystems-control implementations-examples of Weighing machine and Binary multiplier.

Outcomes:

After studying this course student gets knowledge on

- *Basic tools required for design of digital circuits.*
- *Number representation in digital electronic circuits.*
- *Design & application of combinational logic circuits and Implementation of sequential state machine using flip-flops.*

TEXTBOOKS

1. Switching & Finite Automata theory – Zvi Kohavi & Niraj K. Jha, 3rd Edition, Cambridge.
2. Digital Design – Morris Mano, PHI, 3rd Edition, 2006.

REFERENCES

1. An Engineering Approach To Digital Design – Fletcher, PHI. Digital Logic – Application and Design – John M. Yarbrough, Thomson.
2. Fundamentals of Logic Design – Charles H. Roth, Thomson Publications, 5th Edition, 2004.
3. Digital Logic Applications and Design – John M. Yarbrough, Thomson Publications, 2006.

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B.Tech EEE II Year I-Semester

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ELECTRONIC DEVICES AND CIRCUITS

Objectives:

- *To provide clear explanation about the operation of basic semiconductor devices available today.*
- *To show how each device and its characteristics is used in appropriate circuits*
- *Demonstration of Amplifier Design with different gain*.

UNIT I: P-N JUNCTION DIODE AND RECTIFIERS:

Quantative theory of P-N Junction, P-N Junction as Diode, Diode Equation, Volt-Ampere Characteristics, Temperature Dependence of VI Characteristic, Transition and Diffusion Capacitances, Diode Equivalent Circuits, Breakdown Mechanisms in Semi Conductor Diodes, Zener Diode Characteristics, Principle of Operation and Characteristics of Tunnel Diode, Schottky Barrier Diode.
The P-N Junction as a Rectifier, Half wave Rectifier, Full wave Rectifier, Bridge Rectifier, Harmonic Components in a Rectifier Circuit, Inductor Filters, Capacitor Filters, L-Section Filters, Π-Section Filters, Comparison of Filters, Voltage Regulation Using Zener Diode, SCR.

UNIT II: BIPOLAR JUNCTION TRANSISTOR AND FIELD EFFECT TRANSISTOR:
The Junction Transistor, Transistor Current Components, Transistor Construction, BJT Operation, BJT Symbol, Transistor as an Amplifier, Common Base, Common Emitter and Common Collector Configurations, Limits of Operation, BJT Specifications.
The Junction Field Effect Transistor (Construction, Principle of Operation, Symbol), Pinch –Off Voltage –Volt –Ampere Characteristics, The JFET Small Signal Model, MOSFET (Construction, Principle of Operation, Symbol) MOSFET Characteristics In Enhancement and Depletion Modes.

UNIT III: TRANSISTOR BIASING AND STABILIZATION:
Operating Point, The DC and AC Load Lines, Need For Biasing, Fixed Bias, Collector Feedback Bias, Emitter Feedback Bias, Collector Emitter Feedback Bias, Voltage Divider Bias, Bias Stability, Stabilization Factors, Stabilization Against Variation In V_{BE} and β,
Bias Compensation Using Diodes and Transistors. Thermal Runway, Thermal Stability, Biasing FET.

UNIT IV: BJT AND FET AMPLIFIERS:
BJT Hybrid Model, Determination of h-Parameters From Transistor Characteristics, Analysis of A Transistor Amplifier Circuit Using h-Parameters, Comparison of CB, CE And CC Amplifier Configurations.FET Common Source Amplifier, Common Drain Amplifier, Generalized FET Amplifier, FET, As Voltage Variable Resistor, Comparison of BJT And FET, The Uni Junction Transistor.

UNIT V: FEED BACK AMPLIFIERS:
Concepts of feedback. Claffication of feedback amplifiers, General characteristics of negative feedback amplifiers, Effect of Feedback on Amplifier characteristics, Simple problems.

Outcomes:

- *Concepts of physical electronics particularly solid state devices and its conductivity.*
- *Operation of PN-junction diode, zener diode and other diodes and interpret its characteristics and Construction of different rectifier circuits with and without filters.*

- *Ability to draw characteristics of a transistor in various configurations and interpret its usages in different regions, bias-curve which are used to establish the quiescent operating conditions in a different amplifier circuits*

TEXT BOOKS:

1. Millman's Electronic Devices and Circuits – J. Millman, C.C.Halkias, and Satyabrata Jit Tata McGraw Hill, 2nd Ed., 2007.
2. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall,9th Edition,2006.
3. Introduction to Electronic Devices and Circuits- Rober T. Paynter PE.
4. Electronics Devices and Circuits – A. P. Godse Technical Publications.

REFERENCE BOOKS:

1. Electronic Devices and Circuits – T.F. Bogart Jr., J.S.Beasley and G.Rico, Pearson Education, 6th edition, 2004.
2. Principles of Electronic Circuits – S.G.Burns and P.R.Bond, Galgotia Publications, 2nd Edn.., 1998.
3. Microelectronics – Millman and Grabel, Tata McGraw Hill, 1988.
4. Electronic Devices and Circuits – Dr. K. Lal Kishore, B.S.

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NETWORK THEORY

***Objective*:**

- *Understand network devices functions and configurations hub, switches, tap and routes.*
- *Understand network security devices and analyze network services.*
- *Understand network troubleshooting concepts and network security concepts.*

UNIT –I
Network Topology
Definitions - Graph - Tree, Basic cut-set and Basic Tie-set matrices for planar networks - Duality & Dual networks.
Three Phase Circuits: Phase sequence- Star and delta connection-Relation between line and phase voltages and currents in balanced systems- Analysis of balanced and unbalanced three phase circuits-Measurement of active and reactive power.

UNIT-II
D.C and A.C Transient Analysis
Transient response of R-L, R-C, R-L-C circuits (series and parallel) for D.C excitation- Initial conditions- Solution method using differential equation and Laplace transforms . Transient response of R-L, R-C, R-L-C circuits (series only) for sinusoidal excitation- Initial conditions- Solution method using differential equation and Laplace transforms .

UNIT-III
Network Functions
The concept of complex frequency, Physical interpretation of complex frequency, Transform impedance and Transform circuits, Series and Parallel combination of elements, Terminal pairs or ports, Network functions for the one port and two port, poles and zeros of network functions, Significance of poles and zeros, Properties of driving point functions, Properties of transfer functions, Necessary conditions for driving point function, Necessary conditions for transfer functions, Time domain response from pole zero plot.

UNIT-IV
Network Parameters
Two port network parameters- Z, Y, A, B, C, D and Hybrid parameters and their relations. Cascaded networks, Concept of transformed network- Two port network parameters using transformed variables.

UNIT-V
Filters and Fourier Analysis of A.C Circuits
Low pass, High pass, Band pass, Band Elimination, Prototype filter design. The Fourier theorem, Fourier series consideration of symmetry, exponential form of Fourier series.

Outcomes: *After going through this course the student can able to understand*

- *Independently understand the concepts of packet capturing and it works.*
- *Independently install and configure network device for network monitoring tasks.*

- *Independently carryout network security tasks at any small, medium of enterprise networks.*

TEXT BOOKS:

1. Electric circuits - *A.Chakrabarthy*, Dhanpat Rai & Sons,2006.
2. Circuits & Networks - *A.Sudhakar and Shyammohan S.Palli*, Tata McGraw Hill, 2012.
3. Introductory circuit analysis Robert L. Boylested Peasan 12th edition 2011.
4. A course in Electrical circuit analysis M.C.Soni.

REFERENCE BOOKS:

1. Electric Circuit analysis - *B.Subrahmanyam*, I.K International
2. Network analysis - *Mahmood Nahvi, Joseph Edminister*, *Schaum's Outlines*, 4th edition, McGraw-Hill Companies,Incorporated, 2003.
3. Network Analysis - *M.E Van Valkenberg.* Prentice-Hall, 1974.
4. Electric circuit analysis - *C.L.Wadhwa*, New Age International, 2006.
5. Electrical circuits theory-*K.Rajeswaran,* Pearson Education, 2004.
6. Basic circuits analysis - *D.R Cunningham. & J.A. Stuller*, Jaico Publications, 1993.

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ELECTRO MAGNETIC FIELDS

Objective:

- *To introduce the concepts of electric field, magnetic field.*
- *Applications of electric and magnetic fields in the development of the theory for power transmission lines and electrical machines.*
- *Ability to introduce and time varying fields.*

UNIT – I

Electrostatics

Sources and effects of electromagnetic fields – Vector fields – Different co-ordinate systems – Electrostatic Fields – Coulomb's Law – Electric Field Intensity (EFI) – EFI due to a line and a surface charge – Work done in moving a point charge in an electrostatic field – Electric Potential– Properties of potential function – Potential gradient – Guass's law – Application of Guass's Law – Maxwell's first law. Laplace's and Poison's equations – Solution of Laplace's equation in one variable.

UNIT – II

Conductors, Dielectric & Capacitance

Electric dipole – Dipole moment – potential and EFI due to an electric dipole and Torque – Behaviour of conductors in an electric field – Conductors and Insulators.

Electric field inside a dielectric material – polarization – Dielectric – Conductor and Dielectric – Dielectric boundary conditions, Capacitance – Capacitance of parallel plate and spherical and co-axial capacitors with composite dielectrics – Energy stored and energy density in a static electric field – Current density – conduction and Convection current densities – Ohm's law in point form – Equation of continuity.

UNIT – III

Magneto Statics, Ampere's circuital law

Static magnetic fields – Biot-Savart's law – Oesterd's experiment - Magnetic field intensity (MFI) – MFI due to a straight current carrying filament – MFI due to circular, square and solenoid current – Carrying wire – Relation between magnetic flux, magnetic flux density and MFI – Maxwell's second Equation. Ampere's circuital law and its applications viz. MFI due to an infinite sheet of current and a long current carrying filament – Point form of Ampere's circuital law – Maxwell's third equation, Field due to a circular, rectangular and square loops.

UNIT –IV

Force in Magnetic fields, Magnetic Potential

Magnetic force - Moving charges in a Magnetic field – Lorentz force equation – force on a current element in a magnetic field – Force on a straight and a long current carrying conductor in a magnetic field – Force between two straight long and parallel current carrying conductors – Magnetic dipole and dipole moment – a differential current loop as a magnetic dipole – Torque on a current loop placed in a magnetic field. Scalar Magnetic potential and its limitations – vector magnetic potential and its properties – vector magnetic potential due to simple configurations – vector Poisson's equations.

UNIT – V

Inductance, Time Varying Fields

Self and Mutual inductance – Neumans's formulae – determination of self-inductance of a solenoid and toroid and mutual inductance between a straight long wire and a square loop wire in the same plane – energy stored and density in a magnetic field. Introduction to permanent magnets, their characteristics and applications.

Time varying fields – Faraday's laws of electromagnetic induction – Its integral and point forms – Maxwell's fourth equation – Statically and Dynamically induced EMFs – Simple problems - Modification of Maxwell's equations for time varying fields – Displacement current – Poynting Theorem and Poynting vector.

Outcomes:

After going through this course the student can able to understand

- *Ability to apply vector mathematics and physics to calculate parameters electromagnetic problems, Properties and behavior of conductors, dielectrics & capacitance.*
- *Magneto statics and Physical laws of electro magnetism, Force in magnetic fields, Magnetic potential and its properties.*
- *Calculation of inductance, Basic concepts on time varying fields in point form and Integral form.*

TEXT BOOKS:

1. Engineering Electromagnetics - *William H. Hayt & John. A. Buck* McGraw Hill Companies, 8th Editon, 2014.
2. Electromagnetic Fields - *Sadiku*, Oxford Publications, 8th edition, 2007.

REFERENCE BOOKS:

1. Introduction to Electro Dynamics - *D J Griffiths*, Prentice-Hall of India Pvt. Ltd, 4th edition, 2012.
2. Electromagnetic - *J P Tewari*, Khanna Publishers, 2nd edition, 2005.
3. Electromagnetics - *J. D Kraus,* McGraw Hill Inc, 6thedition 2012.
4. Electromagnetic fields - *S. Kamakshaiah*, Right Publishers, 2007.

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ELECTRICAL MACHINES - I

Objective:

- *This course deals the construction of DC machine different types of DC generator, characteristics and applications.*
- *This course provides principle, characteristics and applications of DC motor*
- *This course analyze various losses, testing of DC machines.*

UNIT – I
Operation & Construction of D.C. Generators
D.C. Generators – Principle of operation – Action of commutator – constructional features – classification of DC generators – separately excited and self excited generators – E.M.F. Equation – Applications of DC Generators.

UNIT – II
Armature windings
Armature windings – lap and wave windings – simplex and multiplex windings – use of laminated armature –— Armature reaction – cross magnetizing and demagnetizing AT/pole – compensating winding – commutation – reactance voltage – methods of improving commutation.

UNIT –III
Operating Characteristics of D.C. Generators
Build up of EMF – magnetization curve/OCC Characteristics – critical field resistance and critical speed – causes for failure of self excitation – remedial measures – load characteristics of d.c shunt, series and compound generators – parallel operation of d.c series generators – use of equalizer bar and cross connection of field windings – load sharing.

UNIT – IV
D.C. Motors
D.C Motors – Principle of operation – Back E.M.F. - Torque equation – characteristics and applications of shunt, series and compound motors – Armature reaction and commutation – speed control of D.C. Motors: armature voltage and field flux control methods – Ward-Leonard system.
Principle of operation of 3 point and 4 point starters with protective devices.

UNIT – V
Testing of D.C. Machines
Testing of D.C. machines: Losses – Constant & Variable losses – calculation of efficiency – condition for maximum efficiency
Methods of Testing – direct, indirect and regenerative testing – brake test – Swinburne's test – Hopkinson's test – Field's test – Retardation test – separation of stray losses in a D.C. motor test.

Outcomes:

After going through this course the student can able to understand

- *Construction of D.C machine, different types of DC generators, characteristics and industrial applications,*

- *The principle of DC motor, electrical characteristics and industrial application.*
- *Various losses, different tests in DC machines.*

TEXT BOOKS

1. Electric Machinery- *P.S. Bimbra*, Khanna Publishers, 7th edition, 2010,
2. Theory and performance of Electrical machines – *J.B Gupta*, S.K Kataria & Sons publishers, 2009.

REFERENCE BOOKS

1. Electrical Machines – *S.K. Bhatta Charya*, McGraw Hill Companies, 2007.
2. Electrical Machines - *I.J. Nagrath & Kothari*, McGraw Hill Companies, 3rd edition, 2004.
3. Electric Machines – *M.V. Deeshpande*, Wheeler Publishing, 1997.
4. Electrical machinery - *A.E. Fritzgerald C. Kingsley and S. Umans*, McGraw Hill Companies, 5th edition, 2010.
5. A Text book of Electrical Technology – B.L. Thereja and A.K. Theraja, S. Chand Publications, Vol2 eprint 2015.

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ELECTRICAL CIRCUITS LAB

Objective:

- *To understand concept of circuit laws.*
- *To solve the electrical networks using mesh and nodal analysis by applying network theorems.*
- *To understand the concepts of resonance, locus diagrams.*

Any TEN Experiments are to be conducted.

1) Verification of Kirchhoff's current law and Kirchhoff's Voltage law.
2) Verification of Thevenin's, Norton's and Maximum Power Transfer Theorems.
3) Verification of Superposition theorem.
4) Verification of Compensation Theorem.
5) Verification of Reciprocity and Millmann's Theorems.
6) Time response of first order RL/RC network for periodic non-sinusoidal inputs-time constant and steady state error determination.
7) Series and Parallel Resonance.
8) Determination of Self, Mutual Inductances and Coefficient of coupling.
9) Verification of Z and Y Parameters.
10) Transmission and hybrid parameters.
11) Measurement of Active Power for Star and Delta connected balanced loads.
12) Measurement of Reactive Power for Star and Delta connected balanced loads.
13) Measurement of 3-phase Power by two wattmeter method for unbalanced loads.
14) Locus Diagrams of RL and RC Series Circuits.

Outcomes:

After going through this course the student can able to understand

- *Use basic laboratory equipment and technology to measure electrical quantities using laboratory test equipment.*
- *Able to explain the concept of circuit laws and network theorems.*
- *Able to explain the concept of resonance, locus diagram.*

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ELECTRONIC DEVICES AND CIRCUITS LAB

PART A: (Only for Viva-voce Examination)

ELECTRONIC WORKSHOP PRACTICE (in 3 lab sessions):

1. Identification, Specifications, Testing of R, L, C, Components (Color Codes), Potentiometers, Switches (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays, Bread Boards, PCB's.

2. Identification, Specification and Testing of Active Devices, Diodes, BJT's LOW power JFET's, MOSFET's, Power Transistors, LED's, SCR, UJT.

3. Study and operation of

- Multi-meters (Analog and Digital**)**
- Regulated Power Supplies
- Function Generator
- CRO

PART B (For Laboratory Examination – Minimum of 10 experiments)

1. Forward & Reverse Bias Characteristics of PN Diode.

2. Zener diode characteristics and Zener as voltage Regulator.

3. Half Wave Rectifier with & without filters.

4. Full Wave Rectifier with & without filters

5. Input &output characteristics of Transistor in CB Configuration.

6. Input &output Characteristics of Transistor in CE Configuration.

7. FET characteristics.

8. Measurement of h- parameters of transistor in CB, CE, CC configurations

9. Frequency Response of CC Amplifier.

10. Frequency Response of CE Amplifier.

11. Frequency Response of FET Amplifier (Common source).

12. SCR Characteristics

13. UJT Characteristics.

PART C: Equipment required for laboratories:

1. Regulated power supplies (RPS)

2. CRO's : 0-20MHZ

3. Function Generator : 0-1 MHZ

4. Multimeters

5. Decade Resistance Boxes / Rheostats

6. Decade Capacitance Boxes

7. Ammeters (Analog or Digital) : 0-20μA, 0-50μA, 0-100μA, 0-200μA,0-10 mA

8. Voltmeters (Analog or Digital) : 0-50V,0-100V, 0-250V

9. Electronic Components : Resistors, Capacitors, BJTs, LCDs, SCRs, UJTs, FETs, LEDs, MOSFETs, diodes Ge & Si type, Transistors NPN, PNP type

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GENDER SENSITIZATION

(An Activity-based Course)

Objectives:

- *To develop students sensibility with regard to issues of gender in contemporary India.*
- *To provide a critical perspective on the socialization of men and women.*
- *To introduce students to information about some key biological aspects of genders.*

Unit-I:

UNDERSTANDING GENDER:

Gender: Why Should We Study It? *(Towards a World of Equals: Unit-*1*)*

Socialization: Making Women, Making Men *(Towards a World of Equals: Unit-*12*)*

Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

Just Relationships: Being Together as Equals *(Towards a World of Equals: Unit-*12*)*

Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Further Reading: Rosa Parks-The Brave Heart.

Unit-II:

GENDER AND BIOLOGY:

Missing Women: Sex Selection and Its Consequences *(Towards a World of Equals: Unit-4)*

Declining Sex Ratio. Demographic Consequences.

Gender Spectrum: Beyond the Binary *(Towards a World of Equals: Unit-*10*)*

Two or Many? Struggles with Discrimination.

Additional Reading: Our Bodies, Our Health *(Towards a World of Equals: Unit-*13*)*

Unit-III:

GENDER AND LABOUR:

Housework: The Invisible Labour *(Towards a World of Equals: Unit-*3*)*

"My Mother doesn't Work." "Share the Load."

Women's Work: Its Politics and Economy *(Towards a World of Equals: Unit-*7*)*

Facts and Fiction. Unrecognized and Unaccounted work. Further Reading: Wages and Conditions of Work.

Unit-IV:

ISSUES OF VIOLENCE:

Sexual Harassments: Say No! *(Towards a World of Equals: Unit-*6*)*

Sexual Harassments, not Eve-teasing-Coping with Everyday Harassment-Further Reading:"Chupulu".

Domestic Violence: Speaking Out *(Towards a World of Equals: Unit-*8*)*

Is Home a safe Place? –When Women Unite [Film]. Rebuilding Lives. Further Reading: New Forums for Justice.

Thinking about Sexual Violence *(Towards a World of Equals: Unit-*11*)*

Blaming the Victim."I Fought for my life....."- Further Reading: The Caste Face of Violence.

Unit-V:

GENDER STUDIES:

Knowledge: Through the Lens of Gender *(Towards a World of Equals: Unit-5)*

Point of View. Gender and the Structure of Knowledge. Further Reading: Unacknowledged Women Artists of Telangana.

Whose History? Questions for Historians and others *(Towards a World of Equals: Unit-9)*

Reclaiming a Past. Writing other Histories. Further Reading: Missing Pages from Modern Telangana History.

Essential Reading: All the Units in the Textbook." *Towards a World of Equals: A Bilingual Textbook on Gender"* written by A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu.

Note: Since it is Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field.

Outcomes:

- *Students will have developed a better understanding of important issues related to gender in contemporary India.*
- *Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.*
- *Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.*

REFERENCE BOOKS:

1. Sen, Amartya. "More than One Million Women are Missing." New York Review of Books 37.20 (20 December 1990). Print. 'We Were Making History...' Life Stories of Women in the Telangana People's Struggle. New Delhi: Kali for Women, 1989.
2. Tripti Lahiri."By the Numbers: Where Indian Women Work," Women's Studies Journal (14 December 2012) Available online at: http:// blogs.wsj.com/ India real time/2012/11/14/by-the-numbers-where-Indan-women-work/**>**
3. K. Satyanarayana and Susie Tharu (Ed.) Steel Nibs Are Sprouting: New Dalit Writing From South India, Dossier 2: Telugu And Kannada http://http://harpercollins.co.in/BookDetail.asp?Book Code=3732
4. Vimala. "Vantillu (The Kitchen)." Women Writting in India: 600 BC to the Present. Volume II: The 20th Centuary. Ed. Susie Tharu and K. Lalita. Delhi: Oxford University Press,1995. 599-601.
5. Shatrughna, Veena et al. Women's Work and its Impact on Child Health and Nutrition,Hyderabad, National Institute of Nutrition, Indian Council of Medical Research. 1993.

6. Stree Shakti Sanghatana. "*We Were Making History* ....'Life Stories of Women in the Telangana People's Struggle. New Delhi: Kali for Women,1989.
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12. Jeganathan Pradeep, Partha Chatterjee (Ed). "Community, Gender and Violence Subaltern Studies XI". Permanant Black and Ravi Dayal Publishers, New Delhi,2000
13. K.Kapdia. The Violence of Development: The Politics of Identity, Gender and Social Ineualities in India. London: Zed Books, 2002
14. S. Benhabib. Situating the Self: Gender, Community, and Postmodernism in Contemporary Ethics, London: Routledge, 1992
15. Virginia Woolf. A Room of One's Own. Oxford: Black Swan. 1992.
16. T.Banuri and M. Mahmood, Just Development: Beyond Adjustment with a Human Face, Karachi: Oxford University Press, 1997

ANURAG ENGINEERING COLLEGE

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B.Tech EEE II Year II-Semester

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3	1	0	3

ELECTRONIC CIRCUITS

Objectives:

- *To provide clear explanation about the operation of transistor parameters and the operation of multi-vibrators to generates different waveforms.*
- *To show how each device and its characteristics used in appropriate circuits*
- *Demonstration of Amplifier Design with different gain & Oscillator circuits with different frequency operation.*

UNIT-1: SINGLE STAGE AMPLIFIERS DESIGN AND ANALYSIS:

Review of CE, CB, CC& CS amplifiers-Classification of Amplifiers, Distortion in amplifiers-exact and approximate analysis, CE, CB, CC amplifiers comparison.

BJT& FET Frequency response: Low frequency analysis-Low frequency response of BJT amplifiers-Low frequency response of FET amplifier-Miller effect capacitance-High frequency response of BJT amplifier-Square wave testing

UNIT II: OSCILLATORS:

Condition for oscillations. RC and LC type oscillators, Crystal oscillators, Frequency and amplitude stability of oscillators, Generalized analysis of LC oscillators, Quartz (Hartley, Colpitts), RC-phase shift and Wien-bridge oscillators.

UNIT III: LARGE SIGNAL AMPLIFIERS:

Class –A Power Amplifier, Maximum Value of Efficiency of Class-A Amplifier, Transformer coupled amplifier- Push Pull Amplifier-Complimentary Symmetry Circuits (Transformer Less Class B Power Amplifier)-Phase Inverters, Transistor Power Dissipation, Thermal Runway, Heat sinks.

UNIT IV: CLIPPERS AND CLAMPERS:

Diode clippers, Transistor clippers, clipping at two independent levels, Transfer characteristics of clippers, Emitter coupled clipper, Comparators, applications of voltage comparators, clamping operation, clamping circuits using diode with different inputs, Clamping circuit theorem, practical clamping circuits, effect of diode characteristics on clamping voltage, Transfer characteristics of clampers.

UNIT V: SWITCHING CHARACTERISTICS OF DEVICES

Diode as a switch, piecewise linear diode characteristics, Transistor as a switch, Break down voltage consideration of transistor, saturation parameters of Transistor and their variation with temperature, Design of transistor switch, transistor-switching times.

Multivibrators: Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using transistors, applications.

Outcomes:

- *Ability to find out the different parameters of the transistor.*
- *Design specifications and circuit construction for Amplifiers & Oscillators, specifications and circuit construction for Clippers& Clampers.*
- *Ability to find out the different parameters of the power amplifiers and to design different types of multi-vibrators*.

TEXT BOOKS:

1. Electronic Devices and Circuit Theory, Robert L.Boylestad, Louis Nasheisky, 9th Edition 2007, Pearson Education
2. Electronic Devices and Circuits by S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, 2nd edition 2008, Tata McGraw Hill Companies.
3. Solid State Pulse Circuits by David A. Bell, 4th Edition, Prentice Hall of India

REFERENCE BOOKS:

1. Introductory Electronic Devices and Circuits (Conventional flow version) – Robert T. Paynter, 7th Edition, 2009, PEI.
2. Electronic Devices and Circutits, Anil K. Maini, Varsha Agrawal, 1st Edition, WILEY.
3. Pulse, Digital & Switching Waveforms by Jacob Milliman, Harbert Taub and Mothiki S Prakash rao, 2nd edition 2008, Tata McGraw Hill Companies.

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MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Objective:

- *To explain the basic principles of managerial economics, financial accounting.*
- *To understand current business environment underlying business decision making.*
- *To understand principles of accounting and prepare Journal, Ledger, Trial Balance and analyze, interpret & comment on the financial statements of a business enterprise by using ratios*.

UNIT – I: INTRODUCTION TO MANAGERIAL ECONOMICS

Definition, Nature and scope of Managerial Economics, Demand Analysis- Demand Determinants, Law of Demand and its exceptions. Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Methods of Demand Forecasting (Survey Methods, Statistical Methods, Expert Opinion Method, Test Marketing, Controlled Experiments, Judgmental Approach to Demand Forecasting)

UNIT – II: THEORY OF PRODUCTION AND COST ANALYSIS

Production Function – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Laws of Returns, Internal and External Economics of Scale.

Cost Analysis: Cost concepts, Opportunity Cost, Out of Pocket Costs vs. Imputed Costs. Breakeven Analysis (BEA) – Determination of Breakeven Point (simple problems), Managerial Significance and limitations of BEA.

UNIT – III: MARKET STRUCTURES& PRICING POLICIES

Market structures: Types of Competition, Features of Perfect Competition, Monopoly and Monopolistic Competition, Price - Output determination in Perfect Competition and monopoly.

Objectives and Policies of Pricing: Objectives of pricing**,** Methods of Pricing - Cost Plus Pricing, Marginal Cost Pricing, Sealed Bid Pricing, Going Rate Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing, Two - Part Pricing, Block Pricing, Peak Load Pricing, Cross Subsidization.

UNIT – IV: CAPITAL AND CAPITAL BUDGETING

Capital and its significance, Types of Capital, Estimation of Fixed and Working Capital requirements. Nature and scope of Capital Budgeting, features of Capital budgeting proposals, Methods of Capital Budgeting- Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method, Profitability Index, Internal Rate of Return (simple problems).

UNIT – V: INTRODUCTION TO FINANCIAL ACCOUNTING

Accounting, Double-Entry Book Keeping, Journal, Ledger, and Trial Balance, Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).

Financial Analysis through ratios: Computation, Analysis and Interpretation of Liquidity Ratios (Current Ratio and Quick Ratio), Activity Ratios (Inventory Turnover Ratio and Debtor Turnover Ratio), Capital Structure Ratios (Debt – Equity, Interest Coverage Ratio), and Profitability Ratios (Gross Profit Ratio, Net Profit Ratio, Operating Profit Ratio, P/E Ratio and EPS).

Outcomes:

- *By the end of this course the students will be able to assess the costs useful for managerial decision making and determine Break Even Point (BEP) of an enterprise.*
- *Able to process & principles of accounting and prepare Journal, Ledger, Trial Balance and analyze,*
- *Able to interpret & comment on the financial statements of a business enterprise by using ratios*.

TEXT BOOKS:

1. Aryasri, Managerial Economics and Financial Analysis, TMH, 2012.
2. Varshney & Maheshwari, Managerial Economics, Sultan Chand & Sons, 2014.
3. S.A. Siddiqui and A.S. Siddiqui, Managerial Economics and Financial Analysis, New Age International Publishers, Hyderabad, 2013

REFERENCES:

1. Raghunatha Reddy & Narasimhachary, Managerial Economics & Financial Analysis, Scitech, 2009.
2. V. Rajasekarn & R. Lalitha, Financial Accounting, Pearson Education, New Delhi, 2010.
3. Domnick Salvatore, Managerial Economics in a Global Economy, 4th Edition, Cengage, 2009.
4. Subhash Sharma & M. P. Vittal, Financial Accounting for Management, Text & Cases, Machmillan, 2012.
5. S. N. Maheshwari & S. K. Maheshwari, Financial Accounting, Vikas 2012.
6. Truet and Truet, Managerial Economics; Analysis, Problems and Cases, Wiley, 2012.
7. Dwivedi, Managerial Economics, Vikas 2012.
8. M. Kasi Reddy and S.Saraswathi, Managerial Economics and Financial Accounting, PHI, 2012.
9. Erich A. Helfert, Techniques of Financial Analysis, Jalco, 2007.

Codes / **Tables**: Present Value Tables need to be permitted into the Examination Hall

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POWER SYSTEMS - I

Objectives: *Objectives of this course are*

- *To introduce the concepts and phenomenon of different sources of power generation..*
- *To given an idea about fundamental concepts of power distribution and different substations.*
- *To familiarize with the tariff methods for electrical energy consumption and economic aspects of power generation.*

UNIT-I : Thermal & Nuclear Power Stations

Thermal Power Station: Line diagram of Thermal Power Station (TPS) showing paths of coal, steam, water, air, ash and flue gasses.- Brief description of TPS components: Economizers, Boilers, Super heaters, Turbines, Condensers, Chimney and Cooling towers

Nuclear Power Stations: Nuclear Fission and Chain reaction - Nuclear fuels - Principle of operation of Nuclear reactor.-Reactor Components: Moderators, Control rods, Reflectors and Coolants - Radiation hazards: Shielding and Safety precautions.- Types of Nuclear reactors and brief description of PWR, BWR and FBR.

UNIT-II: Hydroelectric & Gas Power Stations

Hydroelectric Power Stations: Classification of turbines - impulse and reaction turbines, Elements of hydro electric power station- types –concept of pumped storage plants-storage requirements, mass curve (explanation only) estimation of power developed from a given catchment area, heads and efficiencies

Gas Power Stations: Principle of Operation and Components (Block Diagram approach only).

UNIT-III: Substations & Gas Insulated Substations (GIS)

Classification of substations: Indoor & Outdoor substations: Substations layout showing the location of all the substation equipment. Bus bar arrangements in the Sub-Stations: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams.

Gas Insulated Substations: Advantages of Gas insulated substations, different types of gas insulated substations, single line diagram of gas insulated substations, busbar, construction aspects of GIS, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations.

UNIT-IV: General Aspects of D.C. & A.C. Distribution Systems:

Classification of Distribution Systems - Comparison of DC vs. AC and Under-Ground vs. Over - Head Distribution Systems- Requirements and Design features of Distribution Systems.

D.C. Distribution Systems: Voltage, Drop Calculations (Numerical Problems in D.C Distributors for the following cases: Radial D.C Distributor fed one end and at the both the ends (equal/unequal voltages) and Ring Main Distributor.

A.C. Distribution Systems: Voltage Drop Calculations (Numerical Problems) in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

UNIT-V: **Economic Aspects of Power Generation & Tariff Methods**

Load curve, load duration and integrated load duration curves-load, demand, diversity, capacity, utilization and plant use factors- Numerical Problems.

Tariff Methods: Costs of Generation and their division into Fixed, Semi-fixed and Running Costs. Desirable Characteristics of a Tariff Method-Tariff Methods: Flat Rate, Block- Rate, two-part, three-part, and power factor tariff methods and Numerical Problems.

Outcomes:

After going through this course the students can able to understand

- *How the electrical power will be generated from different sources.*
- *Layout of substations, their Equipments and distribution systems.*
- *The economical aspects of power generation and different types of tariffs.*

TEXT BOOKS:

1. Principles of Power Systems by V.K Mehta and Rohit Mehta S.Chand Company Pvt. Ltd, New Delhi 2004.
2. Power System Engineering – M.L. Soni, P.V. Gupta, Dhanpat Rai & Co 2010.

REFERENCE BOOKS:

1. A Text book of Power system Engineering, R.K. Rajput, Laxmi Publications (P) Limited 2nd edition 2015.
2. Electrical Power Generation, Transmission and Distribution, S.N.Singh, PHI.
3. Electrical Power Systems by C.L.Wadhawa, New Age International (P) Limited, Publishers 6th edition, 2010.
4. Generation of Electrical Energy, Dr. B.R. Gupta, S. Chand 14th edition, 2011.
5. Electrical Power Systems, P.S.R. Murty, BS Publications.

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CONTROL SYSTEMS

Objectives:

- *To introduce the principles and applications of control systems in everyday life.*
- *To introduce the basic concepts of block diagram reduction, time domain analysis solutions to time invariant systems.*
- *To understand different aspects of stability analysis of systems in frequency domain and time domain.*

UNIT – I

Introduction: Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer functions – Translational and Rotational mechanical systems and electrical systems.

Transfer Function Representation: Transfer Function of DC Servo motor – AC Servo motor-Synchro transmitter and Receiver, Block diagram representation of systems considering electrical systems as examples -Block diagram algebra – Representation by Signal flow graph - Reduction uses Mason's gain formula.

UNIT-II

Time Response Analysis: Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional- integral systems.

UNIT –III

Stability Analysis: The concept of stability – Routh's stability criterion and its limitations. Qualitative stability and conditional stability.

Root Locus Technique: The root locus concept - construction of root loci-effects of adding poles and zeros to G(s) H(s) on the root loci.

Frequency Response Analysis: Introduction, Frequency domain specifications, Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin- Stability Analysis from Bode Plots.

UNIT – IV

Stability Analysis in Frequency Domain: Polar Plots, Nyquist Plots and applications of Nyquist criterion to find the stability - Effects of adding poles and zeros to G(s)H(s) on the shape of the Nyquist diagrams.

Classical Control Design Techniques: Compensation techniques – Lag, Lead and Lead-Lag Controllers design in frequency Domain, PID Controllers.

UNIT – V

State Space Analysis of Continuous Systems

Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization - Solving the Time invariant state Equations- State Transition Matrix and its Properties.

Outcomes:

After going through this course the student can able to understand

- *The basic concepts and applications of control systems in day to day life.*
- *The transfer function analysis in mathematical modeling of control system which helps mainly in stability and designing of control systems.*
- *Express and solve system equations in state variable form.*

TEXT BOOKS:

1. Control Systems Engineering – *I.J.Nagrath and M.Gopal*, New Age International(P) Limited, Publishers, 4th edition.
2. Control Systems – Nagoorkani, RBA Publications 3rd edition,2015.

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REFERENCE BOOKS:

1. Modern Control Engineering –*Katsuhiko Ogata* – Prentice Hall of India Pvt. Ltd., 3rd Edition, 1998.
2. Control Systems-*N.K.Sinha*, New Age International (P) Limited Publishers, 3rd Edition,1998.
3. Control Systems Engg. -– *John wiley,* NISE, 4rd edition, 2007.
4. Automatic Control Systems - *B. C. Kuo*, John wiley and son's*.,* 8th edition, 2003.

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ELECTRICAL MACHINES – II

Objective:

- *To deal with the detailed analysis of Single & Three Phase Transformers & induction motors and analysis Three Phase Induction Motors.*
- *To deal with the detailed analysis Single Phase Induction Machines and their applications.*
- *To introduce the concept of parallel operation of Transformers*.

UNIT-I

Single phase transformers

Types - constructional details- minimization of hysteresis and eddy current losses-emf equation - operation on no load and on load - phasor diagrams. Equivalent circuit - losses and efficiency-regulation. All day efficiency - effect of variations of frequency & supply voltage on iron losses.
Performance of transformers: OC and SC tests - Sumpner's test - predetermination of efficiency and regulation-separation of losses test, Parallel operation with equal and unequal voltage ratios.

UNIT II

Auto Transformers & Three phase Transformers

Auto transformers-equivalent circuit - comparison with two winding transformers.
Three phase Transformers: Poly-phase connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ, Third harmonics in phase voltages-three winding transformers-tertiary windings. Determination of Zp, Zs and Zt transients in switching - off load and on load tap changing; Scott connection.

UNIT III

Three Phase Induction Motors

Construction details of cage and wound rotor machines-production of a rotating magnetic field - principle of operation - rotor emf and rotor frequency - rotor reactance, rotor current and pf. at standstill and during operation. Rotor power input, rotor copper loss and mechanical power developed and their inter relation-torque equation-deduction from torque equation - expressions for maximum torque and starting torque - torque slip characteristic - double cage and deep bar rotors - equivalent circuit - phasor diagram - crawling and cogging.

UNIT IV

Performance of Three Phase Induction Motors

Circle diagram-no load and blocked rotor tests-predetermination of performance. Methods of starting, starting current and torque calculations of Induction Motors. Speed control-change of frequency- change of poles and methods of consequent poles; cascade connection, injection of an emf into rotor circuit (qualitative treatment only)-induction generator-principle of operation.

UNIT V

Single Phase Induction Machines:

Single phase Induction motor – Constructional features- Cross field theory, Double revolving field theory Equivalent circuit- spilt –Phase motors- Capacitor start Capacitor run motors.
Single phase Induction generator – principle & operation – characteristics – Applications.

Outcomes:

After going through this course the student can be able to understand

- *Construction, working principle, operating characteristics of single phase and 3 phase transformers. Able to solve the problems about regulation, efficiency, sharing of load in parallel operation.*
- *construction, working principle, speed torque characteristics, able to solve the problems, with different types of motors for efficiency, torque, speed control methods and their industrial applications*.
- *Upon completing the course, student should be able to understand double field theory, construction of single phase induction machines and their characteristics and industrial applications.*

TEXT BOOKS:

1. Electric Machinery- *P.S. Bimbra*, Khanna Publishers, 7th edition, 2010.
2. Theory and Performance of Electrical Machines - *JB Gupta*, SK Kataria & lSons, 2009.

REFERENCE BOOKS:

1. Performance and Design of AC Machines - *MG.Say*, BPB Publishers, 1968.
2. Theory of Alternating Current Machinery- *Langsdorf*, Tata McGraw Hill Companies, 2nd edition, 2001.
3. Electromechanics-II (transformers and induction motors) - *S. Kamakashaiah,* Hitech publishers.
4. Electric Machines – *I.J.Nagrath & D.P.Kothari*,Tata McGraw Hill, 7th Edition, 2005.
5. A Text Book of Electrical Technology – *B.L. Theraja and A.K. Theraja,Vol2,* S.Chand Publications

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B.Tech EEE II Year II-Semester

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3	1	0	3

ENVIRONMENTAL STUDIES

Objectives:

- *To study various types of conventional and non conventional energy resources including solid, liquid and gaseous fuels.*
- Global energy scenario and energy policies of various countries.
- Energy conservations , electricity acts and its impact on global variations.

UNIT – I

Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance.

Ecosystems: Concept of an ecosystem – Classification, structure and function of Forest, Pond, Grass Land ecosystems - Producers, consumers and decomposers. - Energy flow in the ecosystem - Food chains, food webs and ecological pyramids- Ecological succession.

Biodiversity and its conservation: Introduction - Definition: genetic, species and ecosystem diversity. - Bio-geographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. ICUN categories of biodiversity and RED DATA book - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT - II

Natural Resources: Renewable and non-renewable – Natural resources and associated problems

Forest resources – Use and over – exploitation, deforestation,– Timber extraction, mining, dams and other effects on forest and tribal people

Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.

Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources: Equitable use of resources for sustainable lifestyles.

UNIT – III

Environmental Pollution: Definition, Cause, effects and control measures of different kinds of pollution (Air, Water , Soil , Nuclear, e –Waste)

Social Issues and the Environment: From Unsustainable to Sustainable development -Urban problems related to energy -Water conservation, rain water harvesting, and watershed management. -Climate change, global warming, ozone layer depletion, nuclear accidents and holocaust.

UNIT – IV

Waste management technology: Solid waste Management: Causes, effects and control measures of Solid and Biomedical wastes. Disaster management: floods, earthquake, cyclone and landslides.

Waste water treatment technology: Sewage Water and Effluent Water- primary, secondary and tertiary treatments. Brief account on Bioremediation and Phyto-remediation, R.O technology. Application of GIS and GPS system in environment.

Environmental policy, Rules and regulations. EIA (Environmental Impact Assessment) – Definition, Baseline Data acquisition, Impacts Assessment, EIS(Environment Impact Statement) & EMP (Environment Management Plan) – Environment Protection Act-1986, - Air (Prevention and Control of Pollution) Act- 1981, -Water (Prevention and control of Pollution) Act-1974, -Wildlife Protection Act-1974, –Forest Conservation Act.

UNIT – V

Towards sustainable future: concept of sustainable development, threats of sustainability, population and its explosion, over exploitation of resources, strategies for achieving sustainable development. Environmental education, Conservation of resources. Urban sprawl, sustainable cities and sustainable communities, human health. Environmental ethics, concept of green building, Basic principles of Green engineering, clean development mechanism (CDM), Low carbon life cycle, Polluters-pay principle.

Field work: Visit to a local area to document environmental assets River/forest/grassland/hill/ mountain Visit to a local polluted site-Urban/Rural/industrial/Agricultural Study of common plants, insects, birds, Visit to effluent treatment plant/sewage treatment plant Study of simple eco systems pond, river, hill slopes etc.

Mini projects by students which is mandatory.

Outcomes:

After going through this course the student can be able to understand

- *Knowledge of solid, liquid, gaseous fuels and characterization techniques for fuels.*
- *Knowledge of energy conservations in various forms.*
- *Economical aspects of energy studies and its impact on global environment.*

TEXT BOOKS:

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, University Press.
2. Environmental studies, From Crisis to cure by R.Rajagopalan,2005.

REFERENCES:

1. Environmental Science: towards a sustainable future by Richard T.Wright.2008 PHL Learning Private Ltd .New Delhi
2. Environmental Engineering and science by Gilbert M.Masters and Wendell P.Ela.2008 PHI Learning Pvt. Ltd.

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ELECTRICAL MACHINES LAB-I

Objective:

- *To give the students an insight in to the constructional details of DC machines.*
- *To train and evaluate the ability of students to perform the analyze of DC generator.*
- *To the ability of to perform the analyze of DC motor.*

*ANY **TEN** Experiments are to be conducted*

1. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.
2. Load test on DC shunt generator. Determination of characteristics.
3. Load test on Dc series generator. Determination of characteristics.
4. Load test on DC compound generator. Determination of characteristics.
5. Hopkinson's tests on DC shunt machines. Predetermination of efficiency.
6. Fields test on DC series machines. Determination of efficiency.
7. Swinburne's test on DC shunt machine. Predetermination of efficiency at various loads as motor and generator.
8. Speed control of DC shunt motor by Armature Voltage Control and Field Flux Control Method.
9. Brake test on DC shunt motor. Determination of performance curves.
10. Brake test on DC series motor. Determination of performance curves.
11. Separation of losses in DC shunts motor.
12. Retardation test on DC shunt motor. Determination of losses.

Outcomes:

After going through this course the student can be able to

- *Interpret the constructional details of DC machine.*
- *Estimate or test the performance of DC generator.*
- *Analyze the performance of DC motors*

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CONTROL SYSTEMS LAB

Objective:

- *They we get basic knowledge on practical control system and PLC application.*
- *They get the knowledge on application of machine and electrical devices with control.*
- *They get the knowledge on to design lead, lag and lead –lag systems on control system.*

ALL Experiments are to be conducted.

1. Time response of Second Order System.
2. Effect of P, PD, PI, PID controller on a second order system.
3. Characteristics of Synchro's.
4. Lead and Lag Compensation –Magnitude and phase plot.
5. Characteristics of AC Servomotor.
6. Transfer function of a DC Generator.
7. Transfer function of a DC Motor.
8. Verification of Truth Tables by using Programmable Logic Controller.
9. Temperature Controller using PID.
10. Characteristics of Magnetic Amplifier.

Outcomes:

After going through this course the student can be able to

- *Will able to do various engineering projects.*
- *Ability to formulate transfer function for given control system problems and find time response of given control system model.*
- *Ability to design controller and compensator in control system.*

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HUMAN VALUES AND PROFESSIONAL ETHICS

Objectives:

- *To help the students appreciate the essential complementarities between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.*
- *To facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Value based living in a natural way.*
- *To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behaviour and mutually enriching interaction with Nature.*

UNIT - I:

Course Introduction - Need, basic Guidelines, Content and Process for Value Education: Understanding the need, basic guidelines, content and process for Value Education. Self Exploration - what is it? - its content and process; 'Natural Acceptance' and Experiential Validation - as the mechanism for self exploration. Continuous Happiness and Prosperity - A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities - the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly - A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT - II:

Understanding Harmony in the Human Being - Harmony in Myself! : Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

UNIT - III:

Understanding Harmony in the Family and Society - Harmony in Human - Human Relationship: Understanding harmony in the Family the basic unit of human interaction. Understanding values in human - human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; **Trust (Vishwas) and Respect (Samman) as the foundational values of relationship.** Understanding the meaning of Vishwas; Difference between intention and competence. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astiva as comprehensive Human Goals. Visualizing a universal harmonious order in society - Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha) - from family to world family!

UNIT - IV:

Understanding Harmony in the nature and Existence - Whole existence as Co-existence: Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature - recyclability and self-regulation in nature. Understanding

Existence as Co-existence (Sah-astiva) of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.

UNIT - V:

Implications of the above Holistic Understanding of Harmony on Professional Ethics: Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basic for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics:

a. Ability to utilize the professional competence for augmenting universal human order,
b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order.

a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers
b. At the level of society: as mutually enriching institutions and organizations.

TEXT BOOKS:

1. R. R. Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. Prof. K. V. Subba Raju, 2013, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition.

REFERENCE BOOKS:

1. Ivan IIlich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
2. E. F. Schumancher, 1973, Small is Beautiful: a study of economics as if people mattered. Blond & Briggs, Britain.
3. A Nagraj, 1998 Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
4. Sussan George, 1976, How the Other Half Dies, Penguin Press, Reprinted 1986, 1991.
5. P. L. Dhar, R. R. Gaur, 1990, Science and Humanism, Commonwealth Publishers.
6. A. N. Tripathy, 2003, Human Values, New Age International Publishers.
7. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
8. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth - Club of Rome's report, Universe Books.
9. E G Seebauer & Robert L.Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.

M Govindrajan, S Natrajan & V. S Senthil kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India.

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE III Year I-Semester

L	T	P	C
3	1	0	3

LINEAR IC APPLICATIONS

Objectives:

- *Study about electrical properties of analog ICs like Op-Amps, IC 555 timer, PLL.*
- *Analyze and know the design concepts of various applications of ICs.*
- *Study the design concepts Digital circuits using ICs.*

UNIT – I

Integrated Circuits: Classification, chip size and circuit complexity, Classification of Integrated circuits, comparison of various logic families, standard TTL NAND Gate-Analysis & characteristics, TTL open collector O/Ps, Tristate TTL, MOS & CMOS open drain and tri-state outputs, CMOS transmission gate, IC interfacing- TTL driving CMOS & CMOS driving TTL.

UNIT - II:

OP-AMP and Applications: Basic information of OP-AMP, ideal and practical OP-AMP, internal circuits, OP-AMP characteristics, DC and AC characteristics, 741 OP-AMP and its features, modes of operation-inverting, non-inverting, differential.

Basic application of OP-AMP, instrumentation amplifier, ac amplifier, V to I and I to V converters, sample & hold circuits, multipliers and dividers, Differentiators and Intergrators, Comparators, introduction to voltage regulators.

UNIT - III:

Active Filters & Oscillators: Introduction, 1st order LPF, HPF filters, Band pass, Band reject and all pass filters. Oscillator types and principle of operation - RC, Wien and quadrature type, waveform generators - triangular, sawtooth, square wave and VCO.

UNIT - IV:

Timers & Phase Locked Loops: Introduction to 555 timer, functional diagram, monostable and astable operations and applications, Schmitt Trigger. PLL - introduction, block schematic, principles and description of individual blocks of 565.

UNIT - V:

D-A and A-D Converters: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs –

parallel comparator type ADC, counter type ADC, successive approximation ADC and slope ADC. DAC and ADC specifications.

Outcomes:

- *To Summarize the basics of linear integrated circuits and explain operational amplifiers with applications*
- *Able to explain the comparator circuits like Schmitt trigger, astable multivibrator and construct filter circuits for particular application*
- *To describe analog to digital converters (ADC), and digital to analog converters (DAC) with its Specifications, explain a stable voltage regulators*

TEXT BOOKS:

1. Linear Integrated Circuits, D. Roy Chowdhury, New Age International(p) Ltd.
2. Op-Amps & Linear ICs, Ramakanth A. Gayakwad, PHI

REFERENCES BOOKS:

1. Operational Amplifiers & Linear Integrated Circuits, R.F. Coughlin & Fredrick F. Driscoll, PHI.
2. Operational Amplifiers & Linear Intergrated Circuits: Theory & Applications, Denton J. Daibey, TMH.
3. Design with Operational Amplifiers & Analog Integrated Circuits, Sergio Franco, McGraw Hill.
4. Digital Fundamentals - Floyd and Jain, Pearson Education.

B.Tech EEE III Year I-Semester

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3	0	0	3

MANAGEMENT SCIENCE

Objectives:

- *The aim of this course is to enable the students to see that many managerial decision-making situations can be addressed using standard techniques and methods.*
- *To provide a comprehensive and concise introduction to the key techniques and methods used within management science those are directly relevant to the managerial context.*
- *To enable you to see both the benefits, and limitations, of the techniques and methods presented.*

Unit-I:

Introduction to Management: Nature and importance of management, Functions of Management, Taylor's Scientific Management Theory, Fayol's principles of management, Maslow's theory of Human Needs, Douglas Mc Gregor's Theory X and Theory Y, Herzberg's Two factor Theory of Motivation. Systems Approach to Management, Leadership Styles, Social Responsibilities of Manager, Organization levels and types of organization structures.

Unit-II

Operations Management: Principles and Types of Plant Layout-Methods of production (Job, batch and Mass production), Work Study - Basic procedure involved in Method Study and Work measurement- Statistical Quality Control - X chart, R chart, C chart, P chart, (simple problems), Acceptance Sampling, Deming's contribution to quality.

Materials Management: Objectives, Need for inventory control, EOQ, ABC Analysis, Purchase procedure, Stores management and Stores records, Supply chain management.

Unit –III

Human Resources Management (HRM): Evolution of HRM, Concepts of HRM, Basic functions of HR Manager - Manpower Planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating.

Marketing: Functions of Marketing, Marketing Mix, Marketing strategies based on Product Life cycle, Channels of distribution.

Unit –IV

Project Management(PERT/CPM): Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method(CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing.(Simple problems)

Unit –V

Strategic & Contemporary Management Practices: Mission, Goals, Objectives, Policy,

Strategy, Programmes, Elements of corporate planning process, Environmental Scanning, SWOT analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives. Basic concepts of Just-In-Time(JIT) system, Total Quality Management(TQM), Six Sigma and Capability Maturity Model(CMM) levels, Value chain Analysis.

Outcomes:

- *On completion of the course, the student should be able to discuss the main techniques and methods used within management science.*
- *Able to critically appraise the strengths and limitations of these techniques and methods, carry out simple exercises using such techniques and methods themselves*.
- *Able to making situations can be addressed using standard techniques and methods,managerial decision.*

Text books:

1. Aryasri, Management Science, TMH, New Delhi, 2009

References:

1. Kotler Philip and Keller Kevin Lane, Marketing Management, Pearson, 2012.
2. Koontz and Weihrich, Essentials of Management, McGraw Hill, 2012.
3. Thomas N. Duening and John M. Ivancevich Management, Principles and Guidelines, Biztantra, 2012.
4. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2012.
5. Samuel C. Certo, Modern Management, 2012.
6. Schermerhorn, Capling, Poole and Wiesner, Management, Wiley, 2012.
7. Parnell, Strategic Management, Cengage, 2012.
8. Lawrence R Jauch, R. Gupta and William F. Glueck: Business Policy and Strategic Management Science, McGraw Hill, 2012.

(AUTONOMOUS)

B.Tech EEE III Year I-Semester

L	T	P	C
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POWER ELECTRONICS

Objectives:

- *To introduce the basic concepts of power semiconductor devices,*
- *To introduce the analysis of wide variety of converters and their applications*.
- *To introduce the analysis of single phase and three phase line commutated AC voltage controller, choppers, inverters.*

UNIT-I

Power Semi Conductor Devices and Commutation Circuits

Thyristors – Silicon Controlled Rectifiers (SCRs) – BJT – Power MOSFET – Power IGBT and their characteristics and other thyristors .Basic theory of operation of SCR – Static characteristics – Turn on and turn off methods- Dynamic characteristics of SCR - Turn on and Turn off times -Salient points.

Two transistor analogy of SCR - UJT firing circuit - Series and parallel connections of SCRs Snubber circuit details – Specifications and Ratings of SCRs, BJT, IGBT - Numerical problems – Line Commutation and Forced Commutation circuits.

UNIT-II

Single Phase Converters

Phase control technique - Single phase Line commutated converters Midpoint and Bridge connections – Half controlled converters with R, RL and RLE loads with continuous current mode of operation –Derivation of average load voltage and current -Active and Reactive power inputs to the converters without and with free wheeling Diode.

Fully controlled converters, Midpoint and Bridge connections with R, RL and RLE loads for continuous current mode of operation. Derivation of average load voltage and current – Line commutated inverters. Active and Reactive power inputs to the converters without and with Freewheeling Diode. Effect of source inductance – Derivation of load voltage and current – Numerical problems.

UNIT-III

Three Phase Line Commutated Converters

Three phase converters – Three pulse and six pulse converters – Midpoint and bridge connections average load voltage With R and RL loads- Effect of Source inductance.

Dual converters (circulating & non-circulating current mode of operation) - Waveforms – Numerical Problems.

UNIT-IV

AC Voltage Controllers & Cyclo Converters

AC voltage controllers – Single phase two SCRs in anti parallel – With R and RL loads – modes of operation of Triac with R and RL loads – Derivation of RMS load voltage, current and power factor wave forms. Firing circuits -Numerical problems.

Cyclo-converters – Single phase midpoint Cyclo converters with Resistive and inductive load (Principle of operation only) – Bridge configuration of single phase Cyclo converter (Principle of operation only) – Waveforms

UNIT-V

Choppers and Inverters

Choppers – Time ratio control and Current limit control strategies – Step down choppers Derivation of load voltage and currents with R, RL and RLE loads for continuous and discontinuous modes. Step up Chopper – load voltage expression. Morgan's chopper – Jones chopper (Principle of operation only) Waveforms - AC Chopper – Problems.

Inverters – Single phase inverter – Basic series inverter – Basic parallel Capacitor inverter-3ph Bridge inverters 120^0 and 180^0 conduction modes of operation – Waveforms – Simple forced commutation circuits for bridge inverters. Voltage control techniques for inverters-Pulse width modulation techniques – Numerical problems.

Outcomes: *After this course, student will be able to*

- *understand the operation and characteristics of various types of semiconductor devices*
- *analyze the operation and characteristics of various single-phase converters, three-phase converters and choppers*
- *analyze the operation and performance of AC voltage controllers and inverters*

TEXT BOOKS:

1. Power electronics-P.S. Bimbhra-khanna Publishers 5th edition 2012.
2. Power electronics – M.D. Singh & K.B. Kanchandhani, Tata Mc Graw – Hill Publishing Company, 2nd edition 2006.
3. Power Electronics: Circuits Devices and Applications – M.H. Rashid, Prentice Hall of India, 3rd edition,2003.

REFERENCE BOOKS:

1. Power Electronics – Vedam Subramanyam, John wiley and sons Ltd Publishers,1997.
2. Power Electronics – P.C. Sen, Tata Mc Graw-Hill Publishing- 1st edition,2001.
3. Thyristorised power Controllers – G.K. Dubey, S.R Doradra, A. Joshi and R.M.K. Sinha, New Age international Pvt Ltd. Publishers 1st edition-2005(Reprint)

(AUTONOMOUS)

B.Tech EEE III Year I-Semester

L	T	P	C
3	1	0	3

POWER SYSTEMS-II

Objectives:

- *To deal with basic theory of transmission lines modeling and their performance analysis.*
- *To emphasis on mechanical design of transmission lines, cables and insulators.*
- *To provide knowledge about the system transients, sag and various issues relate to over head transmission lines.*

UNIT-I

Transmission Line Parameters

Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition, Numerical Problems.

Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

UNIT-II

Performance of Transmission Lines

Classification of Transmission Lines - Short, medium and long line and their model representations - Nominal-T, Nominal-Pie and A, B, C, D Constants for symmetrical & Asymmetrical Networks, Numerical Problems, Mathematical Solutions to estimate regulation and efficiency of all types of lines - Numerical Problems.

Long Transmission Line-Rigorous Solution, evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations, SIL of Long Lines, Representation of Long Lines - Equivalent-T and Equivalent Pie network models.

Skin and Proximity effects - Description and effect on Resistance of Solid Conductors - Ferranti effect - Charging Current - Effect on Regulation of the Transmission Line, Shunt Compensation.

UNIT-III

Power System Transients

Types of System Transients - Incident, Reflected and Refracted Waves - Wave Length and Velocity of Propagation of Waves -Travelling or Propagation of Surges - Surge Impedance - Attenuation, Distortion, Reflection and Refraction Coefficients - Termination of lines with different types of conditions, Open Circuited Line, Short Circuited Line,T-Junction, Lumped Reactive Junctions (Numerical Problems). Bewley's Lattice Diagrams (for all the cases mentioned with numerical examples).

UNIT-IV

Corona & Overhead Line Insulators

Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference. Types of Insulators, String efficiency and Methods for improvement, Numerical Problems voltage distribution, calculation of string efficiency, Capacitance grading and Static Shielding.

UNIT-V

Sag and Tension Calculations and Underground Cables

Sag and Tension Calculations with equal and unequal heights of towers Effect of Wind and Ice on weight of Conductor, Numerical Problems - Stringing chart and sag template and its applications

Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation resistance and stress in insulation, Numerical Problems. Capacitance of Single and 3-Core belted cables, Numerical Problems. Grading of Cables - Capacitance grading, Numerical Problems, Description of Inter-sheath grading.

Outcomes:

- *Able to do calculation of R,L and C of transmission lines.*
- *Able to do calculation of power system transients.*
- *Able to understand transient phenomenon, calculation of sag and tension.*

TEXT BOOKS:

1. A Text Book on Power System Engineering- M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarthy, Dhanpat Rai & Co Pvt. Ltd second revised edition 2010.
2. Electrical power systems - C.L.Wadhwa, New Age International (P) Limited, Publishers 6^{th} edition 2010.

REFERENCE BOOKS:

1. Power system Analysis- John J Grainger William D Stevenson, TMC Companies, illustrated edition 1994.
2. Power System Analysis and Design- B.R.Gupta, 7^{th} edition 1998,s.chand publishers.
3. Power System Analysis - Hadi Saadat – TMH Edition 3^{rd} edition 2010.
4. Modern Power System Analysis- I.J.Nagaraj and D.P.Kothari, Tata McGraw Hill, 4^{nd} Edition.
5. A course in Power systems-J.B.Gupta, S.K.Kataria & Sons, 2010 edition.

ANURAG ENGINEERING COLLEGE

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B.Tech EEE III Year I-Semester

L	T	P	C
4	1	0	4

ELECTRICAL MACHINES- III

Objective:

- *To deal with the detailed analysis of Synchronous generators and motors*
- *To read with the prime sources of electrical power generation and its utilities.*
- *To read with the different types of special motors which are having significant applications in domestic and industrial applications.*

UNIT-I

Synchronous Generator

Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation. Harmonics in generated e.m.f. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics.

UNIT-II

Voltage Regulation of Synchronous Generators

Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – Salient pole alternators – two reaction theory – experimental determination of X_d and X_q (Slip test) Phasor diagrams – Regulation of salient pole alternators.

UNIT-III

Parallel Operation of Synchronous Generator

Synchronizing alternators with infinite bus bars – Synchronizing power and synchronizing torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – determination of sub-transient, transient and steady state reactances.

UNIT-IV

Synchronous Motors

Principle of operation-methods of starting-phasor diagram-Variation of current and power factor with excitation-synchronous condenser-Mathematical analysis for power developed-circle diagrams of synchronous machines-hunting and its suppression-damper windings-Applications.

UNIT-V

Special Motors

Basic Principle of operation and application of AC series motor-Universal motor-Stepper motor –shaded pole motor-Reluctance motor-BLDC motor (Elementary treatment only)

Outcomes:

- *Student will able learn about synchronous generator.*
- *Getting knowledge about regulation and effect of synchronous machines.*
- *Select suitable special motor for domestic applications.*

TEXT BOOKS:

1. Electrical Machinery – P.S. Bimbra, Khanna Publishers.
2. Theory and Performance of Electrical machines - J.B Gupta, S.K. Kataria & Sons.

REFERENCE BOOKS:

1. Electric Machines – I.J.Nagrath & D.P.Kothari, Tata Mc Graw-Hill Publishers, 4rd Edition 2010.
2. Electrical Machines- Milukutla S Sarma, Mukesh K Pathak, Cengage Learning, 2009
3. Electric Machinery – A.E. Fitzgerald, C.Kingsley and S.Umans, Mc Graw-Hill Companies, 6th edition, 2003.
4. Electromachanics-III (Synchronous and single phase machines),S.Kamakashiah, Right Publishers 3rd edition 2008.
5. A Text book of Electrical Technology – B.L. Thereja and A.K. Theraja, S. Chand Publications, Vol3 2007.

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B.Tech EEE III Year I-Semester

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3	0	0	3

RENEWABLE ENERGY SOURCES

(Professional Elective-I)

***Objectives**:*

- *Ability to learn Renewable energy sources, generating systems, its performance characteristics.*
- *Ability to design solar panels such as flat plate collectors, dish collectors, fuel cells.*
- *Ability to understand fundamentals of energy conversion systems.*

UNIT – I

Principles of Solar Radiation

Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT-II

Solar Energy Storage and Applications

Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications-solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT-III

Wind Energy

Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.

UNIT-IV

Geothermal Energy

Resources, types of wells, methods of harnessing the energy, potential in India.

Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles.

Tidal and Wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT-V

Direct Energy Conversion

Need for DEC, Carnot cycle, limitations, principles of DEC. Seebeck effect, MHD generators,

OUTCOMES: *The student will be able analyze*

- *Solar thermal and photovoltaic systems and related technologies for energy conversion.*
- *Wind energy conversion, Biomass conversion, Geo thermalenergy conversion and principles and technologies.*
- *Power from oceans and conversion, Fundamentals of direct energy conversion systems.*

TEXT BOOKS:

1. Non-Conventional Energy Sources - G.D. Rai, Khanna Publishing House, 2011.
2. Renewable Energy Technologies - Ramesh & Kumar, Narosa Publishing House 1997.

REFERENCE BOOKS:

1. Renewable energy resources- Tiwari and Ghosal, Narosa Publishing House, 2007.
2. Non-Conventional Energy - Ashok V Desai,Wiley Eastern Ltd, New Delhi, 2003.
3. Non-Conventional Energy Systems - K Mittal, Wheeler Publishing Co.
4. Solar Energy – Sukhame, Tata McGraw-Hill Education, 3rd edition, 2008.

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B.Tech EEE III Year I-Semester	L	T	P	C
	3	0	0	3

COMPUTER ORGANIZATION

(Professional Elective-I)

Objectives:

- *Understand instruction format, life cycle and CPU Architecture and Organization and the basic Architecture of Microprocessor.*
- *Understand different types of I/O interfaces, the concepts of pipelining techniques.*
- *Understand the Multiprocessor concepts*

UNIT--I:

Instruction: Instruction Definition, instruction cycle, flow chart for instruction cycle, instruction storage, types of instruction formats (Zero, one, two and three address). Addressing modes: mode field, implied, immediate register, register direct, register indirect, auto increment, decrement, indexed, relative, base address mode, Numerical examples and problems.

UNIT -- II:

CPU-Organization: 8086 – CPU – Block diagram and pin diagram, concept of pipelining, minimum and maximum mode, General purpose registers; segment register and generation of 20 bits address, segmentation of main memory, Addressing modes, systems bus, Types of flags.

UNIT -- III:

Memory Hierarchy, Main memory, memory address map, memory connection to CPU; auxiliary memory, Magnetic disks, magnetic tapes; cache memory, hit and miss ratio, direct, associative and set associative mapping; Micro-programmed control: control memory, address sequencing.

UNIT -- IV:

I/O interface: I/O Bus and Interface modules, I/O versus Memory Bus, isolated vs Memory-mapped I/O. Asynchronous data transfer-strobe control, Hand shaking; Modes of Transfer: Example of programmed I/O, interrupt-initiated I/O, software considerations. Daisy- Chaining priority. DMA: DMA Controller, DMA Transfer, Intel 8089 IOP.

UNIT -- V:

Multi Processors: Characteristics of Multi Processor; Interconnection structures: Time shared common bus, multiport memory, crossbar switch, multi-stage switching network; Introduction to Flynn's classification**:** SISD, SIMD, MISD, MIMD (Introduction).

Outcomes: *Students will be able to:*

- *Understand the basic organization of computer and different instruction formats and addressing modes,the concept of pipelining, segment registers and pin diagram of CPU.*
- *Understand and analyze various issues related to memory hierarchy, modes of data transfer between CPU and I/O devices..*
- *Examine various inter connection structures of multi processors.*

TEXT BOOKS:

1. Computer System Architecture – M.Morris Mano, Third Edition, Pearson/PHI, 2011.
2. Microprocessor and Interfacing – Douglas V Hall, Second Edition, TATA McGraw Hill, 2006.

REFERENCE BOOKS:

1. Computer Organization – Carl Hamacher, ZvonksVranesic, SafeaZaky, V Edition,McGraw Hill.
2. Computer Organization and Architecture – William Stallings, 6th Edn.Pearson/PHI.

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE III Year I-Semester

L	T	P	C
3	0	0	3

SIGNALS AND SYSTEMS

(Professional Elective-I)

Objectives:

- *This course focuses on to get in-depth knowledge about signals, systems and analysis of the same using various transforms.*
- *This course deals with the principle of linear system, filter characteristics of system and its band width, the concept of autocorrelation and cross co relation and power density spectrum.*
- *This course focuses design a system for sampling a signal response can be obtained using Laplace transform, properties and ROC of L.T.*

UNIT-I: SIGNAL ANALYSIS:

Analogy between vectors and signals, Orthogonal vector and signal spaces, Approximation of a function by a set of mutually orthogonal functions, Evaluation of mean square error, Closed or complete set of orthogonal functions, Orthogonality in complex functions, Trigonometric and Exponential **Fourier series**, Representation of periodic function by Fourier series Dirchelets Conditions, Complex Fourier spectrum,

UNIT-II: **FOURIER TRANSFORMS AND SAMPLING**

Fourier Transforms: Deriving Fourier Transform (F.T.) from Fourier Series, F.T. of arbitrary and standard signals, Concept of impulse function, Fourier Transforms involving Impulse function, Properties of Fourier transforms,

Sampling: Sampling theorem and its proof, Effect of under sampling-Aliasing, Reconstruction of signal from its samples.

UNIT-III: SIGNAL TRANSMISSION THROUGH SYSTEMS:

Linear system, Impulse response, Response of a Linear System, Linear Time-Invariant (LTI) system, Linear Time-Variant (LTV) System, Transfer function of LTI system, Filter characteristics of Linear Systems. Distortion-less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and Rise time.

UNIT-IV: CONVOLUTION AND CORRELATION OF SIGANLS:

Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution, Convolution property of Fourier Transforms, Cross Correlation and Auto correlation of functions, Properties of Correlation function, Energy density spectrum, Parse-Val's Theorem, Power density spectrum, Relation between Autocorrelation function and Energy/Power spectral density function.

UNIT-V: LAPLACE TRANSFORMS AND Z-TRANSFORMS:

Laplace Transforms: Review of Laplace transforms Partial fraction expansion, Inverse Laplace transform, Concept of Region of convergence (ROC) for Laplace transforms, Constraints on ROC for various classes of signals, Properties of Laplace transforms, Relation between Laplace transform and Fourier transform of a signal. Laplace transform of certain signals using waveform synthesis.

Z-Transforms: Fundamental difference between Continuous and Discrete time signals, Discrete time signal representation using Complex exponential and Sinusoidal signals, Periodicity of Discrete time complex exponential signal, Concept of Z-transform of a discrete sequence. Distinction between Laplace, Fourier and Z-Transforms. Region of convergence in Z-Transforms, Constraints on ROC for various classes of signals, Inverse Z-Transforms, properties of Z-Transforms.

Outcomes:

- *Represent any arbitrary signals in terms of complete sets orthogonal functions and understands the principles of impulse function, step function and signum function.*
- *Under stands the principle of linear system, filter characteristics of system and its band width, the concept of autocorrelation and cross co relation and power density spectrum.*
- *Can design a system for sampling a signal response can be obtained using Laplace transform, properties and ROC of L.T.*

TEXT BOOKS:

1.Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn.

REFERENCES:

1. Signals & Systems - Simon Haykin and Van Veen,Wiley, 2nd Edition.
2. Fundamentals of Signals and Systems Michel J. Robert, MGH International Edition, 2008.
3. Signals, Systems and Transforms - C. L. Philips, J.M.Parr and Eve A.Riskin, Pearson education.3rd Edition, 2004.Publications, 2nd Edition, 2005.

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B.Tech EEE III Year I-Semester

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POWER ELECTRONICS LAB

Objectives:

- To simulate and design various gate firing circuits.
- To familiarize the students by introducing P-Sim and MultiSim and help them to simulate and analyse different Converters .
- To enable the student to study and simulate various Chopper Circuits using Matlab.

Any TEN experiments are to be conducted.

1. Gate firing circuits for SCR.
2. Single phase ac voltage controller with R and RL loads.
3. Single phase half controlled converter with R load.
4. Single phase fully controlled bridge rectifier with R and RL loads.
5. Forced commutation circuits (Class A, Class B, Class C, Class D & Class E).
6. DC Jones chopper with R and RL loads.
7. Single phase parallel inverter with R and RL load.
8. Single phase series inverter with R and RL load.
9. Single phase cycloconverter with R and RL loads.
10. Single phase Dual Converter with RL loads.
11. Operation of MOSFET based Chopper.
12. Three Phase Half Controlled Bridge Converter with R Load.
13. Single Phase Bridge Converter with R and RL Loads.

Outcomes:

- Ability to design and conduct simulation and experiments and use the techniques, skills and modern engineering tools necessary for engineering practice.
- Ability to identify, formulate and sole engineering problems with simulation.
- Ability to simulate characteristics of SCR, MOSFET, IGBT. 5. Ability to simulate Gate firing circuit

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ELECTRICAL MACHINES – II LAB

Objectives:

- Able to recognize various electrical machines which taught in the electrical machine courses, and teach them how to read the name plate data of the machines and implement it.
- Able to perform experiments which are necessary to determine the parameters and the performance characteristics of the most used ac and dc machines.
- Able to work in the field of operation, control and maintenance.

Any TEN experiments are to be conducted.

1. O.C. & S.C. Tests on single phase transformer.
2. Sumpner's test on a pair of single phase transformers.
3. Brake test on three phase Induction motor.
4. No-load & blocked rotor tests on three phase Induction motor.
5. Regulation of a three phase alternator by synchronous impedance method & MMF method.
6. V and inverted V curves of a three - phase Synchronous motor.
7. Equivalent circuit of a single phase induction motor.
8. Determination of X_d and X_q of a salient pole synchronous machine.
9. Scott connection of Transformers.
10. Efficiency of a three phase alternator
11. Parallel operation of alternators.
12. Parallel Operation of Single Phase Transformers.
13. Separation of core losses of a single phase transformer.
14. Regulation of a three phase alternator by ZPF & ASA method.
15. Heat run test on a bank of 3 Nos. of single phase delta connected transformers.
16. Measurement of sequence Impedance of a 3phase alternator.

Outcomes:

- Able to predetermine the efficiency and regulation of single-phase transformer at given power factors and determine its equivalent circuit and to obtain the V and Inverted V curves of a three—phase synchronous motor
- Able to obtain performance characteristics three-phase Induction motor
- To predetermine the regulation of three–phase alternator by synchronous impedance method and Xd and Xq of a salient pole synchronous machine.

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SWITCHGEAR AND PROTECTION

Objective:

- *To study various types of Circuit Breakers and Relays for protection of Generators, Transformers, feeder and bus bars from over voltages and other hazards.*
- *To study various protection methods for protection of Generators, Transformers, feeder and bus bars against over voltages and abnormal conditions.*
- *To emphasis on Neutral grounding for overall protection and to study insulation co-ordination .*

UNIT - I

Circuit Breakers

Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages.- Restriking Phenomenon, Average and Max. RRRV, Numerical Problems - Current Chopping and Resistance Switching - CB ratings and Specifications: Types and Numerical Problems. – Auto reclosures. Description and Operation of following types of circuit breakers: Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum and SF_6 circuit breakers.

UNIT-II

Relays

Principle of Operation and Construction of Attracted armature, Balanced Beam, Induction Disc and Induction Cup relays. Relays Classification: Instantaneous, DMT and IDMT types. Applications of relays: Over current/ under voltage relays, Direction relays, Differential Relays and Percentage Differential Relays.Universal torque equation, Distance relays: Impedance, Reactance and Mho and Off-Set Mho relays, Characteristics of Distance Relays and Comparison.

Static Relays: Introduction to static Relays- phase comparators- Amplitude comparators- Static Relays verses Electromagnetic Relays. Introduction to Numerical Relays.

UNT-III

Generator and Transformer Protection

Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on % Winding Unprotected.

Protection of transformers: Percentage Differential Protection, Numerical Problems on Design of CT s Ratio in differential protections, Buchholtz relay Protection.

UNIT-IV

Feeder and Bus-Bar Protection

Protection of Lines: Over Current, Carrier Current and Three-zone distance relay protection using Impedance relays. Translay Relay.

Protection of Bus bars – Differential protection.

UNIT-V

Neutral Grounding and Protection against over voltages

Grounded and Ungrounded Neutral Systems.- Effects of Ungrounded Neutral on system performance. Methods of Neutral Grounding: Solid, Resistance, Reactance - Arcing Grounds and Grounding Practices.

Generation of Over Voltages in Power Systems.-Protection against Lightning Over Voltages - Valve type and Zinc-Oxide Lighting Arresters - Insulation Coordination -BIL, Impulse Ratio, Standard Impulse Test Wave, Volt-Time Characteristics.

OUTCOMES: *After this course, the student*

- *Gets a thorough knowledge on, various types of protective devices (circuit breakers, relays etc..) and their co-ordination in protection of power system.*
- *Gets a thorough knowledge on, various types of protection methods of generators, transformers, feeders and bus-bars, through different types of protective devices against overvoltage, lightening, etc.,*
- *Applies the above concepts to real-world electrical and electronics problems and applications.*

TEXT BOOKS:

1. Switchgear and Protection – Sunil S Rao, Khanna Publishers 13th edition.
2. Power System Protection and Switchgear - Badri Ram, D.N Viswakarma, TMH Publications 2nd edition.

REFERENCE BOOKS:

1. Transmission network Protection -Y.G. Paithankar, Taylor and Francis, 2nd edition 2009.
2. Power System Protection and Switch Gear - Bhuvanesh Oza, TMH 1st edition 2010.
3. Electrical Power systems – C.L. Wadhwa, New Age International (P) Limited, Publishers, 7th editon.
4. Power Systems Engineering – A. Chakrabarthi, M.L. Soni, P.V. Gupta, Dhanpat Rai & Co.

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COMPUTER METHODS IN POWER SYSTEMS

Objectives:

- *Ability to understand formation of Power System matrices & Power flow studies by various computer methods.*
- *Ability to apply the mathematical concepts to solve power flow analysis and the power system behavior under normal & fault conditions.*
- *It deals with short circuit analysis of power system for steady state and transient stability.*

UNIT-I

Network Matrices

Graph theory: Definitions, Bus incidence Matrix, Y_{bus} formation by direct and singular transformation methods, Numerical Problems.

Formation of Z_{bus}: Partial network, algorithm for the modification of Z_{bus} for addition element for the following cases: addition of element from a new bus to reference, addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses. Modification of Zbus for the changes in network (problems).

UNIT –II

Power Flow Studies

Necessity of power flow studies- data for power flow studies- derivation of static load flow equations- load flow solution using Gauss seidel Method: Acceleration Factor, load flow solution with and without P-V buses, Algorithm and Flowchart, Numerical load flow Solution for Simple Power systems (Max 3- buses): Determination of Bus Voltages, Injected Active and Reactive Powers (Sample one iteration only) and finding line flows and losses for the given Bus Voltages.

Newton Raphson Method in Rectangular and Polar Co-Ordinates form: Load flow solution with or without PV busses- Derivation of Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods

UNIT-III

Short Circuit Analysis

Per unit system representation. Per unit equivalent reactance network of three phase Power System, Numerical Problems. Symmetrical fault Analysis: short circuit current and MVA Calculations, Numerical Problems. Symmetrical Component Theory: Symmetrical Component Transformation, Positive, Negative and Zero sequence components: Voltages, Currents and Impedances. Sequence Networks: Positive, Negative and Zero sequence Networks, Numerical Problems. Unsymmetrical Fault Analysis: LG, LL, LLG faults with and without fault impedances, Numerical Problems.

UNIT-IV

Steady State Stability Analysis

Elementary concepts of Steady State, Dynamic and Transient Stabilities. Description of Steady State Stability Power limit, Transfer Reactance, Synchronizing Power Coefficient, Power angle curve and determination of steady state stability and methods to improve steady state stability.

UNIT-V

Transient Stability Analysis

Derivation of Swing Equation, Determination of Transient Stability by Equal Area Criterion. Application of EAC, Critical Clearing Angle calculation. Solution of swing equation. Point by point method. Methods to improve stability.

Outcomes:

- *Acquire the knowledge of about an incidence matrices and addition elements to the network and different types of load flow methods*
- *Acquire the knowledge about symmetrical and unsymmetrical fault analysis.*
- *Acquire the knowledge about steady state and transient state analysis.*

TEXT BOOKS:

1. Modern Power System Analysis- I.J.Nagrath and D.P.Kothari, Tata McGraw-Hill Publishing Company, 2nd edition, 2003.
2. Power Systems Analysis – PSR Murthy, BS Publications
3. Power system Analysis – A. Nagoorkani, RBA publications

REFERENCE BOOKS:

1. Computer Methods in Power System Analysis - G.W. Stagg & A.H. El-Abiad, International Student Edition, 1968.
2. Power System Analysis - Grainger and Stevenson, Tata McGraw-Hill Publishing Company,1st Edition , 2003.
3. Power System Analysis - Hadi Saadat, Tata McGraw-Hill Publishing Company, 2nd Edition, 2002.
4. Power System Analysis & Design - B.R. Gupta, Wheeler Publications, 3rd Edition, 2003.
5. Electrical Power Systems - C.L. Wadwa - New Age International (P) Ltd, 6th edition,2006.

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ELECTRICAL MEASUREMENTS

Objectives:

- *To deal with the basic principles of all measuring instruments.*
- *To deal with the measurement of voltage, current, Power factor, power, energy, RLC parameters and magnetic parameters.*
- *To deal with testing cases ,error analysis, minimization of all measuring instruments.*

UNIT-I

Measuring Instruments

Classification – deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, moving iron type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunts and series resistance. Electrostatic Voltmeters-electrometer type and attracted disc type – Extension of range of E.S. Voltmeters.

UNIT-II

Instrument transformers

CT and PT – Ratio and phase angle errors – design considerations. Type of P.F. Meters – dynamometer and moving iron type – 1-ph and 3-ph meters – Frequency meters – Resonance type and Weston type – Synchroscopes.

UNIT-III

Measurement of Power and Energy

Single phase dynamometer wattmeter, LPF and UPF, Double element dynamometer wattmeter, expression for deflecting and control torques – Extension of range of wattmeter using instrument transformers – Measurement of active and reactive powers in balanced and unbalanced systems

Single phase induction type energy meter – driving and braking torques – errors and compensations – testing. Three phase energy meter – trivector meter, maximum demand meters.

UNIT IV:

Potentiometer*s* and Magnetic Measurements

Principle and operation of D.C. Crompton's potentiometer – standardization – Measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate types– applications.

Magnetic Measurements: Ballistic galvanometer, flux meter.

UNIT-V:

Measurement of R, L & C

Method of measuring low, medium and high resistance – sensitivity of Wheatstone's bridge – Kelvin's double bridge for measuring low resistance, measurement of high resistance – loss of charge method. Measurement of inductance, Quality Factor - Maxwell's bridge, Hay's bridge, Anderson's bridge, Owen's bridge. Measurement of capacitance and loss angle - Desauty bridge. Wien's bridge – Schering Bridge.

Outcomes: *After this course, the student*

- *gets a thorough knowledge on, different types of measuring instruments, their construction ,operation and characteristics.*
- *gets a thorough knowledge on measurements of electrical quantities through voltmeter, ammeter, , watt meters, energy meters, instrument transformers,potentiometers and bridges.*
- *gets a thorough knowledge on errors and their compensation technique in all measuring instruments.*

TEXT BOOKS:

1. Electrical & Electronic Measurement & Instruments - A.K.Sawhney Dhanpat Rai & Co. Publications 2015 edition.
2. Electrical Measurements and measuring Instruments – J. B. Gupta, S.K. Kataria & Sons 2013 edition.
3. Electrical and Electronic Measurements and Instruments – R. K. Rajput – S. Chand Company Ltd 6th edition.

REFERENCE BOOKS:

1. Electrical Measurements – Buckingham and Price, Prentice – Hall
2. Electrical Measurements – forest klarie Harris – John Wiley & Sons.
3. Electrical Measurements: Fundamentals, Concepts, Applications – Reissland, M.U, New Age International (P) Limited, Publishers.
4. Electrical Measurements and measuring Instruments – E.W. Golding and F.C. Widdis, wheeler publications fifth edition

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POWER SEMICONDUCTOR DRIVES

Objectives:

- *This course deals with control of DC drives using single phase and three phase line commutated converters.*
- *This course Provides knowledge about four quadrant operations of DC drives.*
- *This course deals with control of AC drives.*

UNIT – I

Control of DC motors by Single phase Converters

Introduction to Thyristor controlled Drives, Single Phase semi and Fully controlled converters connected to d.c separately excited and d.c series motors – continuous current operation – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque Characteristics- Problems on Converter fed d.c motors.

UNIT-II

Control of DC motors by Three phase Converters

Three phase semi and fully controlled converters connected to d.c separately excited motors – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque characteristics – Problems.

UNIT – III

Four Quadrant operations of DC Drives & Control of DC motors by Choppers

Introduction to Four quadrant operation – Motoring operations, Electric Braking – Plugging, Dynamic and Regenerative Braking operations. Four quadrant operation of D.C motors by dual converters

Single quadrant, Two –quadrant and four quadrant chopper fed dc separately excited and series excited motors – Continuous current operation – Output voltage and current wave forms – Speed torque expressions – speed torque characteristics – Problems on Chopper fed dc Motors.

UNIT – IV

Control of Induction Motor

From Stator Side: Variable voltage characteristics-Control of Induction Motor by Ac Voltage Controllers – Waveforms – speed torque characteristics. Variable frequency characteristics-V/F control of induction motor.

From Rotor side: Static rotor resistance control – Slip power recovery – Static Scherbius drive – Static Kramer Drive – their performance and speed torque characteristics – advantages applications – problems

UNIT – V

Control of Synchronous Motors

Separate control & self control of synchronous motors – Operation of self controlled synchronous motors by VSI and CSI cycloconverters. Load commutated CSI fed Synchronous Motor – Operation – Waveforms – speed torque characteristics – Advantages – Applications.

Outcomes: *After this course, the student will be able to*

- *analyze DC motors speed control through single phase and three phase line commutated converters.*
- *analyze four quadrant operation of DC motors through choppers and dual converters.*
- *analyze the operation of induction motors and synchronous motors.*

TEXT BOOKS:

1. Fundamentals of Electric Drives – by G K Dubey Narosa Publications
2. Power Electronic Circuits, Devices and applications by M.H.Rashid, PHI.

REFERENCE BOOKS:

1. Power Electronics – MD Singh and K B Khanchandani, Tata – McGraw-Hill Publishing company,1998
2. Modern Power Electronics and AC Drives by B.K.Bose, PHI.
3. Thyristor Control of Electric drives – Vedam Subramanyam Tata McGraw Hill Publilcations.
4. A First course on Electrical Drives – S K Pillai New Age International(P) Ltd. 2nd Editon.

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B.Tech EEE III Year II-Semester

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SPECIAL ELECTRICAL MACHINES

(Professional Elective-II)

Objective:

- *To deal with the principles and construction of stepper motor, switched reluctance motor, PMDC motor, linear induction motor*.
- *The various types of machines, whose stator coils are energized by electronically switched currents*.
- *To expose the students to as an extension to study of basic electrical machines.*

UNIT-I: SPECIAL TYPES OF D.C MACHINES:

Series booster-Shunt booster-Non-reversible boost-Reversible booster, Armature excited machines-Rosenberg generator- The Amplidyne and metadyne-Rototrol and Regulex-third brush generator-three-wire generator-dynamometer.

UNIT-II: STEPPER MOTORS

Introduction-synchronous inductor (or hybrid stepper motor), Hybrid stepping motor, construction, principles of operation, energization with two phase at a time- essential conditions for the satisfactory operation of a 2-phase hybrid step motor - very slow - speed synchronous motor for servo control-different configurations for switching the phase windings-control circuits for stepping motors-an open-loop controller for a 2-phase stepping motor.

Variable reluctance (VR) Stepping motors: Single phase - stepping motor, the construction, operating principle torque developed in the motor. Single-stack VR step motors, multiple stack VR motors.

UNIT-III: SWITCHED RELUCTANCE MOTOR: Introduction – improvements in the design of conventional reluctance motors- Some distinctive differences between SR and conventional reluctance motors-principle of operation of SRM- Some design aspects of stator and rotor pole arcs, design of stator and rotor and pole arcs in SR motor-determination of $L(\theta)$-θ profile.

UNIT-IV: PERMANENT MAGNET DC MOTORS

Introduction to PMDC Motors, Equivalent circuit of a PM-Development of Electronically commutated dc motor from conventional dc motor.

Brushless DC Motor: Types of construction – principle of operation of BLDM- sensing and switching logic scheme, sensing logic controller, lockout pulses –drive and power circuits, Base drive circuits, power converter circuit-Theoretical analysis and performance prediction, modeling and magnet circuit d-q analysis of BLDM -transient analysis formulation in terms of flux linkages as state variables-Approximate solution for current and torque under steady state –Theory of BLDM as variable speed synchronous motor (assuming sinusoidal flux distribution).

UNIT-V: LINEAR INDUCTION MOTOR

Development of a double sided LIM from rotary type IM- A schematic of LIM drive for electric traction development of one sided LIM with back iron-field analysis of a DSLIM fundamental assumptions.

Outcomes:

- *By studying this subject students get knowledge on working of special machines.*
- *To know stepper motors, permanent magnet materials and motors and linear induction motor, applications and its characteristics.*
- *To know about stepper motors, permanent motors, linear induction motors applications and characteristics, real world electrical problems and applications*.

TEXT BOOKS:

1. K.Venkataratnam, “Special electrical machines” - University press 1st edition.
2. R.K. Rajput ,“Electrical machines”-5th edition.
3. V.V. Athani,“ Stepper motor : Fundamentals , Applications and Design”- New ageInternational publications ,1st edition.

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ADVANCED POWER ELECTRONICS

(Professional Elective-II)

Objectives:

- *To introduce the analysis of wide variety of converters & their applications.*
- *It deals with different types of inverters & power supplies.*
- *To learn about different types of heating methods.*

UNIT 1

D.C. to D.C. Converter: Classification of choppers. Principle of operation, steady state analysis of class A chopper, step up chopper, switching mode regulators: Buck, Boost, Buck-Boost, Cuk regulators. Current commutated and voltage commutated chopper.

UNIT 2

A.C. to A.C. Converter: Classification, principle of operation of step up and step down cycloconverter. Single phase to single phase cycloconverter with resistive and inductive load. Three phase to single phase cyclo converter: Half wave and full wave. Cosine wave crossing technique. Three phase to three phase cyclo converter. Output voltage equation of cyclo converter.

UNIT 3

D.C. to A.C. Converter: Classification, basic series and improved series inverter, parallel inverter, single phase voltage source inverter, steady state analysis, Half bridge and full bridge inverter: Modified Mc Murray and Modified Mc Murray Bedford inverter, voltage control in single phase inverters, PWM inverter, reduction of harmonics, current source inverter, three phase bridge inverter.

UNIT 4

Power Supplies: Switched mode D.C. and A.C. power supplies. Resonant D.C. and A.C. power supplies.

UNIT 5

Applications: Dielectric and induction heating. Block diagram of D.C. and A.C. motor speed control.

Outcomes:

- *Students get detail knowledge on dc-dc & ac-ac converters.*
- *Students get detail knowledge on dc-ac converters.*
- *Able to know its applications in various areas.*

Text Books:

1. Jacob, Michael Power Electronics: Principles & Application, Thomson press Ltd 2006.
2. M.H. Rashid, Power Electronics: Circuits, devices and applications, PHI 3rd edition 2013.
3. Ned Mohan, Tore M. Undeland, William P. Robbins, Power Electronics: Converters, Applications and Design, John Wiley & Sons 3rd edition 2003.

Reference Books:

1. P.S. Bimbhra, „Power Electronics" , Khanna Publishers.
2. M. Ramamoorthy An Introduction to Thyristors and their applications East-West Press.
3. M.D. Singh and K.B. Khanchandani, Power Electronics, Tata McGraw-Hill.
4. A.K. Gupta & L.P. Singh, Power Electronics and Introduction to Drives Dhanpat Rai Publishers.

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ELECTRICAL DISTRIBUTION SYSTEMS

(Professional Elective-II)

***Objectives**:*

- *Ability to apply the knowledge on distribution systems, Load Modeling and Characteristics.*
- *Ability to analyze substations and benefits derived through optimal location of substations.*
- *Ability to calculate Voltage drop and power – loss and manual methods of solution for radial networks*.

UNIT – I

General Concepts

Introduction to distribution systems, Load modeling and characteristics. Coincidence factor, contribution factor, loss factor - Relationship between the load factor and loss factor. Classification of loads (Residential, commercial, Agricultural and Industrial) and their characteristics.

Distribution Feeders: Design Considerations of Distribution Feeders: Radial and loop types of primary feeders, voltage levels, feeder loading; basic design practice of the secondary distribution system.

UNIT – II

Substations

Location of Substations: Rating of distribution substation, service area within primary feeders. Benefits derived through optimal location of substations.

System Analysis: Voltage drop and power-loss calculations: Derivation for voltage drop and power loss in lines, manual methods of solution for radial networks, three phase balanced primary lines.

UNIT – III

Protection

Objectives of distribution system protection, types of common faults and procedure for fault calculations. Protective Devices: Principle of operation of Fuses, Circuit Reclosures, line sectionalizes, and circuit breakers. Coordination: Coordination of Protective Devices: General coordination procedure.

UNIT – IV

Power Factor Improvement

Capacitive compensation for power-factor control. Different types of power capacitors, shunt and series capacitors, effect of shunt capacitors (Fixed and switched), Power factor correction, capacitor allocation - Economic justification - Procedure to determine the best capacitor location.

UNIT – V

Voltage Control

Voltage Control: Equipment for voltage control, effect of series capacitors, effect of AVB/AVR, line drop Compensation.

Outcomes: *After this course, the student will be able to*

- *Analyze the distribution system planning, load modeling characteristics.*
- *Understand the optimal location of substations and design considerations.*
- *Evaluate voltage drop and power loss calculation and design the capacitor and voltage regulating equipment to improve the power factor and voltage profile.*

TEXT BOOKS:

1. Electric Power Distribution system, Engineering – Turan Gonen,3rd edition 2014.
2. Electric Power Distribution – A.S. Pabla, Tata Mc Graw-hill Publishing company, 11th edition, 2008.

REFERENCE BOOKS:

1. Electrical Power Distribution and Automation - S.Sivanagaraju, V.Sankar, Dhanpat Rai & Co, 2008.
2. Electrical Power Distribution Systems - V.Kamaraju, Tata McGraw-Hill Education, 2nd edition 2010.

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SOLAR PHOTO VOLTAIC SYSTEMS

(Open Elective-I)

Objectives: *Objectives of this course are*

- *to introduce photovoltaic systems*
- *to deal with various technologies of solar PV cells*
- *to understand details about manufacture, sizing and operating techniques and to have knowledge of design considerations.*

Unit I: SOLAR ENERGY

Sun and Earth, Solar Spectrum, Solar Geometry, Solar radiation on horizontal and inclined planes, Instruments for measurement of solar radiation ,Solar cell, Equivalent circuit, V-I characteristics, Performance improvement.

Unit II: SOLAR CELLS

Manufacture of Solar Cells-Technologies, Design of Solar cells, Photovoltaic modules, Design requirements, encapsulation systems, manufacture, power rating, hotspot effect, Design qualifications.

Unit III: PROTECTION AND MEASUREMENTS

Flat plate arrays, support structures, module interconnection and cabling, lightning protection, Performance measurement – using natural sun light and simulator, determination of temperature coefficients, internal series resistance, curve correction factor.

Unit IV: PHOTOVOLTAIC SYSTEMS

Photovoltaic systems- types- general design considerations- system sizing-battery sizing-inverter sizing-design examples – Balance of PV systems.

Unit V: MAXIMUM POWER POINT TRACKERS

Maximum power point trackers-algorithms- perturb and observe-incremental conductance method, hill climbing method, , hybrid and complex methods, data based and other approximate methods, instrument design, other MPP techniques-Grid interactive PV system.

Outcomes*: After this course, the student will be able to*

- *identify photovoltaic system components and system types and calculate electrical energy and power*
- *correctly size system components, design considerations of solar equipment*
- *design a basic grid-tie PV system*.

Text Books:

1.Generating electricity from Sun, F.C.Treble, Pergamon Press
2.Photvolatic systems: Analysis and design, A.K.Mukherjee, Nivedita Thakur, PHI 2011

References:

1.Solar Photovoltaics: Fundamentals, Technologies and applications, C.S.Solanki, PHI, 2009

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MAINTAINANCE OF ELECTRICAL SYSTEMS

(Open Elective-I)

Objectives:

- *to comprehend the basics of Engineering Materials and their testing.*
- *Know the UPS and SMPS and Maintenance of Electrical Power devices*
- *Understand the various Safety Procedures.*

UNIT I: Engineering Materials

Low Resistive Materials – Properties and applications, High Resistive Materials – Properties and applications, Insulating Materials - Properties and Applications, Thermocouple, Soldering.

UNIT II: Testing of Electrical Domestic Appliances

Tools & meters required for testing and repair of Domestic appliances-Principle, construction & working with fault finding, dismantling, assembling and testing after repair of the Domestic appliances. Open circuit, Short circuit, Earth fault and Leakage tests on Electrical Domestic appliances

UNIT III: UPS and SMPS

Commercial power supply-Disturbances and Spikes in supply voltages- UPS – SMPS

UNIT IV: Maintenance of Electrical Power devices

Preventive and periodical maintenance schedule of Batteries (Dry / Wet), UPS / Inverters, DC & AC Motors, Motor starters (AC & DC), Air conditioners, Power transformers, Pole mounted & Plinth mounted transformer yards, Circuit breakers

UNIT V: Safety

Need of safety - Equipment used in Electrical and general safety - Different types of Electrical hazards / accidents - Causes of different Electrical hazards / accidents - Methods to avoid Electrical hazards / accidents - First-Aid methods followed to rescue a person met with Electric shock - Do's & Don't's of Electrical supervisor at Electrical substations - Different fire extinguishers- operation and application of different fire extinguishers.

***Outcomes**: After this course, the student will be able to*

- *Identify the Engineering materials and testing of domestic appliances.*
- *Know the use of UPS and SMPS and maintenance of power devices.*
- *Rescue a person met with Electric shock.*

Text Books:

1. Introduction to Engineering materials, B.K.Agarwal,TATA McGRAW-HILL Edition.
2. Study of Electrical Appliances and devices, K.B.Bhatia, Khanna publication.

References:

1. Electrical Technology Vol I to IV, B. L. Theraja, S. Chand & Co., New Delhi.
2. Operation & Maintenance of Electrical Machines Vol – I, B. V. S. Rao, Media Promoters & Publisher Ltd. Mumbai.
3. Operation & Maintenance off Electrical Machines Vol – II, B. V. S. Rao, Media Promoters & Publisher Ltd. Mumbai.
4. Preventive Maintenance, C.J. Hubert, Hand Books & Journals.

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ELECTRICAL MEASUREMENTS LAB

Objectives:

- *The function of engineering profession is to manipulate materials, energy and information there by dealing benefit for human kind.*
- *Knowledge that is traditionally guide by educational laboratory.*
- *A listing fundamental objectives is presented a long with suggestions for provide future research.*

Any TEN experiments are to be conducted.

1. Calibration and Testing of single phase energy Meter
2. Calibration of dynamometer power factor meter
3. Measurement of % ratio error and phase angle of given C.T. by comparison.
4. Schering Bridge & Anderson Bridge.
5. Measurements of 3 phase reactive power with single-phase wattmeter.
6. Measurement of parameters of a choke coil using 3 voltmeter and 3 ammeter methods.
7. Measurement of 3 phase power with single watt meter and 2 No's of C.T.
8. LVDT and capacitance pickup – characteristics and Calibration
9. PT Testing by Comparison – VG as Null Detector - Measurement of ratio error and phase angle of the given PT.
10. Resistance strain gauge – Strain measurements and calibrations.
11. Calibration LPF wattmeter – by Phantom testing
12. Dielectric oil testing using H.T. testing Kit
13. CT Testing using Mutual Inductor – Measurement of ratio error and phase angle of the given CT by Null Method.
14. Transformer turns ratio measurement using AC Bridge.

***Outcomes**: After this course, the student will be able to*

- *Interruption of precordial companies for rhythm analysis that exceed 15 seconds before each shock compromise the outcome of CPR and increase the sensitivity.*
- *The present study was under taken to evaluate the effects of these interruptions during the operation and the limiting known errors or uncertainty for a given formulae*
- *Choose correct device for the least error desired accuracy.*

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE III Year II-Semester

L	T	P	C
0	0	3	2

ADVANCED ENGLISH COMMUNICATION SKILLS LAB

1. Introduction

The introduction of the English Language Lab is considered essential at 3rd year level. At this stage the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be an integrated theory and lab course to enable students to use good' English and perform the following:

- Gather ideas and information, to organize ideas relevantly and coherently.
- Participate in group discussions.
- Face interviews.
- Write formal letters
- Write project/research reports/technical reports.
- Make oral presentations.
- To take part in social and professional communication.

2. Objectives:

This Lab focuses on using computer-aided multimedia instruction for language development to meet the following targets:

To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.

Further, they would be required to communicate their ideas relevantly and coherently in writing.

3. Syllabus:

The following course content is prescribed for the Advanced Communication Skills Lab:

Vocabulary Building –Word Roots, Prefixes and Suffixes, Study of Word Origin, Analogy, One-Word Substitutes, Synonyms and Antonyms, Idioms and Phrases.

Reading Comprehension – Reading for Facts, Guessing meanings from context, Skimming, Scanning, Inferring Meaning, and Critical Reading.

Writing Skills – Coherence, Cohesion, Sub-skills in writing, Letter Writing, Resume Writing, Covering Letter, e-correspondence.

Technical Writing- Formats and Styles of Technical Report Writing, Research Abilities/Data Collection/Organizing Data/Tools/Analysis.

Group Discussion – Dynamics of Group Discussion, Intervention, Summarizing, Modulation of Voice, Body Language, Relevance, Fluency.

Presentation Skills – Oral presentations (individual and group) through JAM sessions/Seminars, Written Presentations (Projects/ PPTs) through e-mails.

Interview Skills – Strategies of Pre, During and Post – Interview Skills, Opening, Answering Strategies, Interview through Telephone and Video-Conferencing.

4. Minimum Requirement: The English Language Lab shall have two parts:

i) The Computer aided Language Lab for 30 students with 30 systems, one master console, LAN facility and English language software for self- study by learners.
ii) The Communication Skills Lab with chairs and audio-visual aids with a P.A System, a T. V., a digital stereo –audio & video system and camcorder etc.

System Requirement (Hardware component): Computer network with LAN with minimum 30 multimedia systems with the following specifications:
i) P – IV Processor
a) Speed – 2.8 GHZ
b) RAM – 512 MB Minimum
c) Hard Disk – 80 GB
ii) Headphones of High quality

5. **Suggested Software:**

The software consisting of the prescribed topics elaborated above should be procured and used.

Suggested Software:

- Clarity Pronunciation Power – part II
- Oxford Advanced Learner's Compass, 7th Edition
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dreamtech.
- TOEFL & GRE(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- The following software from "train2success.com'
  i. Preparing for being Interviewed,
  ii. Positive Thinking,
  iii. Interviewing Skills,
  iv. Telephone Skills,
  v. Time Management
  vi. Team Building,
  vii. Decision making
- English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge

6. Books Recommended:

1. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
2. Advanced Communication Skills Laboratory Manual by Sudha Rani, D, Pearson Education 2011.
3. English Language Communication : A Reader cum Lab Manual Dr A. Ramakrishna Rao, Dr G. Natanam & Prof S.A. Sankaranarayanan, Anuradha Publications, Chennai 2008.
4. English Vocabulary in Use series, Cambridge University Press 2008.
5. Management Shapers Series by Universities Press(India)Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
7. Handbook for Technical Writing by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. Master Public Speaking by Anne Nicholls, JAICO Publishing House, 2006.
10. English for Technical Communication for Engineering Students, Aysha Vish hwamohan, Tata Mc Graw-Hil 2009.
11. Books on TOEFL/GRE/GMAT/CAT/ IELTS by Barron‘s/DELTA/Cambridge University Press.
12. International English for Call Centres by Barry Tomalin and Suhashini Thomas, Macmillan Publishers, 2009.

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE IV Year I-Semester

L	T	P	C
3	1	0	3

MICROPROCESSORS AND MICROCONTROLLERS

Objectives:

- *To learn the Architecture, addressing modes and instruction set of 8086, 8051 and ARM processor.*
- *To learn the programming concepts of 8086, 8051 and ARM processor.*
- *Interface various peripherals to 8086 and 8051*

UNIT I:

8086 Architecture: Functional Diagram, Register Organization, Addressing modes, Instructions, Functional schematic, Minimum and Maximum mode operations of 8086, 8086 Control signal interfacing, Timing diagrams.

UNIT II:

Assembly Language Programming Of 8086: Assembly Directives, Macro's, Simple Programs using Assembler, Implementation of FOR Loop, WHILE, REPEAT and IF-THEN-ELSE Features.

UNIT III:

I/O Interface: 8255 PPI, Various modes of operations and interface of I/O devices to 8086, A/D, D/A Converter Interfacing.

Interfacing with advanced devices:8086 System bus structure, Memory and I/O Interfacing with 8086, Interfacing through various IC Peripheral Chips, 8257 (DMA Controller), 8259 (Interrupt Priority Control).

Communication Interface: Serial Communication Standards, USART Interfacing RS-232, IEEE-488, 20mA Current Loop, Prototyping and Trouble shooting, Software Debugging tools, MDS.

UNIT IV:

Introduction To Micro Controllers : Overview of 8051 Micro Controller, Architecture, I/O ports and Memory Organization, Addressing modes and Instruction set of 8051, Simple Programs using Stack Pointer, Assembly language programming.

UNIT V:

8051 Real Time Control and Industrial Applications: Interrupts, Timer/Counter and Serial Communication, Programming Timer Interrupts, Programming External H/W interrupts, Programming the serial communication interrupts, Interrupt Priority in the 8051, Programming 8051 Timers, Counters and Programming. Applications of Micro Controllers, Interfacing 8051 to LED's, Push button, Relay's and Latch Connections, Keyboard Interfacing, Interfacing Seven Segment Display, ADC and DAC Interfacing.

Outcomes:

- *Explain the internal Architecture of 8086 microprocessors and evolution of microprocessors, Demonstrate the 8086 microprocessor Maximum mode and Minimum mode systems.*
- *Use 8086 Instructions and Assembler directives for developing 8086 assembly programs with an assembler and the 8051Architecture and evolution of microcontrollers.*
- *Develop interfacing of 8086 microprocessor with digital peripherals using Programmable parallel port, analog peripherals – ADC and DAC and the internal architecture of AVR RISC MI, the use of Interrupts and Interrupt responses, Demonstrate Direct Memory Access data transfer.*

TEXTBOOKS:

1. Kenneth J Ayala, "The 8051 Micro Controller Architecture, Programming and Applications", Thomson Publishers, 2nd Edition.
2. D.V.Hall, "Micro Processor and Interfacing ", Tata McGraw-Hill.

REFERENCE BOOKS:

1. Ajay V. Deshmukh, "Microcontrollers – theory applications", Tata McGraw-Hill Companies – 2005.
2. Ray and BulChandi, "Advanced Micro Processors", Tata McGraw-Hill.
3. Kenneth J Ayala, "The 8086 Micro Processors Architecture, Programming and Applications", Thomson Publishers, 2005.
4. Microcomputer Systems: The 8086/8088 Family: Architecture, Programming and Design, 2nd ed., Liu & Gibson

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE IV Year I-Semester	L	T	P	C
	4	1	0	4

POWER SYSTEM OPERATION & CONTROL

Objectives: *Objectives of this course are*

- *To deal with economic operation of power systems and hydrothermal systems.*
- *To deal with modeling of power system components*
- *To emphasis load frequency control and reactive power control*.

UNIT - I

Economic Operation

Optimal operation of Generators in Thermal Power Stations, - Heat rate Curve – Cost Curve – Incremental fuel and Production costs, input-output characteristics, Optimum generation allocation with line losses neglected. Optimum generation allocation including the effect of transmission line losses – Loss coefficients, General transmission line loss formula.

UNIT - II

Hydro Thermal Scheduling

Optimal scheduling of Hydrothermal System: Hydroelectric power plant models, scheduling problems-Short term hydrothermal scheduling problem.

UNIT- III

Modelling of Power System Components

Modelling of Governor: Mathematical Modelling of Speed Governing System – Derivation of small signal transfer function. Modeling of Turbine: First order Turbine model, Block Diagram representation of Steam Turbines and Approximate Linear Models. Modelling of Generator (Steady State and Transient Models): Description of Simplified Network Model of a Synchronous Machine (Classical Model), Description of Swing Equation (No Derivation) and State-Space II-Order Mathematical Model of Synchronous Machine -Generator – Load Model. Modelling of Excitation System: Fundamental Characteristics of an Excitation system, Transfer function, Block Diagram Representation of IEEE Type-1 Model

UNIT- IV

Load Frequency Control

Necessity of keeping frequency constant-Definitions of Control area – Single area control – Block diagram representation of an isolated power system – Steady state analysis – Dynamic response –Controlled and Uncontrolled cases. Load frequency control of 2-area system – uncontrolled case and controlled case, tie-line bias Control Proportional plus Integral control of single area and its block diagram representation, steady state response – Load Frequency Control and Economic dispatch control.

UNIT-V

Reactive Power Control

Overview of Reactive Power control – Reactive Power compensation in transmission systems – advantages and disadvantages of different types of compensating equipment for transmission systems; load compensation – Specifications of load compensator, Uncompensated and compensated transmission lines: shunt and Series Compensation.

Outcomes: *After this course, the student will be able to*

- *economic operation of power systems and hydrothermal systems.*
- *Know the importance modeling of power system components.*
- *Understand the importance of load frequency control and reactive power control.*

TEXT BOOKS:

1. D.P. Kothari and I.J. Nagrath, "Modern Power System Analysis", Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
2. S. Sivanagaraju & G.Sreenivasan ,"Power System Operation and Control" - Pearson Education India, Eighth impression,2013.

REFERENCES:

1. Allen J. Wood, Bruce F. Wollenberg, Gerald B. Sheblé, "Power generation, Operation and Control", Wiley Publishers, 3rd Edition, 2013.
2. P S R Murthy, "Modelling of Power Systems components", BS Publications, 2nd edition, 2004.
3. Chakrabarti & Haldar, "Power System Analysis: Operation and Control", Prentice Hall of India, 2004 Edition.
4. C.L.Wadhwa , 'Power System Analysis', New Age International- 6th Edition, 2010.
5. Olle. I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill Publishing Company Ltd, New Delhi, 30th reprint, 2007

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE IV Year I-Semester

L	T	P	C
3	1	0	3

UTILIZATION OF ELECTRICAL ENERGY

Objectives:

- *Understand concepts of drives, heating, welding, illumination and traction.*
- *Able to design suitable schemes for welding, heating, drives, illumination and traction.*
- *Able to provide the fundamental concepts of traction*.

UNIT – I

Electric Drives

Type of electric drives, choice of motor, starting and running characteristics, speed control, temperature rise, types of industrial loads, continuous, intermittent and variable loads, load equalization, applications of electric drives.

UNIT – II

Electric Heating & Welding

Advantages and methods of electric heating, Resistance heating ,Induction heating and Dielectric heating.

Electric welding, Resistance and Arc welding, electric welding equipment, comparison between A.C. and D.C. Welding.

UNIT – III

Illumination

Introduction, terms used in illumination, laws of illumination, polar curves, Discharge lamps, MV , SV and LED lamps – comparison between tungsten filament lamps and fluorescent tubes, Basic principles of light control, Types and design of interior lighting and flood lighting.

UNIT – IV

Electric Traction – I

System of electric traction and track electrification. Review of existing electric traction systems in India. Special features of traction motor, methods of electric braking, plugging, rheostatic braking and regenerative braking. Mechanics of train movement. Speed-time curves for different services – trapezoidal and quadrilateral speed time curves.

UNIT – V

Electric Traction-II

Calculations of tractive effort, power, specific energy consumption for given run, effect of varying acceleration and braking retardation, adhesive weight and braking retardation, adhesive weight and coefficient of adhesion.

Outcomes: *At the end of this course student will have ability to*

- *Express working of electric drives.*
- *Articulate different types of heating, welding and illumination.*
- *Ability to understand concepts used in design electric traction*

TEXT BOOKS:

1. Art & Science of Utilization of electrical Energy – Partab, Dhanpat Rai & Sons, 2nd edition.
2. Utilizsation of Electric Power and Electric Traction by J.B. Gupta, S.K. Kataria & Sons, 10th edition.

REFERENCE BOOKS:

1. Generation, Distribution and Utilization of electrical Energy – C.L.Wadhwa, New Age International (P) Limited, Publishers, 2014, 3rd edition.
2. Utilization of Electrical Power including Electric drives and Electric traction – by N.V.Suryanarayana, New Age International (P) Limited, 2005.
3. Utilization of Electrical Power –Er.R.K.Rajput, Laxmi publications,2nd edition,2014.

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE IV Year I-Semester	L	T	P	C
	3	1	0	3

INSTRUMENTATION

(Professional Elective-III)

Objectives:

- Deals with the different types of errors in measurement & performance of CRO.
- Deals with the concept of different types of voltmeters & transducers.
- Can able to analyze impact instrument systems concerned with non electrical quantities.

UNIT-I

Characteristics of Signals

Measuring Systems, Performance Characteristics, - Static characteristics, Dynamic Characteristics; Errors in Measurement – Gross Errors, Systematic Errors, Random Errors.

Signals and their representation: Signal and their representation: Standard Test, periodic, aperiodic, modulated signal, sampled data, pulse modulation and pulse code modulation

UNIT-II

Oscilloscope

Cathode ray oscilloscope-Cathode ray tube-time base generator-horizantal and vertical amplifiers-CRO probes-applications of CRO-Measurement of phase and frequency-lissajous patterns-Sampling oscilloscope-analog and digital type

UNIT-III

Digital Voltmeters

Digital voltmeters- Successive approximation, ramp, dual-Slope integration continuos balance type-Micro processor based ramp type DVM digital frequency meter-digital phase angle meter

Signal Analyzers: Wave Analyzers- Frequency selective analyzers, Heterodyne, Application of Wave analyzers- Harmonic Analyzers, Total Harmonic distortion, spectrum analyzers, Basic spectrum analyzers, spectral displays, vector impedance meter, Q meter. Peak reading and RMS voltmeters

UNIT-IV

Transducers

Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of resistor, inductor, LVDT and capacitor transducers; LVDT Applications, Strain gauge and its principle of operation, gauge factor, Thermistors, Thermocouples, Synchros, Piezo electric transducers, photovoltaic, photo conductive cells, photo diodes.

UNIT-V

Measurement of Non-Electrical Quantities

Measurement of strain, Gauge Sensitivity, Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Vacuum, Flow and Liquid level.

Outcomes: *At the end of this course student will have ability to*

- Know the different types of errors in measurement & performance of CRO.
- Understand the different types of voltmeters, transducers & it's working applications.
- Learn non electrical quantities like velocity, angular velocity, pressure, torque, displacement.

TEXT BOOKS:

1. Transducers and Instrumentation - D.V.S Murthy, Prentice-Hall Of India Pvt. Limited, 2nd edition, 2012.
2. A course in Electrical and Electronic Measurements and Instrumentation- A.K. Sawhney, *Dhanpat Raj and Sons, New Delhi, 2015 edition.*

REFERENCE BOOKS:

1. Measurement Systems, Applications and Design – Ernest *O. Doebelin, International Student Edition, IV Edition, McGraw Hill Book Company, 1998.*
2. Principles of Measurement and Instrumentation – A.S Morris, 3rd Edition, Prentice Hall of India, 2012.
3. Electronic Instrumentation- H.S. Kalsi, Tata MC-Graw Hill 3rd Edition, 2010.
4. Modern Electronic Instrumentation and Measurement techniques – A.D Helfrick and W.D.Cooper, Pearson/Prentice Hall of India, first edition 2009.

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE IV Year I-Semester	L	T	P	C
	3	1	0	3

HIGH VOLTAGE ENGINEERING

(Professional Elective-III)

***Objectives**:*

- *Deals with Various Dielectric Materials, Numerical methods for electric field computation and Applications.*
- *Deals with high voltage generation.*
- *Deals with testing of electrical apparatus.*

UNIT I

Introduction

Electric Field Stresses, Gas / Vacuum as Insulator, Liquid Dielectrics, Solids and Composites, Estimation and Control of Electric Stress, Numerical methods for electric field computation, Surge voltages, their distribution and control, Applications of insulating materials in transformers, rotating machines, circuit breakers, cable power capacitors and bushings.

UNIT II

Break Down in Gaseous, Solid and Liquid Dielectrics

Gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law. Liquid as Insulator, pure and commercial liquids, breakdown in pure and commercial liquids. Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, Breakdown in composite dielectrics, solid dielectrics used in practice.

UNIT III

Generation and Measurements of High Voltages and Currents

Generation of High Direct Current Voltages, Generation of High alternating voltages, Generation of Impulse Voltages, Generation of Impulse currents, Tripping and control of impulse generators. Measurement of High Direct Current voltages, Measurement of High Voltages alternating and impulse, Measurement of High Currents-direct, alternating and Impulse, Oscilloscope for impulse voltage and current measurements.

UNIT IV

Over Voltage Phenomenon and Insulation Co-Ordination

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

UNIT V

Non-Destructive and High Voltage Testing

Measurement of D.C Resistivity, Measurement of Dielectric Constant and loss factor, Partial discharge measurements. Testing of Insulators and bushings, Testing of Isolators and circuit breakers, Testing of cables, Testing of Transformers, Testing of Surge Arresters, Radio Interference measurements.

Outcomes: *Acquire the knowledge*

- *About the dielectrics how to evaluate electric field streams and applications of insulating materials and breakdown of dielectric quire the knowledge.*
- *Acquire the knowledge about generation of high voltages and insulating coordination.*
- *Acquire the knowledge about the testing of electric equipments.*

TEXT BOOKS:

1. High Voltage Engineering - M.S.Naidu and V. Kamaraju – TMH Publications, 3rd Edition, 2009.
2. High Voltage Engineering - C.L.Wadhwa, New Age Internationals (P) Limited, 1997 1st & 3rd edition.

REFERENCE BOOKS:

1. High Voltage Engineering: Fundamentals - E.Kuffel, W.S.Zaengl, J.Kuffel, Elsevier publications, 2nd Edition, 2000.
2. High Voltage Insulation Engineering - Ravindra Arora, Wolfgang Mosch, New Age International (P) Limited, 1995.

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE IV Year I-Semester

L	T	P	C
3	1	0	3

OPTIMIZATION TECHNIQUES

(Professional Elective-III)

Objectives:

- *Deals with Classical Optimization Techniques and Linear Programming.*
- *Deals with optimization techniques and dynamic programming.*
- *Deals with optimization techniques, linear programming, simplex algorithm, transportation problem.*

UNIT – I

Introduction and Classical Optimization Techniques:

Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.

Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

UNIT – II

Linear Programming and Transportation Problem

Linear Programming: 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 to the simplex method – simplex algorithm.

Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.

UNIT – III

Unconstrained Nonlinear Programming and Optimization Techniques

Unconstrained Nonlinear Programming:

One–dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method

Unconstrained Optimization Techniques

Univariate method, Powell's method and steepest descent method.

UNIT – IV Constrained Nonlinear Programming:

Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods. Introduction to convex Programming Problem.

UNIT – V Dynamic Programming:

Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

Outcomes: *After this course, the student will be able to*

- *explain the need of optimization of engineering systems, optimization of electrical and electronics engineering problems.*
- *apply classical optimization techniques, linear programming, simplex algorithm, transportation problem*
- *apply unconstrained optimization and constrained non-linear programming and dynamic programming and formulate optimization problems*

TEXT BOOKS:

1. Engineering optimization: Theory and practice- S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.
2. Operations Research – Dr. S.D.Sharma, Kedar Nath Ram Nath and Co. ,Meerut, 10th edition, 1992
3. Optimization Methods in Operations Research and systems Analysis" – K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.

REFERENCE BOOKS:

1. Introductory Operations Research - H.S. Kasene & K.D. Kumar, Springer(India), Pvt. Ltd.
2. Operations Research: An Introduction – H.A. Taha, PHI Pvt. Ltd., 6th edition, 2012.
3. Linear Programming – G. Hadley, Addison-Wesley. Publishing Co, 1963.

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE IV Year I-Semester	L	T	P	C
	3	1	0	3

ADVANCED CONTROL SYSTEMS

(Professional Elective-IV)

***Objectives**:*

- *Able to learn about State Space Representation and find solution of State Equation, State Transition Matrix.*
- *Understand the concepts of Controllability and Observability for controlling the systems.*
- *Analyze Describing functions, Phase Plane and Stability Analysis*.

UNIT – I

State Space Analysis , Controllability & Observability

State Space Representation, Solution of State Equation, State Transition Matrix, Canonical Forms – Controllable Canonical Form, Observable canonical Form, Jordan Canonical Form.
Test for controllability and Observability for continuous time systems – Time varying case, minimum energy control, time invariant case, Principle of Duality, Controllability and Observability from Jordan canonical form and other canonical forms.

UNIT – II

Stability Analysis

Stability: Stability in the sense of Lyapunov. Lyapunov's stability and Lyapunov's instability theorems, Direct method of Lyapunov for the linear and nonlinear continuous time autonomous systems.

UNIT – III

Phase-Plane Analysis

Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase-plane analysis of nonlinear control systems. Describing Function Analysis: Introduction to nonlinear systems, Types of nonlinearities, describing functions, describing function analysis of nonlinear control systems.

UNIT – IV

Modal Control

Modal Control: Effect of state feedback on controllability and observability. Pole placement by state feedback, Full order observer and reduced order observer. Calculus Of Variations: Calculus of variations approach: minimization of functionals of single function, constrained minimization, minimum principle, control variable inequality constraints. Control and state variable inequality constraints. Euler Lagrangie Equation.

UNIT – V

Optimal Control

Optimal Control: Formulation of optimal control problem, Minimum time, Minimum energy, minimum fuel problems, State regulator problem, Output regulator problem, Tracking problem, Continuous-Time Linear Regulators.

Outcomes:

- *Can able to analyze state space representation and solution of state equation state transition matrix.*
- *Understand the concepts of controllability and observability for controlling the system.*
- *Analyze the describing functions, phase plane and stability analysis.*

TEXT BOOKS:

1. Modern control system theory – M.Gopal, New Age international publishers, 3nd edition, 2014.
2. Advanced Control Theory – A. Nagoorkani, RBA Publications, 2nd edition 2014.

REFERENCE BOOKS:

1. Modern control engineering – K.Ogata, Prentice-Hall of India, 5rd edition, 2010.
2. Digital control and state variable methods – M.Gopal, Tata Mc.Grawhill companies, 4TH EDITION 2012.
3. Computational aids in control systems using MATLAB – HadiSaadat, Mc.GrawHill companies, 1993.
4. Distributed computer control systems – S.S.Lamba and V.P.Singh.

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE IV Year I-Semester	L	T	P	C
	3	1	0	3

NEURAL NETWORKS AND FUZZY LOGIC

(Professional Elective-IV)

Objectives:

- *This course introduces the basics of Neural Networks and essentials of Artificial Neural Networks with Single Layer and Multilayer Feed Forward Networks.*
- *This course deals with Associate Memories*
- *This course introduces fuzzy logic in the applications of neural networks and fuzzy logic*

UNIT – I

Introduction to Neural Networks

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, , ANN Architectures, Types of neuron models: Integrate-and-Fire Neuron Model, Spiking Neuron Model, McCulloch-Pitts Model, Characteristics and Operation of ANN, Historical Developments and Potential Applications of ANN. Types of Neuron Activation Function, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Applications

UNIT–II

Feed Forward Neural Networks

Single layer: Introduction, Perceptron Models- Discrete, Continuous, Training Algorithms- Discrete and Continuous Perceptron Networks,

Multi layer: Generalized Delta Rule, Derivation of Back propagation (BP) Training, Summary of Back propagation Algorithm, Learning Difficulties and Improvements.

UNIT- III

Associative Memories

Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory), Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm

Architecture of Hopfield Network: Discrete and Continuous versions

UNIT – IV

Classical & Fuzzy Sets

Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

Fuzzy Logic System Components:Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

UNIT- V

Applications

Neural network applications: Process identification, control, fault diagnosis and load forecasting. Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.

Outcomes: *After this course, the student*

- *To understand artificial neural network models and their training algorithms*
- *To understand the concept of fuzzy logic system components, fuzzification and defuzzification*
- *applies the above concepts to real-world problems and applications*.

TEXT BOOKS:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications - Rajasekharan and G A Vijayalaxmipai ,Rai – PHI Publication, 2010.
2. Introduction to Artificial Neural Systems – Jacek M Zurada, Jaico publishing house 1997

REFERENCE BOOKS:

1. Neural Networks and learning machines: Foundations, Pearson Education, 3rd edition 2016.
2. Neural Networks – James A Freeman and Davis Skapura, Pearson Education, 1st edition 1991.
3. Neural Engineering - C.Eliasmith and CH.Anderson, PHI, 2004.
4. Neural Networks and Fuzzy Logic System - Bart Kosko, PHI Publications,2003.

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE IV Year I-Semester	L	T	P	C
	3	1	0	3

LINEAR SYSTEM ANALYSIS

(Professional Elective-IV)

***Objectives**:*

- *Systematic development of linear system response models in both the time and frequency domains, Concentrates on continuous system models.*
- *Techniques developed include Laplace transform, Fourier analysis, impulse response, convolution, and state variables for continuous linear systems.*
- *Sampling theorem analysis and Z-Transforms.*

UNIT-I:

State Variable Analysis

Choice of state variables in Electrical networks-Formulation of state equations for Electrical networks-Equivalent source method. Network topological method - Solution of state equations-Analysis of simple networks with state variable approach.

UNIT–II

Fourier series and Fourier Transform Representation

Introduction, Trigonometric form of Fourier series, Exponential form of Fourier series, Wave symmetry, Fourier integrals and transforms, Fourier transform of a periodic function , Properties of Fourier Transform , Parseval's theorem , Fourier transform of some common signals, Fourier transform relationship with Laplace Transform. Introduction, Effective value and average values of non sinusoidal periodic waves, currents, Power Factor, Effects of harmonics, Application in Circuit Analysis, Circuit Analysis using Fourier Series.

UNIT – III

Laplace Transform

Application of Laplace transform Methods of Analysis – Response of RL, RC, RLC Networks to Step, Ramp, and impulse functions, Shifting Theorem – Convolution Integral – Applications
Testing of Polynomials & Network Synthesis: Elements of reliability-Hurwitz polynomials-positive real functions-Properties-Testing-Sturm's Test, examples. Synthesis of one port LC networks-Foster and Cauer methods-Synthesis of RL and RC one port networks-Foster and Causer methods

UNIT-IV

Sampling

Sampling theorem – Graphical and Analytical proof for Band Limited Signal impulse sampling, natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, introduction to Band Pass sampling, Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Power density spectrum, Relation between auto correlation function and Energy / Power spectral density function.

UNIT-V

Z-Transforms

Fundamental difference between continuous and discrete time signals, discrete time complex, exponential and sinusoidal signals, periodicity of discrete time complex exponential, concept of Z-Transform of a discrete sequence. Distinction between Laplace, Fourier and Z-Transforms. Region of convergence in Z-Transforms, constraints on ROC for various classes of signals, Inverse Z-Transform properties of Z-Transforms.

Outcomes: After completing this course the students should be able to:

- *Know and be able to apply properties of linear time-invariant systems.*
- *Represent periodic waveforms by Fourier series.*
- *Solve differential equations using Laplace Transforms and Analyze systems using Laplace*

and Fourier Transform techniques

TEXT BOOKS:

1. Lathi BP: Linear Systems and Signals, Oxford University Press, 2nd edition, 2004, ISBN 0195158334.
2. Network Analysis and Synthesis – Umesh Sinha- Satya Prakashan Publications,2010 ISBN 9788176843423
3. Linear system analysis by U.A.Bakshi, J.S.Chitode, Technical Publications, 2009, ISBN 8184317409, 9788184317404
4. Network Analysis and Synthesis (Including Linear System Analysis) by Wadhwa C.L 3rd Edition, ISBN: 978-81-224-2036-4

REFERENCE BOOKS:

1. Linear System Analysis – A N Tripathi, New Age International, 2007.
2. Network and Systems – D Roy Chowdhary, New Age International, 2nd edition, 2005.
3. Engineering Network Analysis and Filter Desgin- Gopal G. Bhise, Prem R. Chadha, Durgesh C. Kulshreshtha - Umesh Publications, 2009.
4. Linear system anlysis - A.Cheng, Oxford publishers.

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE IV Year I-Semester	L	T	P	C
	3	1	0	3

ENERGY STORAGE SYSTEMS

(Open Elective-II)

Objectives: *Objectives of this course are*

- *To enable the student to understand the need for energy storage.*
- *To understand the devices and technologies available and their applications.*
- *To enable the various types of energy storage and various devices used for the purpose.*

UNIT-I

INTRODUCTION:

Need of Energy Storage, Different modes of Energy Storage.

ENERGY STORAGE:

Potential Energy: Pumped Hydro Storage, KE and Compressed gas system: Flywheel Storage, Compressed air energy Storage, Electrical and magnetic energy storage: Capacitors, Electromagnets and battery storage systems.

UNIT-II

Chemical Energy Storage: Thermo-Chemical, Bio-Chemical, Electro-Chemical, Fossil fuels and synthetic fuels and Hydrogen storage.

SENSIBLE HEAT STORAGE: SHS mediums, Stratified storage systems, Rock-bed storage systems, Thermal storage in buildings, Earth storage, Energy storage in aquifers, Heat storage in SHS systems, Aquifers storage

.

UNIT-III

LATENT HEAT THERMAL ENERGY STORAGE:

Phase Change Materials(PCMs), Selection Criteria Of PCMs, Stefan Problem, Solar Thermal LHTES Systems, Energy Conservation Through LHTES Systems, LHTES Systems in Refrigeration and Air Conditioning Systems.

Unit-VI

SOME AREAS OF APPLICATION OF ENERGY STORAGE:

Enthalpy formulation, Numerical heat transfer in melting and freezing process Food Preservation, Waste Heat Recovery, Solar Energy Storage, Green House Heating,

Unit-V

APPLICATIONS:

Power Plant Applications, Drying and Heating for Process Industries.

Outcomes: *After this course, the student*

- *Can analyze the characteristics of energy from various sources and need for storage*
- *Can classify various types of energy storage and various devices used for the purpose*
- *Can apply the same concepts to real time problem.*

Text Books:

1. H.P.Garg et al, D Reidel (1885)*"Solar Thermal Energy Storage",* Publishing Co.
2. V Alexiades & A.D.Solomon(1993) *"Mathematical Modeling of Melting and Freezing Proces" ,* Hemisphere Publishing Corporation,

References:

1. WashingtonNarayan R, Viswanath B(1998), *Chemical and Electro Chemical Energy System,* Universities Press
2. A. Ter-Gazarian(1994)*, "Energy Storage for Power Systems", Peter* Peregrinus Ltd.London
3. B.Kilkis and S.Kakac (1989),"*Energy Storage Systems",*(Ed),KAP,London,1989

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE IV Year I-Semester	L	T	P	C
	3	1	0	3

ELECTRICAL ENGINEERING MATERIALS

(Open Elective-II)

Objectives:

- *To understand the importance of various materials used in electrical engineering.*
- *To analyze semiconducting and magnetic materials and their behavior.*
- *To evaluate semiconductor materials and special purpose materials.*

UNIT-I

Introduction to Electrical Engineering Materials

Band theory, classification of electrical materials, characteristics of electrical materials

.**Conducting Materials**

Properties of conducting materials, types of conducting materials- copper, aluminum and silver, material used for special purpose like fuse, filaments, circuit breaker contacts, thermocouples materials, bimetals, soldering materials, materials used for instrumentation system.

UNIT-II

Insulating and Dielectric Materials

General property of insulating materials, polarization, dielectric constant, permittivity, surface resistivity and volume resistivity, dielectric strengths, puncture, flashover, types of insulating materials, classification of insulating material according to operating temperature, piezoelectric materials, ceramics: properties and application.

UNIT-III

Semiconducting Materials

Introduction to semiconductor physics, properties of semiconductor materials, silicon and germanium, intrinsic and extrinsic semiconductor, doping, hall effect, diffusion drift phenomenon, special semiconductors.

UNIT-IV

Magnetic Materials

Classification of magnetic material (Diamagnetic ferromagnetic, ferrite, paramagnetic material), soft and hard magnetic material, characteristics of magnetic material, properties of magnetic material (magnetization, permeability, coercivity, retentivity), B-H curve, Hysteresis phenomenon, iron loss, types, methods for reducing iron loss.

UNIT-V

Super Conducting Materials

Concepts of super conducting materials, types of super conducting materials, application of super conducting materials in electrical machines, power cables, electromagnets and future prospects.

Special Purpose Materials
Introduction and electrical applications of carbon nanotubes, electrical applications of SiC based devices.

Outcomes: *Will be able to*

- *Understand various types of dielectric materials, their properties in various conditions.*
- *Evaluate magnetic materials and their behavior.*
- *Evaluate semiconductor materials and technologies.*
- *Materials used in electrical engineering and applications*.

TEXT BOOKS

1. R K Rajput: A course in Electrical Engineering Materials, Laxmi Publications. 2009
2. T K BasaK: A course in Electrical Engineering Materials:, New Age Science Publications 2009
3. TTTI Madras: Electrical Engineering Materials.
4. Adrianus J.Dekker: Electrical Engineering Materials, THM Publication.

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE IV Year I-Semester	L	T	P	C
	0	0	3	2

ELECTRICAL SIMULATION LAB

Objectives:

- *Acquire Practical Knowledge on electrical circuits and power electronic circuits.*
- *Acquire Practical Knowledge on stability analysis and of linear circuits and modeling of transmission lines.*
- *Acquire Practical Knowledge on fault analysis, load flow and transient analysis of power system.*

Any Ten Experiments are to be conducted.

1. DC Transient response of series parallel RLC circuits.
2. Single phase full converter using RLE loads.
3. Single phase AC voltage controller using RLE Loads.
4. Single phase full bridge inverter with PWM controller.
5. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system.
6. State space model for classical transfer function.
7. Linear system analysis (Time domain analysis, Error analysis).
8. Developing a model of single phase rectifier.
9. Developing a model of single phase inverter.
10. Developing a model for single area load frequency problem.
11. Single phase half controlled converter using R and RL load.
12. Three phase fully controlled converter using R and RL load.
13. Fault analysis of power system.
14. Transient stability studies of a power system.
15. Load flow studies of power system.

Outcomes: *Will be able to gain*

- *Practical Knowledge on analysis of electrical circuits and power electronic circuits.*
- *Practical Knowledge on stability analysis and of linear circuits and modeling of transmission lines.*
- *Practical Knowledge on fault analysis, load flow and transient analysis of power system.*

REFERENCE:

1. Laboratory Manual

ANURAG ENGINEERING COLLEGE

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	0	0	3	2

MICROPROCESSORS AND MICROCONTROLLERS LAB

Note: Minimum 12 experiments should be conducted:
The Following programs are to be written for assembler and to be executed the same with 8086 and 8051 kits
List of Experiments:

1. Programmes for 16 bit arithmetic operations for 8086 (Using Various Addressing Modes).
2. Program for sorting an array for 8086.
3. Program for searching for a number or character in string for 8086.
4. Program for string manipulations for 8086.
5. Program for digital clock design using 8086.
6. Interfacing ADC and DAC to 8086.
7. Interfacing 8255 to 8086.
8. Serial communication between two microprocessor kits using 8251.
9. Interfacing to 8086 an programming to control stepper motor.
10. Interfacing LCD to 8086
11. Interfacing 8259 PIC to 8086.
12. Interfacing 8279 keyboard controller to 8086.
13. SRAM/DRAM Interfacing to 8086.
14. Programming using arithmetic, logical and bit manipulation instructions of 8051.
15. Program and verify Timer/counter in 8051.
16. Program and verify Interrupt handling in 8051.
17. Communication between 8051 kit and PC.
18. Interfacing Matrix/Keyboard to 8051.
19. Data Transfer from Peripheral to Memory through DMA controller 8237/8257.

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE IV Year II-Semester	L	T	P	C
	3	1	0	3

HVDC TRANSMISSION & FACTS

(Professional Elective-V)

Objectives:

- *Understand operating principles of HVDC systems and control aspects.*
- *Deals with analysis of harmonics, filters, reactive power and power flow*
- *Understand concepts and control aspects of FACTS devices.*

UNIT—I

Introduction: Comparison of AC and DC transmission systems, application of DC transmission, types of DC links, typical layout of a HVDC converter station. HVDC converters, pulse number, analysis of Graetz circuit with and without overlap, converter bridge characteristics.

UNIT—II

Converter & HVDC System Control: Principles of DC Link Control — Converters Control Characteristics — system control hierarchy, firing angle control, current and extinction angle control, starting and stopping of DC link.

UNIT-III

Harmonics, Filters and Reactive Power Control: Introduction, generation of harmonics, AC and DC filters. Reactive Power Requirements in steady state, sources of reactive power.

Power Flow Analysis in AC/DC Systems: Modeling of DC/AC converters, Controller Equations-Solutions of AC/DC load flow —Simultaneous method-Sequential method.

UNIT-IV

Introduction to FACTS: Flow of power in AC parallel paths and meshed systems, basic types of FACTS controllers, brief description and definitions of FACTS controllers.

Static Shunt Compensators: Objectives of shunt compensation, methods of controllable VAR generation, static VAR compensators, SVC and STATCOM, comparison between SVC and STATCOM.

UNIT-V

Static Series Compensators : GCSC, TSSC, TCSC & SSSC, Objectives of series compensator, Variable impedance type series compensators, Basic operating control schemes, Power angle characteristics, Control range and VA rating, External control.

Combined Compensators: Introduction, unified power flow controller (UPFC), basic operating principle, independent real and reactive power flow controller, control structure.

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Outcomes: *The student will be able to*

- *Acquire the knowledge to compare AC and HVDC systems in terms of power transmission and stability.*
- *Acquire knowledge on analysis of harmonics, filters, reactive power and power flow in HVDC systems.*

- *Acquire knowledge in improving the transmission capability and stability of the power system by applying FACTS controllers.*

TEXT BOOKS:

1. HVDC Transmission – S Kamakshaiah, V Kamaraju, Tata Mc. Graw Hill Publications, First Edition, 2011.
2. "Understanding FACTS –Concepts and Technology of Flexible AC Transmission Systems" Narain G. Hingorani, Laszlo Gyugyi, Wiley India publications, 2011.

REFERENCE BOOKS:

1. K.R. Padiyar, 'HVDC Power Transmission System', 3rd Edition, New Age International, 2015.
2. EHVAC and HVDC Transmission Engineering and Practice – S.Rao, Khanna Publishers, 1990.
3. HVDC Transmission – J.Arrillaga, IEE, 2nd Edition, 1998.
4. Direct Current Transmission – E.W.Kimbark, Volume I, John Wiley & Sons, 1971.

ANURAG ENGINEERING COLLEGE
(AUTONOMOUS)

B.Tech EEE IV Year II-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

SMART GRID
(Professional Elective-V)

Objectives:

- *Ability to understand the concept of smart grod electric power system.*
- *Can able analyze the dynamic energy management system.*
- *Ablity to analyze the new roles of utilities and consumers in smart grid.*

UNIT–I:

INTRODUCTION

Introduction to smart grid- Electricity network-Local energy networks- Electric transportation-Low carbon central generation-Attributes of the smart grid- Alternate views of a smart grid.

SMART GRID TO EVOLVE A PERFECT POWER SYSTEM: Introduction- Overview of the perfect power system configurations- Device level power system- Building integrated power systems- Distributed power systems- Fully integrated power system-Nodes of innovation.

UNIT–II:

DC DISTRIBUTION AND SMART GRID

AC vs DC sources-Benefits of and drives of DC power delivery systems-Powering equipment and appliances with DC-Data centers and information technology loads-Future neighborhood-Potential future work and research.

INTELLIGRID ARCHITECTURE FOR THE SMARTGRID: Introduction- Launching intelligrid-Intelligrid today- Smart grid vision based on the intelligrid architecture-Barriers and enabling technologies.

UNIT–III:

DYNAMIC ENERGY SYSTEMS CONCEPT

Smart energy efficient end use devices-Smart distributed energy resources-Advanced whole building control systems- Integrated communications architecture-Energy management-Role of technology in demand response- Current limitations to dynamic energy management-Distributed energy resources-Overview of a dynamic energy management-Key characteristics of smart devices- Key characteristics of advanced whole building control systems-Key characteristics of dynamic energy management system.

UNIT–IV:

ENERGY PORT AS PART OF THE SMART GRID:

Concept of energy -Port, generic features of the energy port.

POLICIES AND PROGRAMS TO ENCOURAGE END – USE ENERGY EFFICIENCY: Policies and programs in action -multinational - national-state-city and corporate levels.

MARKET IMPLEMENTATION: Framework-factors influencing customer acceptance and response - program planning-monitoring and evaluation.

UNIT–V:

EFFICIENT ELECTRIC END – USE TECHNOLOGY ALTERNATIVES

Existing technologies – lighting - Space conditioning - Indoor air quality - Domestic water heating - hyper efficient appliances - Ductless residential heat pumps and air conditioners – Variable refrigerant flow air conditioning-Heat pump water heating - Hyper efficient residential appliances -Data center energy efficiency- LED street and area lighting - Industrial motors and drives - Equipment retrofit and replacement - Process heating - Cogeneration, Thermal energy storage - Industrial energy management programs - Manufacturing process-Electro-technologies, Residential, Commercial and industrial sectors.

Outcomes: *The student will be able to*

- *Understand the concept of smart grid electric power systems and intergrid architecture for the smart grid.*
- *Analyze the dynamic energy management system.*
- *Analyze the new goals of utilities and consumers in smart grid and market opportunities and potential gains.*

TEXT BOOKS:

1. "The Smart Grid, Enabling Energy Efficiency and Demand Side Response"- Clark W Gellings, CRC Press, 2009.
2. "Smart Grid: Technology and Applications"- Janaka Ekanayake, Kithsiri Liyanage, Jianzhong.Wu, Akihiko Yokoyama, Nick Jenkins, Wiley, 2012.
3. "Smart Grid :Fundamentals of Design and Analysis"-James Momoh, Wiley, IEEE Press, 2012.

ANURAG ENGINEERING COLLEGE
(AUTONOMOUS)

B.Tech EEE IV Year II-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

POWER QUALITY
(Professional Elective-V)

Objective:

- Understand the various power quality phenomenon, their origin and monitoring and mitigation methods
- Sources of sags and transient over voltages, distribution system analysis and protection
- Protection devices, harmonic distortion, principles for controlling harmonics, devices for filtering harmonics**,** Monitoring power quality, and power quality improvement.

UNIT-I:
INTRODUCTION
Introduction of the Power Quality (PQ) problem, Terms used in PQ: Voltage, Sag, Swell, Surges,Harmonics, over voltages, spikes, Voltage fluctuations, Transients, Interruption, overview of power quality phenomenon, Remedies to improve power quality, power quality monitoring.

UNIT-II:
LONG & SHORT INTERRUPTIONS
Interruptions – Definition – Difference between failures, outage, Interruptions – causes of Long Interruptions – Origin of Interruptions – Limits for the Interruption frequency – Limits for the interruption duration – costs of Interruption – Overview of Reliability evaluation to power quality, comparison of observations and reliability evaluation.
Short interruptions: definition, origin of short interruptions, basic principle, fuse saving, voltage magnitude events due to re-closing, voltage during the interruption, monitoring of short interruptions, difference between medium and low voltage systems. Multiple events, single phase tripping – voltage and current during fault period, voltage and current at post fault period, stochastic prediction of short interruptions.

UNIT III:
1 & 3-PHASE VOLTAGE SAG CHARACTERIZATION
Voltage sag – definition, causes of voltage sag, voltage sag magnitude, and monitoring, theoretical calculation of voltage sag magnitude, voltage sag calculation in non-radial systems, meshed systems, and voltage sag duration. Three phase faults, phase angle jumps, magnitude and phase angle jumps for three phase unbalanced sags, load influence on voltage sags.

UNITIV:
POWER QUALITY CONSIDERATIONS IN INDUSTRIAL POWER SYSTEMS
Voltage sag – equipment behavior of Power electronic loads, induction motors, synchronous motors, computers, consumer electronics, adjustable speed AC drives and its operation. Mitigation of AC Drives, adjustable speed DC drives and its operation, mitigation methods of DC drives.

UNIT-V:

MITIGATION OF INTERRUPTIONS & VOLTAGE SAGS

Overview of mitigation methods – from fault to trip, reducing the number of faults, reducing the fault clearing time changing the power system, installing mitigation equipment, improving equipment immunity, different events and mitigation methods. System equipment interface – voltage source converter, series voltage controller, shunt controller, combined shunt and series controller.

Power Quality and EMC Standards:

Introduction to standardization, IEC Electromagnetic compatibility standards, European voltage characteristics standards, PQ surveys.

Outcomes:

- *Learn to distinguish between the various categories of power quality problems.*
- *Understand the root of the power quality problems in industry and their impact on performance and economics.*
- *Learn to apply appropriate solution techniques for power quality mitigation based on the type of problem.*

Text Book:

1."Understanding Power Quality problems" by Math HJ Bollen, IEEE press
2. R. Dugan, M. McGranahan, S. Santoso, W. Beaty, *Electric Power Systems Quality,*3rd Edition (McGraw-Hill, New York, NY, 2012).
3. J. Arrillaga, B. Smith, N. Watson and A. Wood, Power System Harmonic Analysis, John Wiley, 2nd edition, 2003, ISBN 0-471-97548-6.
4. A. Ghosh and G. Ledwich, Power Quality Enhancement Using Custom Power Devices, Kluwer Academic Publications, 2nd edition, 2002, ISBN 1-4020-7180-9

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE IV Year II-Semester	L	T	P	C
	3	1	0	3

EHVAC Transmission

(Professional Elective-VI)

***Objectives**:*

- *This course introduces the necessity of EHVAC transmission line.*
- *It introduces calculation of voltage gradient of conductors corona effects in EHV line.*
- *Calculation of electro static field of EHVAC lines and studying voltage control along with power circle diagram and analyze the test performed large transmission lines over bulk power lines.*

UNIT – I

Preliminaries

Necessity of EHV AC transmission – advantages and problems–power handling capacity and line losses- mechanical considerations –– bundle conductor systems.

Line inductance and capacitances – sequence inductances and capacitances – modes of propagation.

UNIT – II

Voltage gradients of conductors

Electrostatics – field of sphere gap – field of line changes and properties – charge – potential relations for multi-conductors – surface voltage gradient on conductors – distribution of voltage gradient on sub-conductors of bundle – Examples.

UNIT – III

Corona Effects

Corona in E.H.V. lines – Corona loss formulae- attention of traveling waves due to Corona – Audio noise due to Corona, its generation, characteristic and limits. Measurements of audio noise radio interference due to Corona - properties of radio noise – frequency spectrum of RI fields –Measurements of RI and RIV.

UNIT – IV

Electro Static Field

Electrostatic field: calculation of electrostatic field of EHV/AC lines – effect on humans, animals and plants – electrostatic induction in unenergised circuit of double-circuit line – electromagnetic interference-Examples. Traveling wave expression and solution- source of excitation- terminal conditions- open circuited and short-circuited end- reflection and refraction coefficients-Lumped parameters of distributed lines-generalized constants-No load voltage conditions and charging current.

UNIT –V

Voltage control

Power circle diagram and its use – voltage control using synchronous condensers – cascade connection of shunt and series compensation – sub synchronous resonance in series capacitor – compensated lines – static VAR compensating system.

Outcomes: *After this course, the student will be able to*

- *For mutual and solve mathematical model for physical starvation like production distribution goods and economics.*
- *Break down phenomenon of gases and to elucidate the concepts used for generating of high voltages and currents.*
- *Understanding high voltage testing techniques power apparatus and causes of over voltages in power system.*

TEXT BOOKS:

1. EHVAC Transmission Engineering - R. D. Begamudre, New Age International (p) Ltd, 3rd Edition, 2006.
2. EHVAC and HVDC Transmission Engineering and Practice – S.Rao, Khanna Publishers, 2015(Reprint).

REFERENCE BOOKS:

1. Extra High Voltage AC Transmission Engineering - Rokosh Das Begamudre, Wiley Eastern LTD., New Delhi, 1987.
2. EHV Transmission line - Electric Institution -Edison (GEC 1968).

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE IV Year II-Semester	L	T	P	C
	3	1	0	3

POWER SYSTEM RELIABILITY

(Professional Elective-VI)

***Objectives**:*

- *The course will give an introduction to the main principles and objectives of power system reliability analysis and overview of methodologies for reliability analysis of transmission and distribution systems.*
- *It deals with Analysis of time dependencies and interruption costs, impact from protection systems, and life time modeling for maintenance optimization.*
- *Select methods*, which can contribute to the answers and questions connected with the reliability.

UNIT – I

Basics of Probability theory & Distribution

Basic probability theory – rules for combining probabilities of events – Bernoulli's trials – probabilities density and distribution functions – binomial distribution – expected value and standard deviation of binomial distribution.

UNIT – II

Network Modeling and Reliability Analysis

Analysis of Series, Parallel, Series-Parallel networks – complex networks – decomposition method.

Reliability functions: Reliability functions f(t), F(t), R(t), h(t) and their relationships – exponential distribution – Expected value and standard deviation of exponential distribution – Bath tub curve – reliability analysis of series parallel networks using exponential distribution – reliability measures MTTF, MTTR, MTBF.

UNIT – III

Markov Modeling

Markov chains – concept of stochastic transitional probability Matrix, Evaluation of limiting state Probabilities. – Markov processes one component repairable system – time dependent probability evaluation using Laplace transform approach – evaluation of limiting state probabilities using STPM – two component repairable models**.**

UNIT – IV

Frequency & Duration Techniques

Frequency and duration concept – Evaluation of frequency of encountering state, mean cycle-time, for one, two component repairable models – evaluation of cumulative probability and cumulative frequency of encountering of merged states.

Generation System Reliability Analysis: Reliability model of a generation system– recursive relation for unit addition and removal – load modeling - Merging of generation load model –

evaluation of transition rates for merged state model – cumulative Probability, cumulative frequency of failure evaluation – LOLP, LOLE.

UNIT – V

Composite Systems Reliability Analysis

Decompositions method – Reliability Indices – Weather Effects on Transmission Lines. Distribution System and Reliability Analysis: Basic Concepts – Evaluation of Basic and performance reliability indices of radial networks.

Outcomes: *After this course, the student will be able to*

- *Model various systems applying reliability networks.*
- *Evaluate the reliability of simple and complex systems and the limiting state probabilities of repairable systems*
- *Apply various mathematical models for evaluating reliability of irreparable systems.*

TEXT BOOKS:

1. Reliability Evaluation of Engg. System – R. Billinton, R.N.Allan, Plenum Press, New York, reprinted in India by B.S.Publications, 2007.
2. Reliability Evaluation of Power systems – R. Billinton, R.N.Allan, Pitman Advance Publishing Program, New York, reprinted in India - B.S.Publications, 2007.

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	3	1	0	3

DIGITAL SIGNAL PROCESSING

(Professional Elective-VI)

Objectives:

- *To understand characteristics of discrete time signals and systems*
- *To analyze and process signals using various transform techniques*
- *To understand various factors involved in design of digital filters and the effects of finite word length implementation***.**

UNIT I:

Introduction: Introduction to Digital Signal Processing: Discrete time signals & sequences, linear shift invariant systems, stability, and causality. Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems.
Realization Of Digital Filters: Review of Z-transforms, Applications of Z – transforms, solution of difference equations of digital filters, Block diagram representation of linear constant-coefficient difference equations, Basic structures of IIR systems, Transposed forms, Basic structures of FIR systems, System function,

UNIT II:

Discrete Fourier Series: Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear convolution of sequences using DFT, Computation of DFT. Relation between Z-transform and DFS
Fast Fourier Transforms: Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT, and FFT with General Radix N

UNIT III:

IIR Digital Filters: Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Step and Impulse Invariant Techniqiues, Bilinear Transformation Techniques, Spectral transformation, Design Examples: Analog-Digital transformations.

UNIT IV:

FIR Digital Filters : Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques, Frequency Sampling technique, Comparison of IIR & FIR filters.

UNIT V:

Multirate Digital Signal Processing: Decimation, interpolation, sampling rate conversion, Implementation of sampling rate conversion and applications.Finite Word Length Effects: Limit Cycles, Overflow Oscillations, Round Off Noise In IIR Filters, Computational Output Round Off Noise, Methods To Prevent Overflow, Trade Off Between Round Off And Overflow Noise, Dead Band Effects.

Outcomes:

- *Perform time frequency and Z transform analysis on signals and systems*
- *Understanding the inter-relationship between DFT and various transforms and the trade-offs between normal and Multirate DSP techniques and finite length word effects.*
- *Design a digital filter for a given specification and fast computation of DFT and appreciate the FFT processing, the significance of various filter structures and effects of round-off errors*

TEXT BOOKS:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007.
2. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, PHI
3. Digital Signal Processors – Architecture, Programming and Applications,, B.Venkataramani, M. Bhaskar, TATA McGraw Hill, 2002

REFERENCE BOOKS:

1. Digital Signal Processing: Andreas Antoniou, TATA McGraw Hill , 2006
2. Digital Signal Processing: MH Hayes, Schaum's Outlines, TATA Mc-Graw Hill, 2007.
3. DSP Primer - C. Britton Rorabaugh, Tata McGraw Hill, 2005.
4. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling, Sandra L.Harris, Thomson, 2007.
5. Digital Signal Processing – Alan V. Oppenheim, Ronald W. Schafer, PHI Ed., 2006

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE IV Year II-Semester	L	T	P	C
	3	1	0	3

ENERGY CONSERVATION AND AUDIT

(Open Elective-III)

Objectives:

- *To know about the principles of thermodynamics and heat exchange theory.*
- *To analyze energy conservation and energy auditing.*
- *To know about thermal insulation and heat recovery systems.*

UNIT - I

THERMODYNAMICS

Availability, energy and Anergy-Exergy, energy, entropy relationship- Degradation of energy – exergy analysis- exergy conservation- combustion, thermal efficiency, thermal losses; thermal balance sheets

HEAT EXCHANGER THEORY: Types Of heat exchangers - overall heat transfer coefficient – fouling factor - Design of heat Exchangers, L.M.T.D. and N.T.U. methods.

UNIT - II

ENERGY CONSERVATION:

Rules for efficient energy conservation – technologies for energy conservation – outline of waste heat and material reclamation, load management.

ENERGY AUDITING: A definition- Level of responsibility- Control of Energy- Uses of Energy - Energy index - Cost index - Pie charts-sankey diagrams Load profiles - Types of energy audits- General energy audit- Detailed energy audit.

UNIT - III

THERMAL INSULATION & REFRACTORIES:

Heat loss through un insulated and insulated surfaces; effect of insulation on current carrying wires – economic thickness of insulation – critical radius of insulation – properties of thermal insulators – classification of insulation materials – classification of refractories – properties of refractories – Criteria for good refractory material – application of insulating & refractory materials.

UNIT - IV

WASTE HEAT RECOVERY SYSTEMS:

Guideline to identify waste heat – feasibility study of waste heat – shell and tube heat exchangers – Thermal wheel – heat pipe heat exchanger – Heat pump – waste heat boilers – Incinerators.

UNIT - V

HEAT RECOVERY SYSTEMS:

Liquid to liquid heat exchangers – regenerators, recuperaters, rotating regenerators – selection of materials for heat exchangers, U- tube heat exchanger, fluidized bed heat exchanger – economizer.

Outcomes: *By the end of this course the students are able to analyze*

- *principles of thermodynamics and heat exchange theory*
- *energy conservation and energy auditing*
- *thermal insulation and heat recovery systems*

Text Books:

1. The role of Energy Manager, E.E.O., U.K.
2. The Energy conservation Design Resource Hand Book-The Royal architectural Institute of Canada.

References:

1. Conduction Heat Transfer- -Schneder Addition Wieslthy
2. Conduction of Heat in Solids -Carslaw & Jaeger.
3. Fundamentals of heat and mass transfer -R.C. Sachdev New Age International Publishers
4. Heat Transfer By R.K. Rajput/ laxmi publication

ANURAG ENGINEERING COLLEGE

(AUTONOMOUS)

B.Tech EEE IV Year II-Semester	L	T	P	C
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ARTIFICIAL NEURAL NETWORKS

(Open Elective-III)

Objectives: *Objectives of this course are*

- *To introduce the basics and models of Neural Networks and its architectures.*
- *To deal with feed forward and propagation networks.*
- *To deal with associative memories and the applications of Neural Networks.*

UNIT I

INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS:

Introduction, Artificial Neural Networks, Historical Development of Neural Networks, Biological Neural Networks, Comparison Between Brain and the Computer, Comparison Between Artificial and Biological Neural Networks, Network Architecture, Setting the Weights, Activation Functions, Learning Methods.

UNIT II

FUNDAMENTAL MODELS OF ARTIFICIAL NEURAL NETWORKS:

Introduction, McCulloch - Pitts Neuron Model, Architecture, Learning Rules, Hebbian Learning Rule, Perceptron Learning Rule, Delta Learning Rule (Widrow-Hoff Rule or Leastmean Squre (LMS) rule, Competitive Learning Rule, Out Star Learning Rule, Boltzmann Learning, Memory Based Learning.

UNIT III

FEED FORWARD NETWORKS :

Introduction, Single Layer Perceptron Architecture, Algorithm, Application Procedure, Perception Algorithm for Several Output Classes, Perceptron Convergence Theorem, Brief Introduction to Multilayer Perceptron networks, Back Propagation Network (BPN), Generalized Delta Learning Rule, Back Propagation rule, Architecture, Training Algorithm, Selection of Parameters, Learning in Back Propagation, Application Algorithm, Local Minima and Global Minima, Merits and Demerits of Back Propagation Network, Applications, Radial Basis Function Network (RBFN), Architecture, Training Algorithm for an RBFN with Fixed Centers.

ADALINE AND MADALINE NETWORKS : Introduction, Adaline Architecture, Algorithm, Applications, Madaline, Architecture, MRI Algorithm, MRII Algorithm.

UNIT IV

COUNTER PROPAGATION NETWORKS :

Winner Take - all learning, out star learning, Kohonen Self organizing network, Grossberg layer Network, Full Counter Propagation Network (Full CPN), Architecture, Training Phases of Full CPN, Training Algorithm, Application Procedure, Forward Only counter Propagation Network, Architecture, Training Algorithm, Applications, Learning Vector Quantizer (LVQ).

ASSOCIATIVE MEMORY NETWORKS - I : Types, Architecture, Continuous and Discrete Hopfield Networks, Energy Analysis, Storage and Retrival Algorithms, Problems with Hopfield Networks.

UNIT V
ASSOCIATIVE MEMORY NETWORKS - II :

Boltzman Machine, Bidirectional Associative Memory, Adaptive Resonance Theory Networks Introduction, Architecture, Algorithm.
APPLICATIONS OF NEURAL NETWORKS : Implementation of A/D Converter using Hopfield Network, Solving Optimization Problems, Solving Simultaneous Linear Equation, Solving Traveling Salesman Problems using Hopfield Networks, Application in Pattern Recognition, Image Processing.

Outcomes: After this course, the student will be able to understand the

- *Basics and models of Neural Networks and its architectures.*
- *Operation of feed forward and propagation networks.*
- *Associative memories and the applications of Neural Networks.*

Text Books:

1. Introduction to Artificial Neural Systems - J.M.Zurada, Jaico Publishers, 3rd Edition.
2. Introduction to Neural Networks Using MATLAB 6.0 - S.N. Shivanandam, S. Sumati, S. N. Deepa, TMH.

References:

1. Elements of Artificial Neural Networks - Kishan Mehrotra, Chelkuri K. Mohan, and Sanjay Ranka, Penram International.
2. Artificial Neural Network - Simon Haykin, Pearson Education, 2nd Ed.
3. Fundamental of Neural Networks - Laurene Fausett, Pearson, 1st Ed.
4. Artificial Neural Networks - B. Yegnanarayana, PHI.