ACADEMIC REGUALTIONS, COURSE STRUCTURE AND DETAILED SYLLABUS

ELECTRICAL AND ELECTRONICS ENGINEERING

For CBCS BASED B.TECH – FOUR YEAR PROGRAM
(Applicable for the batches admitted from AY 2016-17)

Geethanjali College of Engineering and Technology

(Autonomous)

Cheeryal (V), Keesara (M), Medchal Dist., Telangana – 501 301.

ACADEMIC REGULATIONS 2016
For CBCS Based B.Tech. PROGRAMMES

(Effective for the students admitted into I year from the Academic Year **2016-17** and onwards)

1.0 Under-Graduate Degree Programme (B.Tech.) in Engineering

Geethanjali College of Engineering and Technology (GCET) offers 4 Year (8 Semesters) **Bachelor of Technology** (B.Tech.) Degree Programme, under Choice Based Credit System (CBCS) with effect from the Academic Year 2016 - 17 onwards, in the following Branches of Engineering

S. No.	Branch
I.	Civil Engineering
II.	Computer Science and Engineering
III.	Electrical and Electronics Engineering
IV.	Electronics and Communication Engineering
V.	Mechanical Engineering

2.0 Eligibility for Admission

2.1 Admission to the B.Tech. Programme shall be made either on the basis of the merit rank obtained by the qualifying candidate at an Entrance Test conducted by the Telangana State Government (EAMCET), OR the JNTUH, OR on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the Government of Telangana from time to time.

2.2 The medium of instruction for all the B.Tech. programmes shall be ENGLISH only.

3.0 B.Tech. Programme Structure

3.1 The B.Tech. Programmes of GCET are of semester pattern, with 8 semesters constituting 4 academic years, each academic year having TWO semesters (first/odd and second/even semesters). Each semester shall be of 21 weeks duration (inclusive of examinations), with a minimum of 90 working days per semester.

3.2 UGC/ AICTE specified definitions/ descriptions are adopted appropriately for various terms and abbreviations used in these Academic Regulations/ Norms, which are as listed below.

3.2.1 Semester Scheme:
Each B. Tech program is of 4 (Four) academic years (8 semesters), with each academic year being divided into two semesters of 21 weeks (minimum of 90 working days) each, which includes instruction period, preparation and examinations period; each semester having - '**Continuous Internal Evaluation (CIE)**' and '**Semester End Examination (SEE)**'. **Choice Based Credit System (CBCS)** and **Credit Based Semester System (CBSS)** as denoted by UGC, and curriculum/ programme structure as suggested by AICTE are followed.

3.2.2 Credit Courses:
All courses are to be registered by a student in a semester to earn credits. Credits shall be assigned to each course in a L: T: P/D: C (Lecture periods: Tutorial periods: Practical / Drawing periods: Credits) Structure, based on the following general pattern ..

- One credit - for one hour/ week/ semester for Theory/ Lecture (L) courses;
- One credit - for two hours/ week/ semester for Laboratory/Practical (P) Courses or Drawing Periods (D).
- Two credits for three hours/ week/ semester for Laboratory/Practical (P) Courses or Drawing Periods (D).

- One credit for two hours / week /semester for activity oriented course "Logical reasoning".
- Other student activities (co-curricular and extra-curricular), namely, NCC, NSS, NSO, Study Tour, Guest Lecture etc. and identified Mandatory Courses, if any, shall not carry credits.

3.2.3 Course Classification:

All courses offered for the B.Tech. programme are broadly classified as: (a) Foundation Courses (FnC), (b) Core Courses (CoC), and (c) Elective Courses (EℓC).

- Foundation Courses (FnC) are further categorized as : (i) HS (Humanities and Social Sciences), (ii) BS (Basic Sciences), and (iii) ES (Engineering Sciences);
- Core Courses (CoC) and Elective Courses (EℓC) are categorized as PS (Professional Courses), which are further subdivided as – (i) PC (Professional/ Departmental Core) Courses, (ii) SC (Soft Core Courses - professional courses which can be opted from the given list along with the associated lab component) (iii) PE (Professional/ Departmental Electives) , (iv) OE (Open Electives); and (v) Project Works (PW);
- Minor Courses (1 or 2 Credit Courses, belonging to HS/ BS/ ES/ PC as per relevance).
- Mandatory course(s) (MC – Non credit oriented)

4.0 Course Work for B.Tech. Programme

4.1 A student, after securing admission, shall pursue the B.Tech. programme in a minimum period of 4 academic years, and a maximum period of 8 academic years (starting from the date of commencement of I Year).

4.2 Each student shall register for and secure the specified number of credits required for the completion of the B.Tech. programme and award of the B.Tech. degree in respective branch of Engineering.

4.3 Each semester is structured to provide typically 24 Credits (24 C), totaling to 192 credits (192 C) for the entire B.Tech. programme.

5.0 Course Registration

5.1 A 'Faculty Advisor or Counselor' shall be assigned to each student, who shall advise him about the B.Tech. programme, its structure along with curriculum, choice/option for courses, based on his competence, progress, pre-requisites and interest.

5.2 A Student may be permitted to register for Course of his CHOICE with a typical total of 24 Credits per Semester (Minimum being 20 C and Maximum being 28 C, permitted deviation being ± 17%), based on his PROGRESS and SGPA/ CGPA, and study of the 'PRE-REQUISITES' as indicated for various Courses, in the Department Course Structure and Syllabus contents. However, a MINIMUM of 20 Credits per Semester must be registered to ensure the 'STUDENTSHIP' in any Semester.

5.3 Choice for 'additional courses' to reach the Maximum Permissible Limit of 28 Credits (above the typical 24 Credit norm) must be clearly indicated, which needs the specific approval and signature of the Faculty Advisor/ Counselor.

5.4 Academic section of the college invites 'Registration Forms' from students a priori (before the beginning of the semester). Registration requests for any 'CURRENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'PRECEDING SEMESTER'.

5.5 A student can apply for registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from his faculty advisor, which should be submitted to the College Academic Committee through the Head of the Department (a copy of the same being retained with Head of the Department, Faculty Advisor and the student).

5.6 If the student submits ambiguous choices or multiple options or erroneous entries - during registration for the course(s) under a given/ specified course Group/ Category, namely, core elective with lab, professional elective and open elective as listed in the programme structure, Faculty Advisor shall rectify such errors and advise the student accordingly.

5.7 Course options exercised and approved by Faculty Advisor are final and CANNOT be changed, and CANNOT be inter-changed; further, alternate choices shall also not be considered. However, if the course that has already been listed for registration (by the department) in a semester could not be offered due to any unforeseen or unexpected reasons, then the student shall be allowed to have alternate choice - either for a new course (subject to offering of such a course), or for another existing course offered, which may be considered. Such alternate arrangements shall be made by the department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of class-work for that semester.

5.8 For **Mandatory Courses** like NCC/ NSS/ NSO etc., a '**Satisfactory Participation Certificate'** from the concerned authorities for the relevant semester is essential. No Marks or Grades or Credits shall be awarded for these activities.

6.0 Courses to be offered

6.1 A typical section (or class) strength for each semester shall be 60.

6.2 An Elective Course may be offered to the students, ONLY IF a Minimum of 20 students (1/3 of the Section Strength) opt for the same. The maximum strength of a section is limited to 80 (60 + 1/3 of the section strength).

6.3 More than ONE INSTRUCTOR may offer the SAME COURSE (Lab./Practicals may be included with the corresponding Theory course in the same semester) in any semester.

6.4 If more entries for registration of a course come into picture then the Head of the Department concerned shall decide whether or not to offer such a course for two or multiple sections.

6.5 In case of options coming from students of other departments/ branches/ disciplines (not considering OPEN ELECTIVES), PRIORITY shall be given to the student of the 'Parent Department'.

7.0 Attendance Requirements

7.1 A student shall be eligible to appear for the Semester End Examinations, if he acquires a minimum of 75% of attendance in lectures/tutorials/practicals/drawing/projects/seminars in aggregate of all the courses for that semester.

7.2 Shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be condoned by the college academic committee on valid medical grounds, or participation in sports, games, NCC, NSS, other co-curricular and extra-curricular activities, recognized for the purpose, and the participation having prior approval of the competent authority. Such condonation shall be based on the student's representation with supporting evidence.

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

7.4 Shortage of attendance below 65% in aggregate shall in "**NO"** case be condoned.

7.5 Students, whose shortage of attendance is not condoned in any semester, are not eligible to take their Semester End Examinations and they get detained and their registration for that semester shall stand cancelled. They shall not be promoted to the next semester. They may seek re-registration for all those courses registered in that semester in which they were detained, by seeking re-admission into that semester as and when offered. In the case of elective courses, namely, professional elective(s), soft-core with associated lab and / or open

elective(s), the same may also be re-registered, if offered. However, if those elective(s) are not offered in later semesters, then alternate elective(s) may be chosen from the SAME set of elective course(s) offered under that specific category.

7.6 A student fulfilling the attendance requirements in the present semester shall not be eligible for readmission into the same class.

8.0 Academic Requirements

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in Section No.**7.**

8.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course, if he secures not less than 35% marks (for e.g. 25 out of 70 marks in theory course) in the Semester End Examination, and a minimum of 40% of marks in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing Pass (C) Grade or above in that course.

8.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Industry oriented Mini-Project/ Seminar, if he secures not less than 40% of the total marks to be awarded for each. The student would be treated as failed, if he - (i) does not submit a report on his Industry Oriented Mini-Project, or does not make a presentation of the same before the Departmental Evaluation Committee as per schedule, or (ii) does not present the Project Seminar as required in the IV year I Semester, or (iii) does not present the Technical Seminar as required in the IV year II Semester or (iv) secures less than 40% of marks in Industry oriented Mini-Project/ Seminar evaluations.
He may reappear once for each of the above evaluations, when they are scheduled again; if he fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

8.3 Promotion Rules

8.3.1 Case (i):A student registers for 24 credits or more in each semester as per the provision in section 5.2

8.3.1.1 A student shall not be promoted from I Year to II Year, unless he fulfills the attendance and Academic Requirements and secures a minimum of 24 credits out of 48 credits or more the student has registered in first year, from all the relevant regular and supplementary examinations, whether he takes those examinations or not.

8.3.1.2 A student shall not be promoted from II Year to III Year, unless he fulfills the attendance and Academic Requirements and secures a minimum of 58 credits out of 96 credits or more the student has registered up to and including II Year II Semester, from all the relevant regular and supplementary examinations, whether he takes those examinations or not.

8.3.1.3 A student shall not be promoted from III Year to IV Year, unless he fulfills the attendance and Academic Requirements and secures a minimum of 86 credits out of 144 credits or more the student has registered up to and including III Year II Semester, from all the relevant regular and supplementary examinations, whether he takes those examinations or not.

8.3.2 Case (ii): A student registers for NOT less than 20 credits and less than 24 credits in each semester

8.3.2.1 A student shall not be promoted from I Year to II Year, unless he fulfills the attendance and Academic Requirements and secures a minimum of 50% of the credits registered in first year, from all the relevant regular and supplementary examinations, whether he takes those examinations or not.

8.3.2.2 A student shall not be promoted from II Year to III Year, unless he fulfills the attendance and Academic Requirements and secures a minimum of 60% of the credits registered up to and including II year

II semester, from all the relevant regular and supplementary examinations, whether he takes those examinations or not.

8.3.2.3 A student shall not be promoted from III Year to IV Year, unless he fulfills the attendance and Academic Requirements and secures a minimum of 60% of the credits registered up to and including III year II semester, from all the relevant regular and supplementary examinations, whether he takes those examinations or not.

8.4 A Student shall register for all courses covering 192 credits as specified and listed (with the relevant courses as mentioned) in the Programme Structure, put up all the Attendance and Academic requirements for 192 Credits securing a minimum of C Grade (Pass Grade) or above in each course, and 'earn ALL 192 Credits securing SGPA $\geq$ 5.0 (in each Semester), and CGPA (at the end of each successive Semester) $\geq$ 5.0, to successfully complete the B.Tech. Programme.

8.5 A student must secure the necessary 192 credits as specified for the successful completion of the entire B.Tech. programme (see section 12.1); however, only 186 credits shall be considered for evaluating his overall performance for the award of class as provided for under section 12.0. These 186 credits shall be arrived at by leaving out two courses (one from open elective courses and one from professional elective courses) carrying a total of 6 credits, which have the least Grade point scores.

8.6 Students who fail to earn 192 credits as per the Programme Structure, and as indicated above, within 8 academic years from the date of commencement of their I Year shall forfeit their seats in B.Tech. Programme and their admissions shall stand cancelled.

8.7 A student detained due to shortage of attendance in any semester, may be re-admitted into that semester, as and when offered, with the Academic Regulations of the batch into which he gets readmitted. However, no grade allotments or SGPA/ CGPA calculations shall be done for the corresponding semester in which he got detained.

8.8 A student detained due to lack of credits in any year, may be readmitted in the next year, after fulfillment of the Academic Requirements, with the Academic Regulations of the batch into which he gets readmitted.

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

9.0 Evaluation - Distribution and Weightage of Marks

9.1 The performance of a student in each semester shall be evaluated course-wise (irrespective of credits assigned) with a maximum of 100 marks for all types of courses, namely, theory, drawing, practicals, seminar (Project, Technical), Major project, Industry Oriented Mini-Project, Comprehensive Viva-Voce, Minor Courses etc.

The evaluations are as follows:

- Theory, practical, drawing and major project courses shall be evaluated based on 30% CIE (Continuous Internal Evaluation) and 70% SEE (Semester End Examination),
- Technical seminar and Major project seminar shall be evaluated based on 100% CIE (Continuous Internal Evaluation)
- Industry Oriented mini-project and comprehensive Viva-Voce shall be evaluated based on 100% SEE (Semester End Examination)

A letter grade corresponding to the % marks obtained shall be given for all courses.

9.2 a)

i. For theory courses (inclusive of Minor Courses), during the semester, there shall be TWO (2) mid-term examinations for 25 marks each. Each mid-term examination consists of one objective paper for TEN (10) marks, plus one subjective paper for 15 marks, with a duration of 120 minutes (20 minutes for objective and 100 minutes for subjective papers). Further, there shall be an allocation of 5 marks for assignment. The objective paper is set with multiple choice questions, True/ False, fill-in the blanks, matching type questions and short answer questions. Subjective paper shall contain 3 questions with internal choice, each for 5 marks. All three questions are to be answered.

ii. For "Logical Reasoning", a minor course, which is activity oriented, there shall be a continuous internal evaluation (CIE) during the semester for a total of 30 marks.

b) The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus.

c) The first assignment should be submitted before the conduct of the first mid-term examinations, and the second assignment should be submitted before the conduct of the second mid-term examinations. The assignments shall be as specified by the course instructor concerned.

d) The first mid-term examination marks and first assignment marks shall make one set of CIE marks , and the second mid-term examination marks and second assignment marks shall make second set of CIE Marks; and the average of these two sets of marks shall be taken as the final marks secured by the student in the Continuous Internal Evaluation in that theory course.

e) The details of the question paper pattern for Semester End Examination shall be as follows:

- The examination shall be conducted for 70 marks. The question paper consists of two parts:
  - Part – A for 20 marks (Compulsory);
  - Part – B for 50 marks (Questions with Internal Choice);
- Part – A: The question (numbered 01) under Part A consists of ten sub questions, two from each unit of the prescribed syllabus of the course. Each sub question carries 2 marks. All sub questions are compulsory.
- Part – B consists of five questions (numbered from 02 to 06), one each from the five units of the prescribed syllabus of the course. Each question carries 10 marks and may contain sub questions. For each question, there shall be an internal choice (it means, there shall be two questions from each unit, and the student should answer any one question). The student must answer all the questions of Part B.

Absence in mid-term examination(s):

- If any student is absent in one mid-term examination for any course on health grounds / any valid reasons approved by the College Academic Committee, only one test shall be conducted on all units by the college in each course at the end of each semester.
- If any student is absent in both mid-term examinations for any course on health grounds / any valid reasons approved by the College Academic Committee, only one test for 25 marks shall be conducted on all units and the marks secured out of 25 shall be divided by two, which shall be awarded against the said mid-term examination(s) after the student pays the prescribed fee.

9.3 For practical courses, there shall be a Continuous Internal Evaluation (CIE) during the semester for 30 marks, and 70 marks are assigned for lab/practical Semester End Examination (SEE). Out of the 30 marks for CIE, day-to-day work in the laboratory shall be evaluated for 15 marks; and for the remaining 15 marks - two internal practical tests (each of 15 marks) that include viva-voce shall be conducted by the concerned laboratory instructor and the average of these two tests is taken into account. The SEE for practicals shall be conducted at the end of the semester by two examiners, namely, an external examiner and laboratory faculty as internal examiner. The external examiner shall be appointed by the Chief Superintendent of Examinations of the college as per the recommendation of the Chairperson, Board of Studies of the department concerned. The panel of the external examiners shall be provided by the Chairperson, BoS at the commencement of the semester during the meeting of the BoS.

Absence in laboratory internal examinations:

- If any student is absent in one laboratory internal examination for any laboratory course on health grounds / for any valid reasons approved by the College Academic Committee, only one test shall be conducted for 15 marks on all experiments of that laboratory course, by the college at the end of the semester.
- If any student is absent in both the laboratory internal examinations on health grounds / for any valid reasons approved by the College Academic Committee, only one test shall be conducted on all experiments and the marks secured out of 15 marks shall be divided by two, which shall be awarded against the said laboratory internal examinations.

9.4 For the courses having design and/or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing, Production Drawing Practice, and Estimation), the distribution shall be 30 marks for CIE (20 marks for day-to-day work, and 10 marks for internal tests) and 70 marks for SEE. There shall be two internal tests in a semester and the average of the two shall be considered for the award of marks for internal tests.

9.5 **Open Electives**: Students are to choose Open Elective(s) as per their programme structure.

9.6 a) There shall be an Industry Oriented Mini-Project, in collaboration with an industry of the relevant specialization, to be registered immediately after III Year II semester examinations, and taken up during the summer vacation for four weeks duration.

b) The industry oriented mini-project shall be submitted in a report form, and a presentation of the same shall be made before a committee, which evaluates it for 100 marks. The committee shall consist of Head of the Department, the supervisor of Mini-Project, and two Professors /Assoc-Professors faculty members of the department. There shall be no internal marks for industry oriented Mini-Project. The mini-project shall be evaluated at the end of IV Year I Semester.

9.7 There shall be a project seminar presentation in IV Year I semester. For the project Seminar, the student shall collect the information/ literature on the project, prepare a report, submit the same, and present as a seminar, which shall be evaluated as CIE for 100 marks by the project seminar review committee. The committee shall consist of Head of the Department, the supervisor of project, and two Professors/Associate professors of the department.

9.8

9.8.1 There shall be a technical seminar presentation in IV year II Semester. For the technical seminar a student shall collect information on a specialized technical topic, prepare a technical report and submit to the department at the time of Technical Seminar presentation. The Technical Seminar presentation (along with the Technical Report) shall be evaluated by Two Professors /Assoc-Professors and Head of the Department, for 100 marks. There shall be no SEE for seminar.

9.8.2 For courses, namely, "Gender Sensitization" and "Human Values and Professional Ethics", which are activity oriented minor courses of two credits, there shall be a SEE for Seventy (70) marks which shall be conducted with internal examiner(s) only.

9.8.3. For "Logical Reasoning" an activity oriented course, there shall be a SEE for Seventy (70) marks which shall be conducted with internal examiner(s) only.

9.9 There shall be a comprehensive viva-voce examination (SEE) for 100 marks in IV year II semester. It shall be conducted by an external examiner, Head of the department and two Professors / Assoc-Professors of the department.

9.10 Each student shall start the major project work during the IV Year I Semester, as per the instructions of the project guide/ project supervisor assigned by the Head of Department. Out of a total 100 marks allotted for the major project work, which shall be evaluated in IV year II semester, 30 marks shall be for CIE (Continuous Internal Evaluation) and 70 marks for the SEE (End Semester Viva-voce Examination). The

project viva-voce shall be conducted by a committee comprising an external examiner, Head of the Department and project supervisor. Out of 30 marks allocated for CIE, 15 marks shall be awarded by the project supervisor (based on the continuous evaluation of student's performance throughout the Project Work period), and the other 15 marks shall be awarded by a Departmental Committee consisting of Head of the Department and Project Supervisor, and two Professors/Assoc-Professors, based on the work carried out and the presentation made by the student during internal reviews (at least two internal reviews shall be conducted).

10.0 Grading Procedure

10.1 Marks shall be awarded to indicate the performance of each student in each theory course, or lab/practicals, or project seminar, technical seminar, or major project, or mini-project based on the % marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in section 9 above, and a corresponding letter grade shall be given.

10.2 As a measure of the student's performance, a 10-point absolute grading system using the following letter grades (UGC Guidelines) and corresponding percentage of marks shall be followed as mentioned in the table 10.2. Please also refer to section 8.

Table 10.2: Absolute grading system

% of Marks Secured in a course	*Letter Grade (UGC Guidelines)*	*Grade Points*
More than or equal to 90%	**O (Outstanding)**	**10**
80 and less than 90%	**A^+ (Excellent)**	**9**
70 and less than 80%	**A (Very Good)**	**8**
60 and less than 70%	**B^+ (Good)**	**7**
50 and less than 60%	**B (Average)**	**6**
40 and less than 50%	**C (Pass)**	**5**
Below 40%	**F (FAIL)**	**0**
Absent	**Ab**	**0**

10.3 A student obtaining F Grade in any course shall be considered '**FAILED**' and shall be required to reappear as 'supplementary candidate' in the Semester End Examination (SEE), as and when offered. In such cases, his internal marks (CIE Marks) in those course(s) shall remain the same as those obtained earlier.

10.4 A letter grade does not imply any specific % of Marks.

10.5 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 due to shortage of attendance as listed in section 8.7.

10.6 A student earns Grade Point (GP) in each Course, on the basis of the letter grade obtained by him in that course. 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 …. for a course

10.7 The Student passes the course only when he gets GP ≥ 5 (C grade or above).

10.8 The Semester Grade Point Average (SGPA) is calculated by dividing the sum of Credit Points (ΣCP) secured from ALL Subjects/ Courses registered in a semester, by the Total Number of Credits registered during that semester. SGPA is rounded off to TWO decimal places. SGPA is thus computed as

$$SGPA = \{ \sum_{i=1}^{N} C_i G_i \} / \{ \sum_{i=1}^{N} C_i \} \text{ .... For each Semester,}$$

where 'i' is the course indicator index (takes into account all courses in a semester), 'N' is the no. of courses 'REGISTERED' for the semester (as specifically required and listed under the Program Structure of the parent department), 'C_i' is the no. of credits allotted to the i^{th} course, and 'G_i' represents the Grade Points (GP) corresponding to the letter grade awarded for that i^{th} course.

10.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student in ALL registered courses in ALL semesters, and the total number of credits registered in ALL the semesters. CGPA is rounded off to TWO decimal places. CGPA is thus computed from the I Year second semester onwards, at the end of each semester, as per the formula

$$CGPA = \{ \sum_{j=1}^{M} C_j G_j \} / \{ \sum_{j=1}^{M} C_j \} \text{ ... for all S Semesters registered}$$
$$\text{(ie., upto and inclusive of S Semesters, } S \geq 2 \text{),}$$

where 'M' is the TOTAL no. of courses (as specifically required and listed under the Course Structure of the parent department) the Student has 'REGISTERED' from the 1^{st} semester onwards up to and inclusive of the semester S (obviously M > N), 'j' is the course indicator index (takes into account all Courses from 1 to S Semesters),'C_j' is the no. of credits allotted to the j^{th} course, and 'G_j' represents the Grade Points (GP) corresponding to the letter grade awarded for that j^{th} Course. After registration and completion of I Year I semester however, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

10.10 For merit ranking or comparison purposes, or any other listing, ONLY the 'ROUNDED OFF' values of the CGPAs shall be used.

10.11 For calculations listed in sections 10.6 through 10.10, performance in FAILED courses (securing F Grade) shall also be taken into account, and the credits of such courses shall also be included in the multiplications and summations.

10.12 Passing Standards:

10.12.1 A student shall be declared **'SUCCESSFUL'** or **'PASSED'** in a semester, only when he gets a SGPA ≥ 5.00 (at the end of that particular Semester); and a student shall be declared **'SUCCESSFUL'** or **'PASSED'** in the entire B.Tech. programme, only when he gets a CGPA ≥ 5.00, subject to the condition that he secures a GP ≥ 5 (C Grade or above) in every registered course in each semester (during the entire B.Tech. Programme) for award of the degree.

10.12.2 After the completion of each semester, a Grade Card or Grade Sheet (or Transcript) shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It shall show the details of the courses registered (course code, title, no. of credits, grade earned etc.), credits earned, SGPA, and CGPA.

11. Declaration of Results

11.1 Computation of SGPA and CGPA are done using the procedure listed in sections 10.6 through 10.10.

11.2 For final % of marks equivalent to the computed final CGPA, the following formula is to be used:

% of Marks = (final CGPA – 0.5) x 10

12.0 Award of Degree

12.1 A student who registers for all the specified courses as listed in the programme structure, satisfies all the programme requirements, and passes all the examinations prescribed in the entire B.Tech. programme, and secures the required number of 192 credits (with CGPA ≥ 5.0), within 8 academic years from the date of commencement of the first academic Year, shall be declared to have **'QUALIFIED'** for the award of the B.Tech. degree in branch of Engineering studied.

12.2 A student who qualifies for the award of the degree as listed in section 12.1, shall be placed in the following classes based on evaluation as per section 8.5:

12.2.1 Students with final CGPA (at the end of the B. Tech Programme) ≥ 8.00, and fulfilling the following conditions shall be placed in 'FIRST CLASS with DISTINCTION' -

i. should have passed all the subjects/courses in 'FIRST APPEARANCE' within the first 4 academic years (or 8 sequential semesters) from the date of commencement of his first academic year,
ii. should have secured a CGPA ≥ 8.00, at the end of each of the 8 sequential semesters, starting from the I Year I semester onwards,
iii. should not have been detained or prevented from writing the Semester End Examinations in any semester due to shortage of attendance or any other reason,.

12.2.2 Students having final CGPA (at the end of B.Tech. Programme) ≥ 8.00, but not fulfilling the above conditions shall be placed in 'FIRST CLASS'.

12.2.3 Students with final CGPA (at the end of the B.TECH. Programme) ≥ 6.50 but < 8.00, shall be placed in 'FIRST CLASS'.

12.2.4 Students with final CGPA (at the end of the B.TECH. Programme) ≥ 5.50 but < 6.50, shall be placed in 'SECOND CLASS'.

12.2.5 All other Students who qualify for the award of the degree (as per Section 12.1), with final CGPA (at the end of the B.Tech. Programme) ≥ 5.00 but < 5.50, shall be placed in 'PASS CLASS'.

12.3 A student with final CGPA (at the end of the B.Tech. Programme) < 5.00 shall not be eligible for the award of the degree.

12.4 Students fulfilling the conditions listed under section (iii) of 12.2.1 alone shall be eligible for the award of 'college rank' and / or 'gold medal'.

13.0 Withholding of Results

13.1 If the student has not paid fees to College at any stage, or has pending dues against his name due to any reason whatsoever, or if any case of indiscipline is pending against him, the result of the student may be withheld, and he shall not be allowed to go into the next higher semester. The award or issue of the degree may also be withheld in such cases.

14.0 Transitory Regulations

14.1 General

14.1.1 A Student who has discontinued for any reason, or has been detained for want of attendance or NOT promoted due to lack of required credits as specified, may be considered eligible for readmission to the same semester in which he got detained for want of attendance or promotion to the next year of study after securing the required number of credits, as detailed in 14.2 -14.4 as the case may be.

14.2 For students detained due to shortage of attendance:

14.2.1 A Student who has been detained in I year of R09/R13/R15 Regulations of JNTUH due to lack of attendance, shall be permitted to join I year I Semester of AR16 Regulations of GCET and he is required to complete the study of B.Tech. programme within the stipulated period of eight academic years from the date of first admission in I Year.

14.2.2 A student who has been detained in any semester of II, III and IV years of R09/R13/R15 regulations of JNTUH for want of attendance shall be permitted to join the corresponding semester of AR16 regulations of GCET and is required to complete the study of B.Tech. within the stipulated period of eight academic years from the date of first admission in I Year.
The AR16 Academic Regulations of GCET under which a student has been readmitted shall be applicable to that student from that semester which shall include section 14.5

14.3 For students NOT promoted due to shortage of credits:

14.3.1 A student of R09/R13/R15 Regulations of JNTUH who has been detained due to lack of credits, shall be promoted to the next semester of AR16 Regulations of GCET only after acquiring the required credits as per the corresponding regulations of his/her first admission. For subsequent promotions the rule specified in section 14.5 shall be applicable. The student is required to complete the study of B.Tech within the stipulated period of eight academic years from the year of first admission. The AR16 Academic Regulations of GCET are applicable to a student from the year of readmission onwards.

14.4 For all students readmitted under AR16 Regulations of GCET:

14.4.1 A student who has failed in any course under any regulation has to pass those courses in the same regulations.

14.4.2 A student shall acquire a total of 192 credits for the award of degree. These 192 credits shall be the sum of all the credits secured in all the other regulations of his study (subsequent to normalization as per section 14.5) and those secured under AR16 Regulations of GCET.

14.4.3 If a student readmitted to AR16 Regulations of GCET, has any course with about 80% of syllabus in common with his previous regulations, that particular course in AR16 Regulations of GCET shall be substituted by another course to be suggested by GCET.

14.4.4 If a student readmitted to AR16 Regulations of GCET, has not studied any course/topics in his earlier regulations of study which is a prerequisite for further courses in AR16 Regulations of GCET, the College shall arrange to conduct remedial classes to cover those course/topics for the benefit of the students.

14.5 Promotion Rule

Where the credits allotted to a semester/year under the regulations studied in are different from that under AR16 regulations for the corresponding semester/year, the promotion rules of AR16 vide section 8.3 shall be applied after normalization. Normalization is done by scaling down or up the number of credits of a semester/year under the previous regulations to equal the number of credits of the corresponding semester/year under AR16 regulations and revising the secured credits also in the same proportion.

15.0 Student transfers

15.1 There shall be no branch transfers after the completion of admission process.

15.2 The student seeking transfer from various other universities/institutions has to pass the failed courses which are equivalent to the courses of GCET, and also pass the courses of GCET which the student has not studied at the earlier institution. Further, even if the student had passed some of the courses at the earlier institutions, if the same courses are prescribed in different semesters of GCET, the student has to study those courses in GCET in spite of fact that those courses are repeated.

15.3 The transferred students from other universities/institutions shall be provided one chance to write the internal examinations in the failed courses and/or courses not studied as per the clearance (equivalence) letter issued by JNTUH.

16.0 Scope

i) Where the words "he", "him", "his", occur in the write-up of regulations, they include "she", "her", "hers".
ii) Where the words "Subject" or "Subjects", occur in these regulations, they also imply "Course" or "Courses".
iii) The Academic Regulations should be read as a whole, for the purpose of any interpretation.
iv) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Head of the Institution is final.
v) The college may change or amend the Academic Regulations, Program Structure or Syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the dates notified by the College Authorities.
vi) B.Tech (Regular) program is B.Tech 4 year degree program to which students are admitted to I year
vii) B.Tech LE Scheme refers to the system under which students are admitted to II year of the B.Tech 4 year degree program.

* * * * *

PUNISHMENT FOR MALPRACTICE

	Nature of Malpractices	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 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 course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.
1 (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 shall 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/year. 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/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the impostor is an outsider, he shall 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/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the	Cancellation of the performance in that course.

	examiners or writes to the examiner requesting him to award pass marks.	
6	Refuses to obey the orders of the Chief Superintendent / Assistant –Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that 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/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they shall 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/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is course 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/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that 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 subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College shall be handed over to police and, a police case shall be registered against them.

GEETHANJALI COLLEGE OF ENGINEERING AND TECHNOLOGY HYDERABAD
(Autonomous)
Cheeryal (V), Keesara (M), Medchal Dist., - 501 301

ACADEMIC REGULATIONS 2016
For CBCS Based B.Tech. (Lateral Entry (LE) Scheme)

(Effective for the students admitted into II year from the Academic Year **2017-18** and onwards)

1.0 Eligibility for Admission

1.1 Admission to the B.Tech. Programme shall be made either on the basis of the merit rank obtained by the qualifying candidate at an entrance test conducted by the Telangana State Government (ECET), or the JNTUH, or on the basis of any other order of merit approved by JNTUH, subject to reservations as prescribed by the Government of Telangana from time to time.

Admissions under the Lateral Entry Scheme are made into the Second (II) year of the Four (4) – year degree program

2.0 Course Work:

2.1 A student, after securing admission, shall pursue the B.Tech. programme in a minimum period of 3 academic years, and a maximum period of 6 academic years (starting from the date of commencement of II Year).

2.2 Each student shall register for and secure the specified number of credits required for the completion of the B.Tech. programme and award of the B.Tech. degree in respective branch of Engineering.

2.3 Each semester is structured to provide typically 24 Credits, totaling to 144 credits for the entire B.Tech. (LE) programme.

3.0 Promotion rules

3.1 Case (i): A student registers for 24 credits or more in each semester as per the provision in section 5.2 of AR16 regulations of B.Tech (Regular) four year degree program.

3.1.1 A student shall not be promoted from II Year to III Year, unless he fulfills the attendance and Academic Requirements and secures a minimum of 29 credits out of 48 credits or more the student has registered up to and including II Year II Semester, from all the relevant regular and supplementary examinations, whether he takes those examinations or not.

3.1.2 A student shall not be promoted from III Year to IV Year, unless he fulfills the attendance and Academic Requirements and secures a minimum of 58 credits out of 96 credits or more the student has registered up to and including III Year II Semester, from all the relevant regular and supplementary examinations, whether he takes those examinations or not.

3.2 Case (ii): A student registers for NOT less than 20 credits and less than 24 credits in each semester.

3.2.1 A student shall not be promoted from II Year to III Year, unless he fulfills the attendance and Academic Requirements and secures a minimum of 60% of the credits registered up to and including II year II semester, from all the relevant regular and supplementary examinations, whether he takes those examinations or not.

3.2.2 A student shall not be promoted from III Year to IV Year, unless he fulfills the attendance and Academic Requirements and secures a minimum of 60% of the credits registered up to and including III

year II semester, from all the relevant regular and supplementary examinations, whether he takes those examinations or not.

4.0 A Student shall register for all courses covering 144 credits as specified and listed (with the relevant courses as mentioned) in the Programme Structure, put up all the Attendance and Academic requirements for 144 Credits securing a minimum of C Grade (Pass Grade) or above in each course, and earn ALL 144 Credits securing SGPA ≥ 5.0 (in each Semester), and CGPA (at the end of each successive Semester) ≥ 5.0, to successfully complete the B.Tech. programme.

4.1 A student must secure the necessary 144 credits as specified for the successful completion of the entire B.Tech. programme (see section 5.1); however, only 138 credits shall be considered for evaluating his overall performance for the award of class as provided for under section 5.0. These 138 credits shall be arrived at by leaving out two courses (one from open elective courses and one from professional elective courses) carrying a total of 6 credits, which have the least Grade point scores.

4.2 Students who fail to earn 144 credits as per the Programme Structure, and as indicated above, within 6 academic years from the date of commencement of their II Year shall forfeit their seats in B.Tech. Programme and their admissions shall stand cancelled.

5.0 Award of Degree

5.1 A student who registers for all the specified courses as listed in the programme structure, satisfies all the programme requirements, and passes all the examinations prescribed in the entire B.Tech. programme, and secures the required number of 144 credits (with CGPA ≥ 5.0), within 6 academic years from the date of commencement of the second academic Year, shall be declared to have **'QUALIFIED'** for the award of the B.Tech. degree in the chosen branch of Engineering.

5.2 A student who qualifies for the award of the degree as listed in section 5.1, shall be placed in the appropriate class as follows based on evaluation as per section 4.1:

5.2.1 Students with final CGPA (at the end of the B. Tech Programme) ≥ 8.00, and fulfilling the following conditions shall be placed in 'FIRST CLASS with DISTINCTION'.

i. should have passed all the subjects/courses in 'FIRST APPEARANCE' within the first 3 academic years (or 6 sequential semesters) from the date of commencement of his first academic year,
ii. should have secured a CGPA ≥ 8.00, at the end of each of the 6 sequential semesters, starting from the II Year I semester onwards,
iii. should not have been detained or prevented from writing the Semester End Examinations in any semester due to shortage of attendance or any other reason, thereof.

5.2.2 Students having final CGPA (at the end of B.Tech. Programme) ≥ 8.00, but not fulfilling the above conditions shall be placed in 'FIRST CLASS'.

5.2.3 Students with final CGPA (at the end of the B.TECH. Programme) ≥ 6.50 but < 8.00, shall be placed in 'FIRST CLASS'.

5.2.4 Students with final CGPA (at the end of the B.TECH. Programme) ≥ 5.50 but < 6.50, shall be placed in 'SECOND CLASS'.

5.2.6 All other Students who qualify for the award of the degree (as per section 5.1), with final CGPA (at the end of the B.Tech. Programme) ≥ 5.00 but < 5.50, shall be placed in 'PASS CLASS'.

5.3 A student with final CGPA (at the end of the B.Tech. Programme) < 5.00 shall not be eligible for the award of the degree.

5.4 Students fulfilling the conditions listed under Item (iii) of 5.2.1 alone shall be eligible for the award of 'college rank' and / or 'gold medal'.

6.0 Transitory Regulations

6.1 General

6.1.1 A Student who has discontinued for any reason, or has been detained for want of attendance or NOT promoted due to lack of required credits as specified, may be considered eligible for readmission to the same semester in which he got detained for want of attendance or promotion to the next year of study after securing the required number of credits, as detailed in sections 6.2 through 6.4 as the case may be.

6.2 For students detained due to shortage of attendance:

6.2.1 A student who has been detained in any semester of II, III and IV years of R09/R13/R15 regulations of JNTUH for want of attendance shall be permitted to join the corresponding semester of AR16 regulations of GCET and is required to complete the study of B.Tech. within the stipulated period of six academic years from the date of first admission in II Year.

The AR16 Academic Regulations of GCET under which a student has been readmitted shall be applicable to the student from that semester which shall include section 6.5.

6.3 For students NOT promoted due to shortage of credits:

6.3.1 A student of R09/R13/R15 Regulations of JNTUH who has NOT been promoted due to lack of credits, shall be promoted to the next semester under AR16 Regulations of GCET only after acquiring the required credits as per the corresponding regulations of his/her first admission. For subsequent promotions, the rule specified in section 6.5 shall be applicable. The student is required to complete the study of B.Tech within the stipulated period of SIX academic years from the year of first admission. The AR16 Academic Regulations of GCET are applicable to a student from the year of readmission onwards.

6.4 For all students readmitted under AR16 Regulations of GCET:

6.4.1 A student who has failed in any course under any regulation has to pass those courses in the same regulations.

6.4.2 A student shall acquire a total of 144 credits for the award of degree. These 144 credits shall be the sum of all the credits secured in all the other regulations of his study (subsequent to normalization as per section 6.5) and those secured under AR16 Regulations of GCET.

6.4.3 If a student readmitted to AR16 Regulations of GCET, has any course with about 80% of syllabus in common with his previous regulations, that particular course in AR16 Regulations of GCET shall be substituted by another course to be suggested by GCET.

6.4.4 If a student readmitted to AR16 Regulations of GCET, has not studied any course/topics in his earlier regulations of study which is a prerequisite for further courses in AR16 Regulations of GCET, the College shall arrange to conduct remedial classes to cover those course/topics for the benefit of the students.

6.5 **Promotion Rule**

Where the credits allotted to a semester/year under the regulations studied in are different from that under AR16 regulations for the corresponding semester/year, the promotion rules of AR16 vide section 3.0 shall be applied after normalization. Normalization is done by scaling down or up the number of credits of a semester/year under the previous regulations to equal the number of credits of the corresponding semester/year under AR16 regulations and revising the secured credits also in the same proportion.

7.0 All the other regulations as applicable to B.Tech 4 – year degree program (Regular) shall hold good for B.Tech LE Scheme.

PUNISHMENT FOR MALPRACTICE

	Nature of Malpractices	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 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 course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.
1 (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 shall 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/year. 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/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the impostor is an outsider, he shall 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/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the	Cancellation of the performance in that course.

	examiners or writes to the examiner requesting him to award pass marks.	
6	Refuses to obey the orders of the Chief Superintendent / Assistant –Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that 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/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they shall 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/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is course 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/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that 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 subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College shall be handed over to police and, a police case shall be registered against them.

GEETHANJALI COLLEGE OF ENGINEERING AND TECHNOLOGY HYDERABAD
(Autonomous)
Cheeryal (V), Keesara (M), Medchal Dist -501 301

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

B.Tech Program in Electrical and Electronics Engineering

Vision

To provide excellent Electrical and Electronics education by building strong teaching and research environment.

Mission

1. To offer high quality graduate program in Electrical and Electronics education and to prepare students for professional career or higher studies.
2. The department promotes excellence in teaching, research, collaborative activities and positive contributions to society

Programme Educational Objectives (PEOs)

PEO1. Graduates will excel in professional career and/or higher education by acquiring knowledge in Mathematics, Science, Engineering principles and Computational skills.

PEO2. Graduates will analyze real life problems, design electrical systems appropriate to the requirement that are technically sound, economically feasible and socially acceptable.

PEO3. Graduates will exhibit professionalism, ethical attitude, communication skills, team work in their profession, adapt to current trends by engaging in lifelong learning and participate in research and development.

B.Tech. EEE PROGRAM OUTCOMES

Engineering Graduates will be able to:

PO 1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10.Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSOs)

PSO1. An ability to simulate and determine the parameters like voltage profile and current ratings of transmission lines in Power Systems.

PSO2. An ability to understand and determine the performance of electrical machines namely, speed, torque, efficiency etc.

PSO3. An ability to apply electrical engineering and management principles to Power Projects.

GEETHANJALI COLLEGE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
SCHEME OF INSTRUCTIONS AND EXAMINATION
B. Tech. ELECTRICAL AND ELECTRONICS ENGINEERING
Academic Regulations: AR-16 **Academic Year 2016-17**

PROGRAMME STRUCTURE

FIRST YEAR SEMESTER-I

S. No.	Course Code	Course	Category	No. of Periods Per Week			Scheme of Examination with Maximum Marks			No. of Credits
				L	T	P/D	CIE	SEE	Tot	C
1	16EN1101	English-I	HS	2	-	-	30	70	100	2
2	16PH1101	Engineering Physics	BS	3	1	-	30	70	100	3
3	16MA1101	Mathematics -I	BS	4	1	-	30	70	100	4
4	16CH1101	Engineering Chemistry	BS	3	-	-	30	70	100	3
5	16CS1101	Computer Programming-I	ES	3	-	-	30	70	100	3
6	16ME1101	Engineering Drawing	ES	2	-	3	30	70	100	4
7	16EN11L1	English-I Lab	HS	-	-	2	30	70	100	1
8	16CH11L1	Engineering Chemistry Lab	BS	-	-	3	30	70	100	2
9	16CS11L1	Computer Programming-I Lab	ES	-	-	3	30	70	100	2
Total				**17**	**2**	**11**	**270**	**630**	**900**	**24**
Total Periods Per Week				**30**						

Abbreviation	Description
HS	Humanities and Social Sciences
BS	Basic Sciences
ES	Engineering Sciences
PC	Professional Core
SC	Soft Core
CC	Core Course
PE	Professional Elective
OE	Open Elective

Abbreviation	Description
L	Lecture
T	Tutorial
P	Practical
D	Drawing
C	Number of Credits
CIE	Continuous Internal Evaluation
SEE	Semester End Examination
Tot	Total

FIRST YEAR SEMESTER-II

S. No.	Course Code	Course	Category	No. of Periods Per Week			Scheme of Examination with Maximum Marks			No. of Credits
				L	T	P/D	CIE	SEE	Tot	C
1	16EN1201	English - II	HS	2	-	-	30	70	100	2
2	16PH1202	Semiconductor Physics	BS	4	1	-	30	70	100	4
3	16MA1201	Mathematics -II	BS	3	1	-	30	70	100	3
4	16MA1202	Mathematics -III	BS	3	-	-	30	70	100	3
5	16CS1201	Computer Programming-II	ES	3	-	-	30	70	100	3
6	16EN12L1	English-II Lab	HS	-	-	2	30	70	100	1
7	16PH12L2	Semiconductor Physics Lab	BS	-	-	3	30	70	100	2
8	16MA12L1	Computational Mathematics Lab	BS	-	-	3	30	70	100	2
9	16CS12L1	Computer Programming-II Lab	ES	-	-	3	30	70	100	2
10	16WS12L1	Information Technology Workshop/Engineering Workshop*	ES	-	-	3	30	70	100	2
Total				**15**	**2**	**14**	**300**	**700**	**1000**	**24**
Total Periods Per Week				**31**						

***CSE BoS specified the syllabus for ITWS while ME BoS Specified the syllabus for EWS**

SECOND YEAR SEMESTER-I

S. No	Course Code	Course	Category	No. of Periods Per Week			Scheme of Examination with Maximum Marks			No. of Credits
				L	T	P/D	CIE	SEE	Tot	C
1	16MA2103	Complex Variables	BS	3	1	-	30	70	100	3
2	16ME2104	Fluid Mechanics and Hydraulic Machinery	ES	4	-	-	30	70	100	4
3	16EC2103	Switching Theory and Logic Design	ES	3	1	-	30	70	100	3
4	16EE2101	Electromagnetic Field Theory	ES	4	1	-	30	70	100	4
5	16EE2102	Electrical Circuits	PC	4	1	-	30	70	100	4
6	16ME21L3	Fluid Mechanics and Hydraulic Machinery Lab	ES	-	-	3	30	70	100	2
7	16EE21L1	Field Theory and Circuits Lab	PC	-	-	3	30	70	100	2
8	16EN21L1	Advanced English Communication Skills Lab	HS	-	-	3	30	70	100	2
Total				**18**	**4**	**9**	**240**	**560**	**800**	**24**
Total Periods Per Week				**31**						

SECOND YEAR SEMESTER-II

S. No	Course Code	Course	Category	No. of Periods Per Week			Scheme of Examination with Maximum Marks			No. of Credits
				L	T	P/D	CIE	SEE	Tot	C
1	16EE2201	Power Electronics	PC	4	1	-	30	70	100	4
2	16EE2202	Electrical Machines-I	PC	3	1	-	30	70	100	3
3	16EE2203	Power Systems-I	PC	3	-	-	30	70	100	3
4	16EE2204	Signals and Systems	PC	3	1	-	30	70	100	3
5	16CH2201	Environmental Studies	HS	3	-	-	30	70	100	3
6	16EE22L1	Power Electronics and Simulation Lab	PC	-	-	3	30	70	100	2
7	16EE22L2	Electrical Machines-I Lab	PC	-	-	3	30	70	100	2
8	16EE22L3	Signals and systems simulation Lab	PC	-	-	3	30	70	100	2
9	16HS22L1	Gender Sensitization	HS	-	-	3	30	70	100	2
Total				**16**	**3**	**12**	**270**	**630**	**900**	**24**
Total Periods Per Week				**31**						

THIRD YEAR SEMESTER-I

S. No	Course Code	Course	Category	No. of Periods Per Week			Scheme of Examination with Maximum Marks			No. of Credits
				L	T	P/D	CIE	SEE	Tot	C
1	16EE3101	Control Systems	PC	4	1	-	30	70	100	4
2	16EE3102	Power systems –II	PC	4	1	-	30	70	100	4
3	16EE3103	Electrical Machines-II	PC	3	1	-	30	70	100	3
4	16EC3102	Microprocessors and Microcontrollers	PC	3	1	-	30	70	100	3
5	**Open Elective I**									
	16MB3121	Intellectual Property Rights	OE	3	-	-	30	70	100	3
	16CS3123	JAVA Programming								
	16EC3124	Electronic Measuring Instruments								
	16ME3125	Nano Materials and Technology								
	16CE3126	Global Warming and Climate Change								
6	16EE31L1	Control systems and simulation Lab	PC	-	-	3	30	70	100	2
7	16EE31L2	Electrical Machines-II Lab	PC	-	-	3	30	70	100	2
8	16EC31L1	Microprocessors and Microcontrollers Lab	PC	-	-	3	30	70	100	2
9	16MA31P1	Logical Reasoning	BS	-	-	2	30	70	100	1
Total				**17**	**4**	**11**	**270**	**630**	**900**	**24**
Total Periods Per Week				**32**						

THIRD YEAR SEMESTER-II

S. No	Course Code	Course	Category	No. of Periods Per Week			Scheme of Examination with Maximum Marks			No. of Credits
				L	T	P/D	CIE	SEE	Tot	C
1	16EE3201	Computer Methods in Power Systems	PC	3	1	-	30	70	100	3
2	16EE3202	Electric Drives	PC	3	1	-	30	70	100	3
3	16EE3203	Instrumentation and Measurement Techniques	PC	3	1	-	30	70	100	3
4	**Professional Elective I**									
	16EE3204	Renewable Energy (Wind and Solar)	PE	3	1	-	30	70	100	3
	16EE3205	Special Machines								
	16EE3206	Utilization of Electrical Energy								
	16EE3207	Linear system Analysis								
5	**Professional Elective II**									
	16EE3208	Energy Audit	PE	3	1	-	30	70	100	3
	16EE3209	Switched Mode Power Supplies								
	16EE3210	Power Quality								
	16EE3211	Image Processing								
6	**Open Elective II**									
	16MB3231	Supply Chain Management	OE	3	-	-	30	70	100	3
	16CS3232	Knowledge Management								
	16EC3234	Basics of Communication Systems								
	16ME3235	Manufacturing Processes								
	16CE3236	Building Technology								
7	16EE32L1	Computer Methods in Power systems lab	PC	-	-	3	30	70	100	2
8	16EE32L2	Instrumentation and Measurement Techniques Lab	PC	-	-	3	30	70	100	2
9	16MB32P1	Human Values and Professional Ethics	HS	-	-	3	30	70	100	2
Total				**18**	**5**	**9**	**270**	**630**	**900**	**24**
Total Periods Per Week				**32**						

FOURTH YEAR SEMESTER-I#
 # Subject to final approval by Academic Council

S. No	Course Code	Course	Category	No. of Periods Per Week			Scheme of Examination with Maximum Marks			No. of Credits
				L	T	P/D	CIE	SEE	Tot	C
1	16EE4101	Switch Gear and Protection	PC	3	1	-	30	70	100	3
2	16EE4102	Power Systems Operation and Control	PC	3	1	-	30	70	100	3
3	16MB4101	Management Science	HS	3	-	-	30	70	100	3
4	**Professional Elective III**									
	16EE4103	Flexible AC Transmission Systems	PE	3	-	-	30	70	100	3
	16EE4104	Smart Grid/Micro Grid								
	16EE4105	High Voltage Engineering								
	16EE4106	Hybrid Electric Vehicles								
5	**Open Elective –III**									
	16MB4141	Banking and Insurance	OE	3	-	-	30	70	100	3
	16CS4142	Database Systems								
	16EC4144	Principles of Wireless Communication Systems								
	16ME4145	Aspects of Heat Transfer in Electronically Controlled Units								
	16CE4146	Green Buildings								
	16EN4147	Foreign Language -French								
	16EN4148	Foreign Language - Spanish								
	16EN4149	Foreign Language - German								
6	**Soft Core - I**									
	16EC4106	Embedded Systems	SC	3	1	-	30	70	100	3
	16EC4107	Digital Signal Processing								
7	**Soft Core – I Lab**									
	16EC41L2	Embedded Systems Lab	SC	-	-	3	30	70	100	2
	16EC41L3	Digital Signal Processing Lab								
8	16EE41L2	Power Systems Simulation and Drives Lab	PC	-	-	3	30	70	100	2
9	16EE4108	Industry Oriented Mini-project	CC	-	-	-	-	100	100	1
10	16EE4109	Major Project Seminar	CC	-	-	2	100	-	100	1
Total				**18**	**3**	**8**	**340**	**660**	**1000**	**24**
Total Periods Per Week				**29**						

FOURTH YEAR SEMESTER - II#
 # Subject to final approval by Academic Council

S. N	Course Code	Course	Category	No. of Periods Per Week			Scheme of Examination with Maximum Marks			No. of Credits
				L	T	P/D	CIE	SEE	Tot	C
1	16MB4201	Financial Analysis and Project Management	HS	4	-	-	30	70	100	4
2	**Professional Elective IV**									
	16EE4201	Reliability	PE	3	-	-	30	70	100	3
	16EE4202	HVDC Transmission								
	16EE4203	Robotics								
	16EC4206	VLSI Technology								
3	**Open Elective – IV**									
	16MB4251	Entrepreneurship	OE	3	-	-	30	70	100	3
	16CS4252	Web Development								
	16EC4254	Biomedical Instrumentation								
	16ME4255	Materials Handling								
	16CE4256	Disaster Mitigation and Management								
	16MA4257	Actuarial Statistics								
4	16EE4204	Major Project	CC	-	-	15	30	70	100	10
5	16EE4205	Technical Seminar	CC	-	-	2	100	-	100	1
6	16EE4206	Comprehensive Viva	CC	-	-	-	-	100	100	3
Total				**10**	**0**	**17**	**220**	**380**	**600**	**24**
Total Periods Per Week				**27**						

Comparison of AICTE Guidelines for Curriculum Structure of B.Tech. Degree Program in Electrical and Electronics Engineering Vis-a-vis GCET program

S. No.	*Broad Course Classification*	*Course Group/ Category*	*Course Description*	*Proposed Credits (%)*	*Range of Credits given by AICTE*
1	**Foundation Courses (FnC)**	**BS – Basic Sciences**	Includes - Mathematics, Physics and Chemistry courses	**30 (15.62%)**	**15% - 20%**
2		**ES - Engineering Sciences**	Includes fundamental engineering courses	**29 (15.11%)**	**15% - 20%**
3		**HS – Humanities and Social Sciences**	Includes courses related to Humanities, English, Social Sciences and Management	**20 (10.41%)**	**05%-10%**
4	**Core Courses (CoC)**	**PC – Professional Core**	Includes core courses related to the Parent Discipline/ Department/ Branch of Engg.	**66 (34.38%)**	**30% - 40%**
5	**Elective Courses (ElC)**	**SC- Soft Core**	Includes core elective courses with the associated lab	**5 (2.62%)**	**10% -15%**
		PE – Professional Electives	Includes Elective courses related to the Parent Discipline/ Department/ Branch of Engg.	**14 (7.3%)**	
6		**OE – Open Electives**	Elective courses which include inter-disciplinary courses or courses in an area outside the Parent Discipline/ Department/ Branch of Engg.	**12 (6.25%)**	**05% - 10%**
7	**Core Courses**	**Project Work**	B.Tech. Project or UG Project or UG Major Project	**16 (8.3%)**	**10% - 15%**
8		**Industrial Training/ Mini- Project**	Industrial Training/ Internship/ UG Mini-Project/ Mini-Project		
9		**Seminar**	Seminar/ Colloquium based on core contents related to Parent Discipline/ Department/ Branch of Engg.		
10		**Minor Courses**	1 or 2 Credit Courses (subset of HS)	**included**	
Total Credits for B. Tech. Programme				**192 (100%)**	

OPEN ELECTIVES offered by a Department **SHOULD NOT** be taken by the students of the **same department**

Open Elective I

S. No.	Course Title	Course Code
21	Intellectual Property Rights (MBA)	16MB3121/16MB3221
22	Industrial Safety and Hazards (EEE)	16EE3122/16EE3222
23	JAVA Programming (CSE)	16CS3123/16CS3223
24	Electronic Measuring Instruments (ECE)	16EC3124/16EC3224
25	Nano Materials and Technology (ME)	16ME3125/16ME3225
26	Global Warming and Climate Change (CE)	16CE3126/16CE3226

Open Elective II

S. No.	Course Title	Course Code
31	Supply Chain Management (MBA)	16MB3231/16MB4131
32	Knowledge Management (CSE)	16CS3232/16CS4132
33	Energy Conservation and Management (EEE)	16EE3233/16EE4133
34	Basics of Communication Systems (ECE)	16EC3234/16EC4134
35	Manufacturing Processes (ME)	16ME3235/16ME4135
36	Building Technology (CE)	16CE3236/16CE4136

Open Elective III

S. No.	Course Title	Course Code
41	Banking and Insurance (MBA)	16MB3241/16MB4141
42	Database Systems (CSE)	16CS3242/16CS4142
43	Micro-electro-mechanical Systems (EEE)	16EE3243/16EE4143
44	Principles of Wireless Communication Systems (ECE)	16EC3244/16EC4144
45	Aspects of Heat Transfer in Electronically Controlled Units (ME)	16ME3245/16ME4145
46	Green Buildings (CE)	16CE3246/16CE4146
47	Foreign Language - French	16EN3247/16EN4147
48	Foreign Language -Spanish	16EN3248/16EN4148
49	Foreign Language -German	16EN3249/16EN4149

Open Elective IV

S. No.	Course Title	Course Code
51	Entrepreneurship (MBA)	16MB4251
52	Web Development (CSE)	16CS4252
53	Renewable Energy Sources (EEE)	16EE4253
54	Biomedical Instrumentation (ECE)	16EC4254
55	Materials Handling (ME)	16ME4255
56	Disaster Mitigation and Management (CE)	16CE4256
57	Actuarial Statistics (S&H)	16MA4257

B.TECH EEE
I - YEAR
I-SEM

DETAILED SYLLABUS

GEETHANJALI COLLEGE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
Cheeryal (V), Keesara (M), Medchal Dist - 501 301, Telangana State

16EN1101 – ENGLISH – I

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

I Year. B.Tech. EEE – I Semester

Prerequisite(s): None

Course Objectives:

Develop ability to

1. Read well and speak grammatically correct English.
2. Become a good communicator, both written and oral.
3. Analyse, interpret the given data/text and infer appropriately.
4. Design an outline for a paragraph, essay, letters etc.
5. Listen actively and respond accordingly.
6. Apply classroom learning to conduct oneself in a multicultural environment.

Course Outcomes (COs):

At the end of the course, student would be able to

CO 1: Speak fluent, intelligible and grammatically correct English.
CO 2: Use language appropriately in various functional contexts.
CO 3: Analyse a given situation/text and interpret accordingly.
CO 4: Write effectively in formal and informal situations.
CO 5: Acquire active listening skills and demonstrate the same.
CO 6: Acquire the nuances of behavioral etiquette in a multicultural environment.

UNIT–I

Reading	*Tea Party* by Ruth Prawer Jhabvala
Vocabulary	Homonyms, Homophones Homographs
Grammar	Nouns and Articles Types of Verbs
Speaking	Greeting people and taking leave Introducing oneself and others
Writing	Writing sentences Punctuation

UNIT–II

Reading	1)*Risk Management* by Joe Crompton 2)*Sivakasi* by Amrutha Gayatri
Vocabulary	1)Synonyms 2)Antonyms and Synonyms, Commonly misspelt words
Grammar	1)Subject-verb agreement 2)The present tense
Speaking	Giving Directions
Writing	Paragraph Writing Note making, Note taking

UNIT–III

Reading	1*)Polymer Banknotes* 2*)The one thing every business executive must understand about social media* by Kerpen
Vocabulary	1)Collocations 2)Technical Vocabulary
Grammar	1)Past Tense & Future Tense 2)Adjectives – Comparison, Prepositions
Speaking	1)Group Discussions 2)Speaking on the telephone (Telephone Etiquette)
Writing	Information Transfer

UNIT–IV

Reading	1*)IF* by Rudyard Kipling 2) Courage and integrity are at the core of the successful leadership
Vocabulary	1)Positive descriptive vocabulary, Common errors in English 2)Idioms and Phrases
Grammar	1)Reported Speech 2)Active voice& passive voice
Speaking	1)Talking about hypothetical situations 2)Narrating experiences/events and expressing opinions
Writing	1)Letter Writing 2)Phrasal Verbs 3)Guided Composition

UNIT–V

Reading	Study Skills
Vocabulary	Functional vocabulary related to writing and reading
Grammar	Picture Reading/ Interpretation
Writing	Job Application Narrative Reviews-articles/newspaper/books/movies Essay/articles

Text Book: *Skills Annexe: Functional English for Success*published by Orient Longman

Reference Books

1. *Contemporary English Grammar Structures and Composition* by David Green, Macmillan Publishers 2010, New Delhi
2. *Innovate with English*: A course in English for Engineering students by T Samson, Foundation Books
3. *English Grammar Practice* by Raj N Bakshi, Orient Longman
4. *Spoken English* by R.K.Bansal and Harrison, Orient Longman
5. *Technical Communication* by Meenakshi Raman, Oxford University Press
6. *Grammar Games* by Renuvolcuri Mario, Cambridge University Press
7. *Enrich Your English* by Thakur K.B.P. Sinha, Vijay Nicole Imprints Pvt.Ltd.

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16PH1101 – ENGINEERING PHYSICS

L	T	P/D	C
3	1	-/-	3

I Year. B.Tech. EEE – I Semester

Prerequisite(s): None

Course Objectives:
Develop ability to

1. Understand the fundamental aspects of crystal structures, various types of crystal defects and methods of determining the crystal structures using X- ray diffraction.
2. Distinguish different types of dielectric polarization mechanisms; understand the properties of different dielectric materials and their applications.
3. Demonstrate classification of magnetic materials; understand the phenomenon of superconductivity and the applications of magnetic materials and superconductors.
4. Understand the concepts of interference, diffraction, light amplification, working of various types of LASERs and their applications.
5. Outline the behaviour of materials at nanoscale, three methods of preparation of nanomaterials and their characterization techniques with applications.

Course Outcomes (COs):
After completion of the course, student would be able to

CO 1**:** Explain the fundamentals of crystal structures; summarize various crystal defects and methods of determining the crystal structures using X-Rays.
CO 2: Explain different types of dielectric polarization mechanisms, and the properties of different dielectric materials and their applications.
CO 3: Explain different types of magnetic materials, phenomenon of superconductivity and applications of magnetic materials and superconductors.
CO 4: Explainphenomena of interference, diffraction, and light amplification process, construction and working of Ruby, He-Ne, Semiconductor LASERs and their applications in different fields.
CO 5: Illustrate awareness of sol-gel method, physical vapour deposition method and ball milling method for preparation of nanomaterials and their applications.

UNIT I
Crystallography and X-Ray diffraction
Space lattice, unit cell, lattice parameters, crystal systems, Bravais lattices, atomic radius, coordination number and atomic packing factors of simple cubic, body centered cubic, face centered cubic, and diamond structure. Crystal directions & planes, Miller indices, inter planar spacing of orthogonal crystal systems

Defects in crystal: Point defects, line defects (Qualitative Treatment). Estimation of Schottky and Frenkel defects, Burger's vector.Bragg's law, X-Ray diffraction- Laue method and powder method. Applications of X-Rays in different fields.

UNIT II

Dielectric properties

Electric dipole, dipole moment, dielectric constant, polarizability, electric susceptibility, displacement vector, electronic and ionic polarizations (Quantitative), orientation and space charge polarizations (qualitative). Internal fields in solids, Clausius-Mosotti equation, Piezo, Pyro & Ferro electricity and their applications.

UNIT III

Magnetic Properties

Permeability, field intensity, magnetic field induction, magnetization, magnetic susceptibility, origin of magnetic moment, Bohr magneton, classification of Dia, Para, Ferro, Antiferro and Ferri magnetic materials, domain theory of Ferro magnetism- Hysteresis curve, soft and hard magnetic materials, applications of magnetic materials. Basic concepts of superconductivity andproperties of superconductors: Type –I, Type – II super conductors, BCS theory (Qualitative), applications of superconductors in science and engineering.

UNIT IV

Optics and LASERs

Introduction to interference, theory of interference in thin films, Newton's rings, anti reflection coatings, introduction to diffraction, diffraction due to single slit, double slit and diffraction grating.Lasers and their characteristics, stimulated absorption, spontaneous emission and stimulated emission, Einstein's coefficients and relation between them, pumping schemes, optical resonator, various types of Lasers: Ruby Laser, He-Ne Laser, Semiconductor Laser and applications of Lasers.

UNIT V

Nano Science

Origin of nano-science, nano scale, classification of nanomaterials- surface to volume ratio, Quantum confinement, Synthesis of nanomaterials – sol gel method, physical vapour deposition method, Ball milling method, properties of nanomaterials, characterization of nanomaterials using Scanning Electron Microscope(SEM), Transmission Electron Microscope(TEM), Applications of nano-science in various fields.

Text Books

1. Engineering Physics, K. Malik, A. K. Singh, Tata Mc Graw Hill Book Publishers.
2. Engineering Physics, M N Avadhanulu, S Chand Publications.

Reference Books

1. Introduction to Solid state physics by Kittel, 8th Edition, John Wiley Publishers.
2. Fundamentals of Physics, David Halliday, John Wiley Publishers.
3. University Physics, Sear's and Zemansky (10th Edition), Wesly Publishers.
4. Applied Physics, PK Mittal, IK International Publishing House.
5. Engineering Physics, V. Rajendran, Tata Mc Graw Hill Book Publishers.

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16MA1101 – MATHEMATICS - I

L	T	P/D	C
4	1	-/-	4

I Year. B.Tech. EEE – I Semester

Prerequisite(s): None

Course Objectives:

Develop ability to
1. Understand various types of Matrices, properties and rank of a matrix to find the solution For system of equations, if it exists.
2. Apply the knowledge of eigenvalues and eigenvectors of a matrix from quadratic form into a canonical form through linear and orthogonal transformations.
3. Identify the methods of solving the differential equations of first order and applications in engineering problems namely, Newton's law of cooling, Natural growth and decay.
4. Solve second and higher order differential equations and apply the same to electrical circuits and simple harmonic motion.
5. Analyze properties of Laplace Transform, Inverse Laplace Transform, convolution theorem and apply the same to solve ordinary differential equations.

Course Outcomes (COs):
After completion of the course, student would be able to
CO 1: Write the matrix representation of a set of linear equations and to analyze solutions of a system of equations.
CO 2: Deduce eigenvalues and eigenvectors of a matrix and apply the same to reduce quadraticform into a canonical form through linear and orthogonal transformations.
CO 3: Identify the type of differential equation and use the appropriate method to solve the same.
CO 4: Apply differential equations to solve engineering problems particularly, electrical circuits and simple harmonic motion.
CO 5: Solve ordinary differential equations of second and higher order using Laplace Transform techniques.

UNIT-I
Theory of Matrices-I
Real matrices**-**symmetric, Skew-symmetric, Orthogonal, Complex matrices**:** Hermitian, Skew Hermitian, Unitary Matrices and Idempotent Matrix, Finding rank of a matrix by reducing to Echelon and Normal forms, Inverse of a non-singular matrix using row/column transformations (Gauss-Jordan method). Consistency of system of linear equations (homogeneous and non-homogeneous) using the rank of a matrix, Solving mxn and nxn linear system of equations by Guass elimination.

UNIT- II

Theory of Matrices-II

Cayley-Hamilton Theorem(without proof)-Verification, Calculating inverse of a matrix and powers of a matrix by Cayley-Hamilton theorem, Linear dependence and Independence of Vectors, Linear Transformation-Orthogonal Transformation, Eigen values and eigenvectors of a matrix, Properties of eigen values and eigenvectors of real and complex matrices, Linearly independent eigenvectors of a matrix when the eigen values of the matrix are repeated, Quadratic forms up to three variable, Rank-Positive definite, negative definite, semi-definite, Index, signature of a quadratic form.

UNIT – III

First Order Ordinary Differential Equations

Differential equations- exact, linear and Bernoulli, Applications of first order differential equations-Newton's Law of cooling, Law of natural growth and decay, orthogonal trajectories. Electrical Circuits.

Unit-IV

Higher Order Ordinary Differential Equations

Linear, homogeneous and non-homogeneous differential equations of second and higher order with constant coefficients, Non homogeneous of the type e^{ax}, sin ax, cos ax and x^n, $e^{ax}V(x)$, $x^nV(x)$ and Method of variation of parameters, Applications of second order differential equations to Electrical circuits and simple harmonic motion.

UNIT-V

Laplace transforms

Definition of Laplace transform, domain of the function and Kernel for the Laplace transforms. Existence of Laplace transforms. Laplace transform of standard functions, first shifting theorem, Laplace transform of functions when they are multiplied or divided by "t". Laplace transforms of derivatives and integrals of functions-Unit step function-second shifting theorem-Dirac's delta function, Periodic function-Inverse Laplace transform by Partial fractions (Heaviside method), Inverse Laplace transforms of functions when they are multiplied or divided by "s". Inverse Laplace transforms of derivatives and integrals of functions, Convolution theorem-Applications to ordinary differential equations.

Text Books

1. Advanced Engineering Mathematics by R.K. Jain & S.R.K. Iyengar, 3rd edition, Narosa Publishing House, Delhi.
2. Advanced engineering Mathematics by Kreyszig, John Wiley & Sons Publishers.

Reference Books

1. Higher Engineering Mathematics by B.S. Grewal, Khanna Publications.
2. Engineering Mathematics by Srimanta pal, subhodh C.Bhunia, Oxford higher Education.
3. Advanced Engineering Mathematics with MATLAB, Dean G. Duffy, 3rd Edi, CRC Press Taylor & Francis Group.
4. Mathematics for Engineers and Scientists, Alan Jeffrey, 6th Edi, 2013, Chapman & Hall/ CRC
5. Advanced Engineering Mathematics, Michael Greenberg, Second Edition. Pearson Education.
6. Ordinary & Partial Differential Equations, M D Raisinghania, S. Chand.

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16CH1101 – ENGINEERING CHEMISTRY

I Year. B.Tech. EEE – I Semester

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

Prerequisite(s): None

Course Objectives:
Develop ability to
1. Define and understand various conductances in electrochemistry, functional working of electrodes, different types of batteries and cells and along with their applications.
2. Understand the concept of corrosion, distinguish various types of corrosion and prevention.
3. Identify the causes of hardness in water and its treatment using various techniques.
4. Classify polymers and their applications, understand different mechanisms of polymerization, and understand different fibers along with their applications.
5. Understand the engineering materials namely, cement, lubricants, ceramics and glass.
6. Understand various adsorption techniques and its applications.

Course outcomes (COs):
On completion of this course, student would be able to
CO 1: Explain
   a. Various conductances in electrochemistry.
   b. Functional working of electrodes
   c. Construction and working of different types of batteries and cells along with their functional differences and applications.
CO 2: Explain corrosion and causes of corrosion, distinguish various types of corrosion and explain various methods to prevent corrosion.
CO 3: Explain hardness in water and various techniques used to treat the same.
CO 4: Distinguish clearly various polymers and various synthetic and natural fibers; explain various polymerization processes.
CO 5: Explain the properties of various materials adsorption techniques, cement, lubricants, ceramics and glass and their applications.
CO 6: Explain various adsorption techniques and its applications.

UNIT I
Electrochemistry and Batteries
Electrochemistry: Conductance -Specific, Equivalent and Molar, their Units.
EMF: Galvanic Cell; types of Electrodes: Calomel, Quinhydrone and Glass; Nernst equation and its applications; Concentration cells, determination of pH using glass electrode-Numerical problems.
Batteries: Introduction, types of batteries: Primary cells and secondary cells, differences between them with examples.
Fuel cells: Hydrogen-Oxygen fuel cell; applications of fuel cells.

UNIT II

Corrosion and its control methods

Corrosion: Introduction, definition, Types of Corrosion and disadvantages of corrosion. Mechanism of corrosion- chemical and electrochemical corrosion. Factors affecting rate of corrosion– Nature of metal and Nature of Environment –Electrochemical series and its applications, Corrosion control methods–Cathodic protection (sacrificial anodic and impressed current).

Surface coatings: Metallic coatings & methods of application of metallic coatings –hot dipping (galvanization & tinning), Electro plating (Copper plating) and Electroless plating (Ni plating).**Organic coatings**: Paints-constituents and their functions.

UNIT III

Water and its Treatment

Hardness of Water: Types of hardness-temporary and permanent, units and interrelation between them, Boiler troubles–Scale & sludge, Priming and foaming, Caustic embrittlement-Treatment of boiler feed water–Internal treatment (Colloidal and Calgon conditioning)–External treatment– Zeolite process, ion exchange process. Potable water- Steps involved in treatment of potable water– Disinfecting water by chlorination and ozonization –Reverse Osmosis & its significance.

UNIT IV

Polymers

Introduction: Classification of polymers, Types of Polymerization–addition and condensation, differences between addition and condensation polymers, Mechanism of free radical addition polymerization.

Plastics: Thermoplastic &Thermosetting resins, differences between thermoplastic and thermosetting polymers. Preparation, properties and engineering applications of PVC, Teflon and Bakelite.

Fibers: Introduction, types- natural and synthetic. Preparation, properties and uses of Nylon 6, 6, Nylon 6, 10.Fiber Reinforced Plastics (FRP) –Carbon fiber reinforced plastic and applications.

UNIT V

Materials and Surface Chemistry

A) Materials Chemistry

Cement: Introduction, Types of Cement, setting and hardening of Portland cement, Reinforced Concrete. **Lubricants:** Characteristics of good lubricant, properties– flash and fire, cloud and pour point and their significance, Nano Fabricated Lubricants, **Ceramics**: Advanced Ceramics, **Glass**: Reinforced glass material.

B) Surface Chemistry Adsorption

Adsorption: Introduction, Types of adsorption, Isotherms– Freundlich and Langmuir adsorption isotherm, applications of adsorption, application of adsorption in heterogeneous catalysis (automotive catalysts).**Colloids:** Definition, optical properties and application of colloids in industry.

Text Books

1. Engineering Chemistry by R.P. Mani,K.N. Mishra, B. Rama Devi /CENGAGE learning.
2. Engineering Chemistry by P.C Jain and Monica Jain, Dhanpatrai Publishing Company (2008).

Reference Books

1. Engineering Chemistry by B. Siva Shankar McGraw Hill Publishing Company Limited, New Delhi (2006)
2. Engineering Chemistry J.C. Kuriacose and J. Rajaram, Tata McGraw Hills Publishing Company Limited, New Delhi (2004).
3. Text Book of Engineering Chemistry by S.S. Dara and Mukkati S. Chand and Co Publishers, New Delhi (2006)
4. Chemistry of Engineering Materials by CV Agarwal,C.P Murthy, A.Naidu, BS Publications.
5. An Introduction to Electro Chemistry by Samuel Glassstone, East-West Pvt.ltd.
6. Corrosion Engineering by Mars G,Fontana, McGraw Hill

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16CS1101 – COMPUTER PROGRAMMING-I

I Year. B.Tech. EEE – I Semester

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

Prerequisite(s): None

Course Objectives:
Develop ability to
1. Understand the intricacies of program development and problem solving techniques using Raptor tool.
2. Understand the structure of a C-language Program, list, describe, classify the C data types, input and output concepts as they apply to programs in C.
3. Describe the expression types; understand the rules of precedence and associativity in evaluating the expressions.
4. Understand how a C program evaluates logical and repetitive (loop) statements.
5. Describe the importance of modularity and design multi-function programs.
6. Understand the basic concepts and uses of arrays using C-Language Program.
7. Understand the concept and use of pointers for memory management techniques.

Course Outcomes (COs):
At the end of this course, student would be able to
CO 1: Demonstrate problem solving skills by developing algorithms to solve problems using Raptor tool.
CO 2: Incorporate the concept of variables, constants and basic data types in a C language program.
CO 3: Use simple input and output statements in a C Language Program.
CO 4: Incorporate the use of sequential, selection and repetition control statements into the algorithms implemented as computer programs using C language.
CO 5: Demonstrate an understanding of structured design by implementing programs with functions and passing of parameters to solve more complex problems.
CO 6: Implement C programs using arrays.
CO 7: Write and execute programs that access and manage data through pointers.

UNIT I

Basics of Computers
Logic Building: Flow chart, Algorithm, Pseudo code. Introduction to Raptor Programming Tool
Introduction to Programming – Computer Languages, Creating and running programs, Program Development.
Introduction to the C Language – Background, C Programs, Identifiers, Data Types, Variables, Constants, Input/output functions.
Operators - Arithmetic, relational, logical, bitwise, conditional, increment/decrement, assignment etc.., C program examples. Expressions, Precedence and Associativity, Expression Evaluation, Type conversions.

UNIT II

Statements- Selection Statements (decision making) – if and switch statements with Raptor Tool, and C program examples.

Repetition statements (loops) - while, for, do-while statements with Raptor Tool, and C Program examples

Statements related to looping – break, continue, goto, Simple C Program examples.

UNIT III

Functions-Designing Structured Programs, Functions, user defined functions, inter function communication, Standard functions, Scope, Storage classes-auto, register, static, extern, scope rules, type qualifiers, C program examples.

Recursion- recursive functions, Limitations of recursion, example C programs

UNIT IV

Arrays – Concepts, using arrays in C, arrays and functions, array applications, two – dimensional arrays, multidimensional arrays, C program examples.

UNIT V

Pointers – Introduction (Basic Concepts), Pointers for inter function communication, pointers to pointers, compatibility, void pointer, null pointer.

Pointer Applications - Arrays and Pointers, Pointer Arithmetic and arrays, passing an array to a function.

Memory allocation functions – malloc(), calloc(), realloc(), free().

Array of pointers, pointers to functions, C program examples.

Text Book

1. Computer Science: A Structured Programming Approach Using C, B.A.Forouzan and R.F. Gilberg, Third Edition, Thompson Learning, 2007 Reprint.

Reference Books

1. Raptor-A flow charting Tool http://raptor.martincarlisle.com
2. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI.
3. Programming in C. P. Dey and M Ghosh , Oxford University Press.
4. Programming with C, B.Gottfried, 3rd edition, Schaum's outlines, TMH.
5. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, 7th Edition, Pearson education.

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16ME1101– ENGINEERING DRAWING

L	T	P/D	C
2	-	-/3	4

I Year. B.Tech. EEE – I Semester

Prerequisite(s): None

Course Objectives:
Develop ability to
1. Visualize and communicate all engineering elements and understand various concepts such as dimensions, conventions and BIS standards related to working drawings.
2. Understand the fundamentals of geometrical curves and their applications in engineering.
3. Visualize different positions of planes and solids.
4. Visualize various isometric views and their applications in engineering.
5. Understand multi-view representations and their conversion into pictorial views and vice versa.

Course Outcomes (COs):
After the completion of the course, student would be able to

CO 1: Visualize and communicate all engineering elements and represent the same using standard dimensions and conventions related to working drawings used in engineering practice.
CO 2: Comprehend concepts of all 2D elements such as Conic Sections and 3D Objects namely, Prisms, Cylinders, Pyramids and Cones.
CO 3: Draw orthographic projections of straight lines, planes and solids of given engineering components.
CO 4: Construct isometric scale, isometric projections and views of given engineering components.
CO 5: Visualize multi-view representations and its conversion into pictorial views and vice versa.

Unit I

Introduction to engineering drawing & Importance of engineering drawing: Principles of Engineering Drawing, Various Drawing Instruments., Lettering &dimensioning, BIS standards, Title block, Geometrical constructions, Bisecting a line, arc and angle, Dividing straight line in to equal number of parts, Tangents to circles and arcs, Construction of pentagon, hexagon, inscribing circles inside regular polygons and vice versa etc.,

Curves: Constructions of curves used in engineering practice: Conic sections including rectangular hyperbola - **General method only**, Cycloid, Epi-cycloid, Hypocycloid and Involutes.

Scales: Construction of different types of scales - Plain scale, Diagonal scale, vernier scale

Unit II

Introduction to Orthographic projections: conventions-first and third angle projections.

Projections of points: in all four quadrants.

Projections of straight lines: lines in simple position, inclined to one plane and parallel to other plane.

Projections of straight lines: Line inclined to both the planes.

Unit III

Projections of planes: planes in simple position, plane inclined to one plane and perpendicular to other plane, plane inclined to both the planes.

Projections of solids: (Cube, tetrahedron, Cone, Cylinder, Regular Prisms and Pyramids): solids in simple position (Axis perpendicular to one plane)

UNIT IV

Isometric projections: Principle of isometric projection - isometric scale - isometric views - conventions - plane figures. Simple and compound solids - isometric projection of objects having non-isometric lines.

Unit V

Transformation of projections: conversion of Isometric views to orthographic views. Conversion of orthographic views to Isometric views - simple objects.

Text Books

1. Engineering Drawing – N.D. Bhatt, charotar publications.
2. Engineering Drawing- Basant Agrawal, TMH.

Reference Books

1. Engineering Graphics- P I Varghese Tata McGraw Hill Education Pvt. Ltd.
2. Engineering Drawing – P.J. Shah .S.Chand Publishers.
3. Engineering Drawing- Johle/Tata Mcgraw Hill Book Publishers.
4. Engineering Drawing – M.B. Shah and B.C. Rana, Pearson.
5 .Engineering Drawing - K.Venu Gopal and V.Prabu Raja New Age Publications.
6. Engineering Drawing - John. PHI Learning Publisher.

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16EN11L1– ENGLISH-I LAB

L	T	P/D	C
-	-	2/-	1

I Year. B.Tech. EEE – I Semester

Prerequisite(s): None

Course Objectives:
Develop ability to
1. Use Computer-aided Multimedia learning tool for individual language learning.
2. Sensitize student to the nuances of English speech sounds, accent, intonation and rhythm.
3. Listen actively and speak with intelligibility.
4. Apply language skills in real life situations.

Course Outcomes:
On completion of this course, student would be able to
CO 1: Demonstrate the nuances of language through audio visual tools during presentation.
CO 2: Demonstrate good writing skills.
CO 3: Speak intelligibly.
CO 4: Practice usage of International Phonetic Alphabet.

Module: 1
Ice Breaking Activities, JAM

Module: 2
Speech sounds, Influence of Mother Tongue and Conversation Practice

Module: 3
Syllables, Stress, Intonation

Module: 4
Listening Activities (Only for demonstrative purposes)

Module: 5
Situational Dialogues and Role Play

Module: 6
Information Transfer

Additional Topics
Stress Management
Negotiation Skills

Books Recommended

1.*Speaking English Effectively* 2nd Edition by Krishna Mohan and N.P.Singh, MacMillan Publishers, 2011.

2.*How to prepare for interviews* by Shashi Kumar.V and Dhamija P.V

3.*English Pronunciation in Use* by Hancock, M. 2009, Cambridge University Press

4.*Spoken English, a Manual of Speech and Phonetics*, by R.K.Bansal and J.B.Harrison, Orient Black Swan 2013.

5.Spoken English CDs by Shashi Kumar and Dhamija.

6.A Manual entitled *English Language Communication Skills Lab Manual cum Workbook* by Cengage Learning India 2013

7.GCET *ELCS* Lab Workbook.

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16CH11L1– ENGINEERING CHEMISTRY LAB

L	T	P/D	C
-	-	2/-	1

I Year. B.Tech. EEE – I Semester

Prerequisite(s): None

Course Objectives:
Develop ability to
1. Understand the preparation of compounds namely, Asprin and Biodiesel.
2. Use instrumental methods namely, Potentiometry, Conductometry and Colorimetry to find The concentration of a given solution.
3. Experimentally determine the physical constants namely, viscosity and surface tension of a given liquid using Ostwald's Viscometer and Stalagmometer respectively.
4. Use EDTA method to find the hardness of water, estimate chlorides in hard water by Precipitation titration, ferrous iron in water by Dichrometry and iodine in different salts using Iodometry.
5. Understand the preparation of Oil of Winter green.
6. Experimentally determine ferrous iron in cement by Colorimetric method.

Course Outcomes (COs):
On completion of this course, student would be able to
CO 1: Employ the techniques which are fundamental in the preparation of Aspirin, Biodiesel and Oil of Winter Green
CO 2: Use various instrumental methods in volumetric analysis namely, Potentiometry and Conductometry to determine the concentration of a given solution.
CO 3: Use various titration methods namely, EDTA, Precipitation, Iodometry and Dichrometry for estimating different chemical compounds/ ions present in various samples.
CO 4: Estimate the concentration of a coloured compound using the technique of Colorimetry.
CO 5: Experimentally determine the physical properties of liquids such as viscosity and surface tension.

Any ten of the following twelve experiments must be conducted.

List of experiments

I. Preparation of compounds
1. Preparation of Aspirin
2. Preparation of Biodiesel

II. Instrumental Methods
A. Potentiometry
3. Titration of Strong acid vs Strong base by Potentiometry.
4. Titration of Weak acid vs Strong base by Potentiometry.

B. Conductometry

5. Titration of Strong acid vs Strong base by Conductometry.

C. Colorimetry

6. Estimation of Copper by Colorimetric method.

III. Physical Constants

7. Determination of Viscosity of given liquid by Ostwald's Viscometer.
8. Determination of Surface tension of given liquid by Stalagmometer.

IV. Titrimetry

9. Estimation of Hardness of water by EDTA method.
10. Estimation of Chlorides in hard water by Precipitation method.
11. Estimation of Ferrous Iron in water by Dichrometry.
12. Estimation of Iodine in different salts using Iodometry.

Additional Experiments (Mandatory)

1. Preparation of Oil of Winter green.
2. Determination of Ferrous iron in cement by Colorimetric method.

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16CS11L1 – COMPUTER PROGRAMMING-I LAB

I Year. B.Tech. EEE– I Semester

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

Prerequisite(s): None

Course Objectives:
Develop ability to

1. Have understanding intricacies of program development and problem solving techniques using Raptor tool.
2. Understand the structure of a C-language Program, list, describe, classify the C data types, input and output concepts as they apply to programs in C.
3. Describe the expression types; understand the rules of precedence and associativity in evaluating the expressions.
4. Understand how a C program evaluates logical and repetitive (loop) statements.
5. Describe the importance of modularity and design multi-function programs.
6. Understand the basic concepts and uses of arrays using C-Language Program.
7. Understand the concept and use of pointers for memory management techniques.

Course Outcomes (COs):
At the end of this course, student would be able to

CO 1: Demonstrate problem solving skills by developing algorithms to solve problems using Raptor tool.
CO 2: Incorporate the concept of variables, constants and basic data types in a C language program.
CO 3: Use simple input and output statements in a C Language Program.
CO 4: Incorporate the use of sequential, selection and repetition control statements into the algorithms implemented as computer programs using C language.
CO 5: Demonstrate an understanding of structured design by implementing programs with functions and passing of parameters to solve more complex problems.
CO 6: Implement C programs using arrays.

Write and execute programs that access and manage data through pointers.

LIST OF EXPERIMENTS	
1.	Introduction to RAPTOR Tool Draw Flow chart using RAPTOR for, a. Read a number and Display the same number b. Read and Display the student details c. Read two numbers from user and calculate addition and subtraction of those numbers d. Read two numbers from user at the time of execution and calculate multiplication and division of those numbers

	e. Find the square of a given number (take the number from the user) f. Calculate the value of Y from the equation $y = x^2 + 2x + 3$ (read the value of X from user)
2.	Draw Flow chart using RAPTOR for, a. Calculate the area of a Circle b. Calculate the area of a Square c. Calculate the area of a Rectangle d. Interchange two numbers e. Find the sum of square of two numbers f. Convert Centigrade to Fahrenheit g. Convert Radius to Degrees h. Display the roots of Quadratic Equation
3	Draw Flow chart using RAPTOR for, a. Check the given number is Positive or Negative b. Check the given number is even or odd c. Display whether a person is eligible for vote or not d. Calculate the Largest of two numbers e. Check the given year is leap year or not f. Check whether two numbers are equal or not g. Find the largest value among three given numbers
4	aw Flow chart using RAPTOR for, a. Calculate and display the grade of a student i. < 30 % - Fail ii. Between 31 and 50 – C grade iii. Between 51 to 60 – B grade iv. Between 61 to 75 – A grade v. Greater than 75 - distinction b. Find the quadratic roots of an equation (real or imaginary) c. Check the given number is multiple of 2,4and 8
5	Draw Flow chart using RAPTOR for, 1. Display n numbers using looping 2. Calculate the sum of n natural numbers 3. Display the even numbers below n 4. Calculate sum of even numbers and odd numbers from 1 to n (n value supplied by the user)
6	a. Write a C program to display student details b. Write a C program to perform arithmetic operations c. Write a C program to implement increment and decrement operators d. Write a C program to implement conditional operator e. Write a C program to implement bit wise operator
7	a. Write a C program to calculate the biggest of given two numbers b. Write a C Program to print the result depending on the following

	vi. < 30 % - Fail vii. Between 31 and 50 – C grade viii. Between 51 to 60 – B grade ix. Between 61 to 75 – A grade c. Write a C Program to implement arithmetic calculator using switch case
8	a. Write a C program to find sum of n natural numbers b. Write a C program to find individual digits of the given number c. Write a C program to find factorial of a given number
9	a. Write a C program to display the prime numbers below n (where n value is given by user) b. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. c. Write a C program to generate the first n terms of the sequence. d. Write a C program to find the quadratic roots of an equations e. Write a c program to calculate sum of the following geometric equation Sum=$1+x+x^2+x^3+\ldots..+x^n$
10	a. Write a C program to find the given number is palindrome or not b. Write a C program to find GCD and LCM of two given numbers using functions c. Write a C program to find the factorial of a given number using recursive function d. Write a C program to generate the fibonacci series using recursive function
11	a. Write a c program to find largest and smallest numbers in a list of array elements using functions b. Write a C program to sort the given list of elements in ascending order using functions. c. Write a c program to search for a given element in the list of array and display the “location” if the number is found else print “the number is not found”. i. Using fixed length array ii. Using variable length array.
12	a. Find the duplicate elements in the list of sorted array b. Write a C program that uses functions to perform the Addition of Two Matrices c. Write a C program that uses functions to perform the Multiplication of Two Matrices
13	1. Write a C program to swap two integers using following methods a. call by value b. call by reference 2. Write a C program to find sum of even and odd numbers using functions and pointers
14	1. Write a C program to find Largest Number Using Dynamic Memory Allocation. 2. Write a C program to return multiples values from a function using pointers

B.TECH EEE
I - YEAR
II-SEM

DETAILED SYLLABUS

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16EN1201– ENGLISH – II

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

I Year. B.Tech. EEE – II Semester

Prerequisite(s): 16EN1101 – English - I

Course Objectives:
Develop ability to
1. Function in multidisciplinary teams.
2. Understand professional and ethical responsibility.
3. Apply strategies and inculcate life skills.

Course Outcomes(COs):
On completion of this course,student would be able to
CO 1: Acquire interpersonal and life skills.
CO 2: Demonstrate professional ethics and etiquette.
CO 3: Demonstrate application of various strategies to real-life situations.

UNIT-I

Writing	Steps in Writing Process Cover letter and Job Application, Letter CurriculumVitae Résumé Abstract Writing and Responding to a blog

UNIT-II

Reading	1*)Mokshagundam Visvesvaraya* *2)The Palm Islands*
Vocabulary	Prefixes and Suffixes
Grammar	Joining ideas using conjunctions, Adverbs
Speaking	Opinion-based questions
Writing	Summarizing

UNIT-III

Reading	*1)Leela's Friend* by R.K.Narayan 2)*Forensic Science*
Vocabulary	Guessing the words, Using the Appropriate word, Phrasal verbs
Grammar	Knowing with questions
Speaking	Presentation
Writing	Report Writing

UNIT-IV

Reading	*1)The Last Leaf* by O.Henry 2)*Chose how to start your day*
Vocabulary	Idioms
Grammar	Relating objects by using prepositions, Ergative verbs
Speaking	Creative Speaking Activity
Writing	Technical Report Writing

UNIT-V

Reading	*1)Indian Crowds* by Nirad C.Chaudhuri 2)*Snippets that focus on cultural differences among the people*
Vocabulary	One-Word Substitutes (related to the lesson)
Grammar	Synthesis of Sentences
Speaking	Activity on Indo-American Cultural Differences
Writing	Day to day-experiences of students while travelling

Text Books

1. *Epitome of Wisdom*, published by Orient Longman.
2. *A Passage to England* by Nirad C. Chaudhuri.

Reference Books

1. *Contemporary English Grammar Structures and Composition* by David Green, Macmillan Publishers 2010, New Delhi
2. *Innovate with English*: *A Course in English for Engineering Students* by T Samson, Foundation Books
3. *English Grammar Practice* by Raj N Bakshi, Orient Longman
4. *English Pronunciation in Use* by Hancock, M. 2009, Cambridge University Press
5. *Technical Communication* by Meenakshi Raman, Oxford University Press
6. *Grammar Games* by Renuvolcuri Mario, Cambridge University Press
7. *Enrich Your English* by Thakur K.B.P. Sinha, Vijay Nicole Imprints Pvt.Ltd

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16PH1202– SEMICONDUCTOR PHYSICS

L	T	P/D	C
4	1	-/-	4

I Year. B.Tech. EEE – II Semester

Prerequisite(s): 16PH1101 -Engineering Physics

Course Objectives:
Develop ability to

1. Discuss the formation of energy bands in solids, classification of solids, and find the carrier concentration in intrinsic and extrinsic semiconductors, understand the concept of Fermi level and Hall Effect.
2. Analyze p-n junction diode and its load line characteristics; understand breakdown mechanisms in semiconductor diodes.
3. Understand the functioning of rectifiers and filters; functioning of zener diode as a voltage regulating device.
4. Understand the working of BJT, its various configurations and applications.
5. Discuss various methods of transistor biasing, understand fundamentals of RC coupled amplifier, basic concepts of FET and JFET.

Course Outcomes (COs):
On completion of this course, student would be able to

CO 1**:** Distinguish between conductors, semiconductors and insulators, evaluate carrier concentration in intrinsic and extrinsic semiconductors; identify the type of extrinsic semiconductor through Hall Effect.
CO 2: Analyze V-I characteristics of p-n junction diode and its cut-in voltage.
CO 3: Explain working of half wave and full wave rectifiers, filters and their applications.
CO 4: Explain the functioning of BJT, distinguish various configurations of BJT and their applications.
CO 5: Analyse various transistor biasing methods and explain fundamentals of RC coupled amplifier, functioning of FET, summarize the differences between BJT and FET.

UNIT I
Band theory of solids and semiconductors
Electronin aperiodic Potential, Blochtheorem, Kronig-Penny Model(Qualitative Treatment), Brillouin Zones(E-K curve),origin of energy band formation in solids, concept of effective mass of an electron, classification of materials into conductors, semiconductors & insulators.

Classification of semiconductors, n-type, p-type, Fermi level in Intrinsic and Extrinsic Semiconductors, variation of Fermi level with temperature and concentration of dopants in extrinsic semiconductors, calculation of carrier concentration in Intrinsic & Extrinsic Semiconductors, equation of continuity, direct and indirect band gap semiconductors, Hall effect.

UNIT II

p-n junction diode

Qualitative theory of p-n junction, Energy level diagram of p-n junction in forward & reverse bias condition, p-n junction as a diode, volt-ampere characteristics, temperature dependence of V-I characteristic, ideal versus practical – Resistance levels (Static and Dynamic), Transition and Diffusion capacitances, diode equivalent circuits, load line analysis, breakdown mechanisms in semiconductor diodes, Zener diode characteristics.

UNIT III

Rectifiers and filters

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.

UNIT IV

Bipolar Junction Transistor

Junction transistor, BJT symbol, transistor construction, BJT operation, common base, common emitter and common collector configurations. Transistor current components, limits of operation, transistor as an amplifier, BJT specifications, comparison of CB, CE, CC amplifier configurations.

UNIT V

Transistor Biasing-stabilization and Field Effect Transistor

The DC and AC load lines, Operating point, need for biasing , fixed bias, collector feedback bias, Emitter feedback bias, Collector-Emitter feedback bias, Voltage divider bias - bias stability and stabilization factors, stabilization against variations in V_{BE} and β, RC coupled amplifier (qualitative treatment)

Field Effect Transistor: The Junction field effect Transistor (Construction, Principle of operation, symbol)- Pinch–off voltage – volt ampere characteristics, The JFET small signal model, comparison of BJT and FET (Qualitative treatment analysis).

Text Books

1. Millman's Electronic devices & Circuits-Jacob Millman, Christos C.Halkias, Satyabrata Jit.
2. Engineering Physics, K. Malik, A. K. Singh, Tata Mc Graw Hill Book Publishers.

Reference Books

1. Electronic devices & Circuits, S Salivahanan, N Srushkumar, A Vallava Raj, Second edition, Tata Mc Graw Hill Book Publishers.
2. Fundamentals of Physics, David Halliday, John Weily Publishers.
3. University Physics, Sear's and Zemansky (10^{th} Edition), Wesly Publishers.
4. Modern Physics, R. Murugesan, S Chand & Co Publishers (For Statistical Mechanics)
5. Fiber optic communication, Gerd, Kizer., Tata Mc Graw Hill Book Publishers 5^{th} edition.
6. Engineering Physics, V. Rajendran, Tata Mc Graw Hill Book Publishers.

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16MA1201– MATHEMATICS - II

I Year. B.Tech. EEE – II Semester

L	T	P/D	C
3	1	-/-	3

Prerequisite(s): 16MA1101 Mathematics-I

Course Objectives:
Develop ability to
a. Identify the methods of differential calculus to optimize single and multivariable functions.
b. Evaluate improper integrals using Beta and Gamma functions.
c. Evaluate multiple integrals and apply the same to solve engineering problems.
d. Understand convergence of the series using Fourier series technique and to find solution of integral equations using Fourier Transforms.
e. Explain properties of vector operators. Use vector calculus to determine the length of a curve, area between surfaces and volume of solids.

Course Outcomes (COs):
On completion of this course, student would be able to
CO 1: Apply the methods of differential calculus to optimize single and multivariable functions.
CO 2: Evaluate improper integrals using Beta and Gamma functions.
CO 3: Evaluate multiple integrals and apply the concepts of the same to find areas, volumes and moment of inertia of regions on a plane or in space.
CO 4: Apply Fourier series to find convergence of series and Fourier Transforms to solve integral equations.
CO 5: Apply vector operators on scalar and vector point functions to compute length of a curve, area between surfaces and volume ofsolids, using vector calculus.

UNIT-I
Functions of Several Variables
Limit, Continuity, Partial Differentiation, Total Derivatives, Functions of several variables- Functional dependence- Jacobian- Maxima and Minima of functions of two variables without constraints and with constraints-Method of Lagrange multipliers

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

UNIT-III

Multiple Integration and its Applications

Multiple integrals – double and triple integrals – change of order of integration- change of variables (polar, cylindrical and spherical), Finding the area of a region using double integration and volume of a region in space using triple integration.

UNIT – IV

Fourier series and Transforms

Definition of periodic function, Fourier expansion of periodic functions in a given interval of length2π.Determination of Fourier coefficients–Fourier series of even and odd functions–Fourier series in an arbitrary interval –even and odd periodic continuation – Half-range Fourier sine and cosine expansions, Fourier integral theorem –Fourier sine and cosine integrals, Fourier Integral transforms–Fourier sine and cosine transforms and their properties–inverse transforms–Finite Fourier transforms

UNIT –V

Vector Calculus

Scalar point function and vector point function, Gradient- Divergence- Curl and their related properties, - Laplacian operator- Solenoidal and irrotational vectors, Scalar Potential function, directional derivatives. Line integral – work done – Surface integrals -Volume integral. Green's theorem, Stoke's theorem and Gauss's Divergence theorems (Statement & their Verification).

Text Books

1. Advanced engineering Mathematics by Kreyszig, John Wiley & Sons Publishers.
2. Advanced Engineering Mathematics by R.K. Jain & S.R.K. Iyengar, 3rd edition, Narosa publishing House, Delhi.

Reference Books

1. Higher Engineering Mathematics by B.S. Grewal, Khanna Publishers.
2. Engineering Mathematics by Srimanta pal, subhodh C.Bhunia, Oxford higher Education.
3. Mathematics for Engineers and Scientists, Alan Jeffrey, 6th Edi, 2013, Chapman & Hall/ CRC
4. Advanced Engineering Mathematics, Michael Greenberg, Second Edition. Pearson Education
5. Ordinary & Partial Differential Equations, M D Raisinghania, S. Chand.

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16MA1202– MATHEMATICS - III

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

I Year. B.Tech. EEE – II Semester

Prerequisite(s): 16MA1101 Mathematics-I

Course Objectives:
Develop ability to

1. Understand approximation of a polynomial/curve to satisfy the given set of data.
2. Determine approximate zeros of an algebraic/transcendental/system of equations using suitable numerical methods.
3. Evaluate differentiation/integration methods for a given set of data using numerical methods.
4. Apply various numerical methods to compute approximate solution of a given ordinary differential equation with initial conditions.
5. Apply Partial Differential Equations to solve problems in one dimensional heat and wave equations.

Course Outcomes (COs):
On completion of this course, student would be able to:
CO 1: Approximate a polynomial/curve to satisfy the given set of data.
CO 2: Apply suitable numerical methods to find the approximate root/solution of algebraic/ transcendental/system of equations.
CO 3: Apply various numerical methods to evaluate differentiation/integration for a given set of data.
CO 4: Solve a given ordinary differential equation with initial conditions using suitable numerical methods.
CO 5: Apply partial differential equations to solve problems namely, one dimensional wave equation and heat equation.

UNIT I
Interpolation and Curve fitting
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-interpolation with unevenly spaced points-Lagrange's interpolation formula.
Curve fitting: Fitting of a straight line - Second degree curve –exponential curve -power curve by method of least squares.

UNIT II
Root finding Methods
Solution of Algebraic and Transcendental Equations and Linear system of equations, Introduction – Graphical interpretation of solution of 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 III

Numerical Differentiation, Integration

Numerical differentiation: Newton's forward and backward difference derivatives, Stirling's Central difference derivatives, Numerical integration – General quadrature formula, Trapezoidal rule, Simpson's$1/3^{rd}$and $3/8^{th}$Rule.

UNIT IV

Numerical solutions of First order differential equations

Numerical solution of Ordinary Differential equations: Solution by Taylor's series method –Picard's Method of successive Approximation- single step methods-Euler's Method-Euler's modified method, Runge - Kutta Methods.

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, Method of separation of variables for second order equations –Applications of Partial differential equations- one dimensional wave equation, one dimensional Heat equation.

Text Books

1. Advanced engineering Mathematics by Kreyszig, John Wiley & Sons Publishers.
2. Advanced Engineering Mathematics by R.K. Jain & S.R.K. Iyengar, 3rd edition, Narosa Publishing House, Delhi.

Reference Books

1. Computer Oriented Numerical Methods by V. Rajaraman, PHI Learning.
2. Higher Engineering Mathematics by B.S. Grewal, Khanna Publishers.
3. Engineering Mathematics by Srimanta pal, subhodh C.Bhunia, Oxford higher Education.
4. A text book of Higher Engineering Mathematics, Bali N P and Saxena, Lakshmi Publications.
5. Introductory methods of Numerical Analysis by S.S. Sastry, PHI learning.

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16CS1201 – COMPUTER PROGRAMMING-II

I Year. B.Tech. EEE –II Semester

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

Prerequisite(s): 16CS1101 Computer Programming-I

Course Objectives:
Develop ability to
1. Understand the concepts of String Manipulation Functions using C language in programming.
2. Introduce the structure, union, and enumerated types
3. Understand the classical approaches to sorting arrays: selection, bubble, insertion, merge sorting; sequential and binary searching algorithms.
4. Introduce the basic concepts of lists, stacks and queues and their applications.
5. Understand the basic characteristics of text, binary files and C implementation of file I/O using streams.

Course Outcomes(COs):
At the end of this course, student would be able to
- **CO 1:** Write and execute programs that read, write and manipulate strings using C language program.
- **CO 2:** Use the type definition, enumerated types, define and use structures, unions in programs using C language.
- **CO 3:** Write programs that sort data using selection, bubble, insertion techniques and perform search mechanisms either by sequential or binary search techniques using C language program.
- **CO 4:** Demonstrate the basic operations of stacks and queues using C program.
- **CO 5:** Write programs that read and write text, binary files using the formatting and character I/O functions.

UNITI

Strings – Concepts, C Strings, String Input / Output functions, string manipulation functions arrays of strings, string / data conversion, C program examples.
Enumerated – The Type Definition (typedef), Enumerated types
Preprocessor commands: C program examples.

UNIT II

Structure and Union Types
Structures – Declaration, initialization, accessing structures, operations on structures, Complex structures, C program examples.

Structures in C
Structures and functions, passing structures through pointers, self referential structures, unions, bit fields, C programming examples

UNIT III

Sorting - Selection sort, bubble sort, insertion sort and merge sort techniques (Using Arrays)

Searching - Linear search, binary search, binary recursive search techniques (Using Arrays)

UNIT IV

Linear list - Singly linked list implementation, insertion, deletion and searching operations on linear list

Stacks - Push and Pop Operations, Introduction to In-fix and Post-Fix Notation. (Arrays and List implementation.)

Queues - Enqueue and Dequeue operations. (Arrays and List implementation.)

UNIT V

File 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, C program examples.

Command line arguments, C program examples.

Program Development – Simple file, Multi-function, Multi-source files, Separate Compilation of functions

Text Books

1. Computer Science: A Structured Programming Approach Using C, B.A.Forouzan and R.F. Gilberg, Third Edition, Thompson Learning, 2007 Reprint.

Reference Books

1. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI.
2. Programming in C. P. Dey and M Ghosh , Oxford University Press.
3. Programming with C, B.Gottfried, 3rd edition, Schaum's outlines, TMH.
4. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, 7th Edition, Pearson education.
5. C and Data structures – P. Padmanabham, Third Edition, B.S. Publications.

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16EN12L1– ENGLISH-II LAB

I Year. B.Tech. EEE – II Semester

L	T	P/D	C
-	-	2/-	1

Prerequisite(s): 16EN1101 English –I
16EN11L1English-I Lab

Course Objectives:
Develop ability to
1. Use Computer Aided Multimedia tools for advanced language learning.
2. Sensitize student to the nuances of combination of speech sounds, accent, intonation and rhythm of English language.
3. Listen actively and speak fluently at various fora.
4. Apply language skills with ease in real life situations.
5. Enhance writing skills.

Course Outcomes(COs):
On completion of this course, student would be able to
CO 1: Demonstrate with ease, the nuances of English language through audio visual tools.
CO 2: Listen actively and speak fluently at various fora.
CO 3: Demonstrate language skills aptly in various situations.
CO 4: Demonstrate writing skills with appropriate usage of words.

Module: 1
Consonant Clusters, Past Tense and Plural Markers, Minimal Pairs

Module: 2
Describing people, places, situations – Narrating- Giving Directions

Module: 3
Discussions and Public Speaking

Module: 4
Debate

Module: 5
Oral Presentations

Module: 6
Creative Writing

Additional Topics
Assertive Communication
Time Management

Books Recommended

1. *Speaking English Effectively* 2nd Edition by Krishna Mohan and N.P.Singh, MacMillan Publishers, 2011.

2. *How to prepare for interviews* by Shashi Kumar.V and Dhamija P.V

3. *English Pronunciation in Use* by Hancock, M. 2009, Cambridge University Press

4. *Spoken English, a Manual of Speech and Phonetics*, by R.K.Bansal and J.B.Harrison, Orient Black Swan 2013.
5. *Spoken English* by Shashi Kumar and Dhamija.

6. A Manual entitled *English Language Communication Skills Lab Manual cum Workbook* by Cengage Learning India 2013

7. *Creative Writing Skills* by Ashraf Rizvi, Tata Mc. Graw Hill

8. CD's on listening.

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16PH12L2– SEMICONDUCTOR PHYSICS LAB

I Year. B.Tech. EEE – II Semester
Prerequisite(s): 16PH1101 - Engineering Physics

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

Course Objectives:
Develop ability to
1. Determine modulii of elasticity.
2. Determine wavelength of spectral lines in Mercury spectrum, wavelength of LASER, radius of curvature of a plano-convex lens.
3. Determine time constant of a capacitor, energy gap of a given semiconductor, study V-I characteristics of p-n junction and Zener diode; calculate ripple factor of a given rectifier.
4. Plot input and output characteristics of a given transistor in different configurations, understand methods of transistor biasing, plot V-I characteristics of a Field Effect Transistor (FET).
5. Determine the magnetic induction at several points on the axis of coil carrying current using Stewart and Gee's method; plot the V-I characteristics of solar cell.

Course Outcomes (Cos):
On completion of this course, student would be able to
CO 1: Infer Modulii of elasticity of given material, compute shearing stress and strain: identify their limitations.
CO 2: Demonstrate the optical phenomena like interference and diffraction by computing wavelength of spectral lines of a given source.
CO 3: Explain the signal delay in electronic circuits by calculating time constant of a capacitor,plot the V-I characteristics of p-n junction diode and zener diode, Compute ripple factor of a given rectifier.
CO 4: Evaluate current gain of a given transistor; compute drain resistance and transconductance of a FET.
CO 5: Compute the magnetic induction using Stewart and Gee's method; Obtain the V-I characteristics of solar cells and specify their applications.

List of Experiments:
1. Determination of Rigidity Modulus of a given wire using Torsional Pendulum.
2. Determination of radius of curvature of a given Plano Convex lens by forming Newton's Rings.
3. Determination of wavelength of spectral lines of mercury spectrum - Diffraction grating.
4. Determination of wavelength of a given source of LASER-Diffraction Grating.
5. Determination of time constant of a given R-C combination.
6. Determination of energy gap of a given semiconductor.
7. V-I Characteristics of p - n junction diode and zener diode.
8. Input and Output Characteristics of n-p-n Transistor - CE configuration.
9. Input and Output Characteristics of n-p-n Transistor - CB configuration.
10. Conversion of ac to dc by using Half wave rectifier without filters.
11. Conversion of ac to dc by using Full wave rectifiers without filters.
12. FET Characteristics.

Additional Experiments:
1. Determination of magnetic field of induction at several points on the axis of coil carrying current using Stewart and Gee's method.
2. V-I characteristics of Solar cell.

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16MA12L1– COMPUTATIONAL MATHEMATICS LAB

L	T	P/D	C
-	-	3	2

I Year. B.Tech. EEE – II Semester
Prerequisite(s): 16CS1101Computer Programming-I

Course Objectives:
Develop ability to write and execute programs using C-Programming/Octave/Scilab to
1. Find the solution of system of non-homogeneous equations by L-U decomposition method
2. Construct a polynomial of suitable degree by using the discrete data.
3. Find the numerical solutions of ordinary differential equations using different numerical methods like Taylor's series method, Picard's method, Euler's method, Euler's modified method and Runge-Kutta method, when the usual methods fail to find the general solution of a differential equation.
4. Apply numerical integration methods to find integration of unintegrable functions.

Course Outcomes (Cos):
At the end of this course, student would be able to
CO 1: Determine the solution of system of non-homogeneous equations by L-U decomposition method
CO 2: Construct a polynomial of suitable degree by using the discrete data
CO 3: Apply Numerical differentiation techniques to find first, second and higher order derivatives, when the function under consideration is not differentiable
CO 4: Determine the numerical solutions of ordinary differential equations using different numerical methods like Taylor's series method, Picard's method, Euler's method, Euler's modified method and Runge-Kutta methods, when usual methods fail to find the general solution of differential equation

Programming Tasks:

1. Determine y for a given x, if two arrays of x and y of same size are given (using Newton's interpolation both forward and backward).
2. Determine y for a given x, if two arrays of x and y of same size are given(using Lagrange's and Gauss's interpolation)
3. Find the solution of given system of linear equations using L-U decomposition method.
4. Find the solution of given system of linear equations using Jacobi's method.
5. Find the solution of given system of equations using Gauss-Seidel iteration method.
6. Find the solution of given system of equations using Gauss Jordan elimination method.
7. Evaluate definite integral using trapezoidal rule, Simpson's $1/3^{rd}$ rule and $3/8^{th}$ rule.
8. Solve a given differential equation using Taylor's series.
9. Solve a given differential equation using Euler's and modified Euler's method.
10. Solve a given differential equation using Runge-Kutta method.

Advance Lab techniques:

1. Solve system of equations using QR-algorithm.
2. Solve system of equations using Predictor-Corrector algorithm.

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16CS12L1 – COMPUTER PROGRAMMING-II LAB

I Year. B.Tech. EEE – II Semester
Prerequisite(s): 16CS1101 Computer Programming I
16CS11L1Computer Programming-I Lab

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

Course Objectives:
Develop ability to
1. Understand the concepts of String Manipulation Functions using C language in programming.
2. Introduce the structure, union, and enumerated types
3. Understand the classical approaches to sorting arrays: selection, bubble, insertion, merge sorting; sequential and binary searching algorithms.
4. Introduce the basic concepts of lists, stacks and queues and their applications.
5. Understand the basic characteristics of text, binary files and C implementation of file I/O using streams.

Course Outcomes (COs):
At the end of this course, student would be able to
CO 1: Write and execute programs that read, write and manipulate strings using C language program.
CO 2: Use the type definition, enumerated types, define and use structures, unions in programs using C language.
CO 3: Write programs that sort data using selection, bubble, insertion techniques and perform search mechanisms either by sequential or binary search techniques using C language program.
CO 4: Demonstrate the basic operations of stacks and queues using C program.

Write programs that read and write text, binary files using the formatting and character I/O functions.

Week No	Name of the program
1.	1. Write a C program to find weather a given string is palindrome or not. 2. Write a C program to insert characters at a given location in a given string. 3. Write a C program to delete characters from a given string and position 4. Write a C program to print the number of vowels and consonants using Strings.
2.	1. Write a C program to convert Roman number to Decimal Number. 2. Write a C program to find the 2's Compliment of a given string 3. Write a C program to Reverse a String by Passing it to function 4. C Program to Input a String with at least one Number, Print the Square of all the Numbers in a String

3	1. Write a c program to implement complex structures for the following operations. i. Addition of 2 Complex numbers ii. Multiplication of 2 Complex Numbers
4	a. Write a c program to implement arrays of structures? b. Write a c program to implement bit fields in C?
5	1. Write a C Program to store the information (name, roll no, and branch) of a student using unions. 2. Write a c program to implement inter function communication by passing pointers to a structure.
6	1. Write a c program to sort the elements using selection sort 2. Write a c program to sort the elements using Bubble sort. 3. Write a c program to sort the elements using Insertion sort 4. Write a c program to sort the elements using Merge sort
7	a. Write a c program to search an element in a list of elements using linear search. If the element found display the position, otherwise print "element not present". b. Write a c program to search an element in a list of elements using Binary search. If the element found display the position, otherwise print "element not present". c. Write a c program to search an element in a list of elements using recursive Binary search. If the element found display the position, otherwise print "element not present".
8	Write a c program to implement singly linked list for the following operations. a) Insertion b)Deletion c)Search
9	a. Write a c program implement Stack using arrays. b. Write a c program implement Stack using linked list. c. Write a c program convert infix to postfix notation.
10	1. Write a c program implement Queue using arrays for the following operations. i) Enqueue ii) Dequeue 2. Write a c program implement Queue using Linked list for the following operations. i) Enqueue ii) Dequeue
11	1. Write a c program open a new file and implement the following I/O functions. a. fprintf(), fscanf() b. getw(), putw() c. getc(), putc() 2. Write a c program to copy data from one file to another. 3. Write a c program to merge two files, using command line arguments.

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16WS12L1 –IT WORKSHOP

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

I Year. B.Tech. EEE– II Semester
Prerequisite(s): None

Course Objectives:
Enable students to

1. Identify different components of Personal Computer (PC) and their configurations.
2. Identify various steps for disassembly and assembly of PC components.
3. Install Windows and Linux operating systems on Personal Computers.
4. Troubleshoot simple hardware and software related problems.
5. Make Text Documents using various features of document preparation tools such as MS-Word, Libre Office Write, LaTex.
6. Make Spread Sheet using various features of worksheet preparation tools namely, MS-Excel, Libre Office Calc.
7. Make Presentations using various features of presentation tools namely, MS-Powerpoint, Libre Office Express.

Course Outcomes (COs):
After completion of this course, student would be able to

CO 1: Identify the components of Personal Computer (PC) System.
CO 2: Disassemble and assemble the components of Personal Computer.
CO 3: Troubleshoot trivial hardware and software related problems.
CO 4: Use productivity software such as MS Office Tools: Word, Excel, Power Point, Libre Office Tools: Write, Calc, Express and LaTex.
CO 5: Install Operating Systems such as Windows and Linux on personal computers

List of Experiments:

Week 1	**Task 1**: Different generations of computers, computing environments, Identify the peripherals of a computer, components in CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral. **Task 2**: The students need to go through the video which shows the process of assembling a PC. The student should disassemble and assemble the PC back to its working condition.
Week 2	**Task 1:** Every student should learn installing Windows-7 in the personal computer. **Task 2:** Hardware & software Troubleshooting: Students have to be given a PC which does not boot due to improper assembly or defective peripherals and Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition.
Week 3	**Task**: Every student should learn the process of installing Linux in the computer along with configuring as dual boot with both windows and Linux.

Week 4	**Task 1**: Features of Word Processor Tool: Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track changes. **Task 2**: Creating a Newsletter: Features: Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge.
Week 5	**Task 1**: Features of Spreadsheet Tool: Creating a Scheduler - Features:- Gridlines, Format Cells, Summation, auto fill, Formatting Text **Task 2**: Calculating GPA : Cell Referencing, Formulae in spreadsheet – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, lookup, Sorting, Conditional formatting.
Week 6	**Task**: Features of Presentation tool: Students will work on basic power point utilities and tools which help them to create power point presentation. Presentation Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Hyperlinks, Inserting – Images, Clip Art, Audio, Video, Objects, Tables and Charts Lines and Arrows.
Week 7	**Task:** Document preparation using Latex
Week 8	**Task:** Libre Office

Text Books

1. Comdex Information Technology Course Tool Kit, Vikas Gupta, WILEY Dreamtech, 2009-10, Edition.
2. Introduction to Information Technology, ITL Education Solutions Limited, Pearson Education, 2012.

Reference Books

1. Introduction to Computers, Peter Norton, 6/e Mc Graw Hill Publishers.
2. LaTex Companion, Leslie Lamport, PHI/ Pearson.
3. Upgrading and Repairing, PC's 18th e, Scott Muller QUE, Pearson Education.
4. IT Essentials PC Hardware and Software Companion Guide, Third Edition, David Anfinson and Ken Quamme, CISCO Press, Pearson Education.

16WS12L1 –ENGINEERING WORKSHOP

I Year. B.Tech. EEE– II Semester
Prerequisite(s): None

Course Objectives:
Develop ability to

1. Inculcate general machining skills.
2. Understand the dignity of labor, precision, safety at work place, team working and development of positive attitude.
3. Gain hands on experience on different trades of engineering such as fitting, carpentry, tin smithy, welding, foundry, black smithy, house wiring and sheet metal.
4. Acquire knowledge of thread cutting and pipe joining in plumbing.
5. Understand the concept of Machining with lathes and automats.
6. Be aware of power tools used in various Engineering applications.

Course Outcomes (COs):
On completion of this course, student would be able to

CO 1: Use various modern engineering tools for engineering practice
CO 2: Recognize dignity of labour and workshop safety regulations.
CO 3: Design and model different prototypes in carpentry such as T-Lap Joint and L-Lap Joint.
CO 4: Make basic prototypes in Tin Smithy such as Open Scoop and Rectangular Tray.
CO 5: Perform basic House Wiring techniques such as Series wiring, Staircase (one lamp with two switches) Connection, Connecting one lamp with one switch, connecting two lamps with one switch.
CO 6: Design and model basic prototypes in fitting such as L-Fitting, V-Fitting and Dove tail Fitting.
CO 7: Make basic prototypes in Black Smithy such as S-Hook, C –Hook and Flat Chisel.
CO 8: Perform basic Foundry such as Dumbbell Pattern, Stepped Pulley Pattern and Gear Pattern

Demonstrate knowledge of welding process, Plumbing and power Tools.

List of Experiments:

I. Trades for Exercises
At least TWO exercises from each trade:

1. Carpentry
   T-Lap Joint, L-Lap Joint, Cross Lap joint, Dove Tail Joint
2. Fitting
   L-Fitting, V-Fitting,Dove tail Fitting.
3. Tin-smithy and development of jobs carried out and soldering.
   Open Scoop, Rectangular Tray, Funnel.
4. House-wiring

Series Wiring, Staircase Wiring, Connecting one lamp with one switch, connecting two lamps with one switch.

5. Black smithy
   S-Hook, C –Hook, Flat Chisel.
6. Foundry
   Doumble Pattern, Stepped Pulley Pattern, Gear pattern

II. Trades for Demonstration & Exposure

1. Welding
   V-Butt Joint, Corner Butt Joint, Lap Joints.
2. Power tools used in construction, wood working, electrical engineering and mechanical engineering.
3. Plumbing
   Thread Cutting, Pipe Joining –1, Pipe Joining -2.

Text Books

1. Work shop manual - P.Kannaiah/K.L Narayana/SciTech publishers.
2. Workshop manual by Venkat Reddy, 2nd Edn, SciTech publishers.

Reference Books

1. Raghuwanshi B.S., Workshop Technology Vol. I & II, Dhanpath Rai & Sons.
2. John K.C., Mechanical Workshop Practice. 2nd Edn.PHI 2010.
3. Jeyapoovan T. and Pranitha S, Engineering Practices Lab Manual, 3rd Edn. Vikas Pub.2008.

B.TECH EEE
II - YEAR
I-SEM

DETAILED SYLLABUS

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16MA2103 – COMPLEX VARIABLES

II Year. B.Tech. EEE – I Semester
Prerequisite(s): 16MA1201 Mathematics-II

L	T	P/D	C
3	1	-/-	3

Course Objectives:
Develop ability to
1. Understand difference between real and complex valued functions and verify its analyticity.
2. Appreciate integrations of complex valued functions.
3. Express complex valued functions in terms of power series and test its convergence using complex integral theorems.
4. Understand residues and apply residue theorem to compute several kinds of real definite integrals.
5. Transform a given complex valued function from Z-plane to W-Plane using conformal, standard and bilinear transformations.

Course Outcomes (COs):
On completion of this course, student would be able to
CO 1: Test analyticity of a given function using Cauchy-Riemann equations and find complex function for given real or imaginary parts.
CO 2: Apply Cauchy's theorem, Cauchy's integral formula including generalizedone to evaluate integration of complex valued functions.
CO 3: Use Maclaurin's and Laurent series to expand given complex valued functions and test its convergence.
CO 4: Compute several kinds of real definite integrals using residue theorem.
CO 5: Employ conformal, standard and bilinear transformations to transform a given complex valued function from Z-plane to W-Plane.

UnitI
Complex Functions and Analyticity–Differentiation: Complex functions and its representation on Argand plane, Concepts of limit Continuity, Differentiability, Analyticity, Cauchy-Riemann conditions, Harmonic functions – Milne – Thompson method.

UnitII
Complex Integration: Line integral – Evaluation along a path and by indefinite integration – Cauchy's theorem – Cauchy's integral formula – Generalized Cauchy's integral formula.

Unit III
Power series expansions of complex functions: 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.

UNITIV

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.

UNITV

Conformal mapping: Transformation of z-plane to w-plane by a function, Conformal transformation. Standard transformations- Translation; Magnification and rotation; inversion and reflection, Transformations like e^z, log z, z^2 , and Bilinear transformation, Properties of Bilinear transformation, determination of bilinear transformation when mappings of three points are given.

Text Books

1. Advanced Engineering Mathematics by Kreyszig, John Wiley & Sons.
2. Advanced Engineering Mathematics by R.K. Jain & S. R. K. Iyengar, Narosa Publishing House.

Reference Books

1. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers.
2. Complex analysis for Mathematics and Engineering by John H, Jones And Bartlett India Pvt Ltd. - New Delhi. 6th Edition.
3. Foundations of Complex Analysis by S. Ponnuswamy, Narosa Publications.
4. Engineering Mathematics by Srimanta pal, subhodh C.Bhunia, Oxford higher Education.
5. A Text Book of Engineering Mathematics by N P Bali, Manesh Goyal.
6. Mathematics for Engineers by K. B. Datta and M.A S.Srinivas, Cengage Publications.

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16ME2104– FLUID MECHANICS AND HYDRAULIC MACHINERY

II Year B.Tech EEE – I Semester
Prerequisite(s): None

L	T	P/D	C
3	1	-/-	3

Course Objectives:
Develop ability to
1. Understand the fundamental properties of fluids.
2. Understand basic concepts of conservation of mass, energy and momentum equations and application to simple problems.
3. Understand working principles of pressure, velocity and discharge measuring devices.
4. Understand concept of Hydel power generation and determination of efficiency for a given catchment area.
5. Understand momentum and angular momentum principles.
6. Understand basic principles of impact of jet on vanes.
7. Understand working of various turbines such as Pelton wheel, Francis and Kaplan turbines.
8. Understand working of centrifugal and reciprocating pumps.

Course Outcomes (COs):
On completion of this course, student would be able to

CO 1: Explain fluid properties and types of fluid flows.
CO 2: Apply conservation of mass, energy and momentum principles to fluid flow problems in engineering applications.
CO 3: Formulate one dimensional compressible fluid flow problems and solve the same.
CO 4: Explain concept of Hydel power generation and determine efficiency for a given catchment area.
CO 5: Analyse practical problems of various turbines used in Industry and hydro power plants.
CO 6: Specify and select suitable turbine based on head requirements.
CO 7: Design working proportions of hydraulic machines (pumps and turbines).
CO 8: Solve various engineering problems related to centrifugal and reciprocating pumps used in agriculture, domestic and industrial applications.

UNIT I
Fluid Statics & Fluid Kinematics
Properties of fluid – specific gravity, viscosity, surface tension, compressibility, vapor pressure and their influence on fluid motion, measurement of pressure(Manometers). Classification of flows, Streamline, path line and streak lines and stream tube, continuity equation for one dimensional flow

UNIT II

Fluid Dynamics

Surface and body forces – Euler's and Bernoulli's equation, Venturimeter, Orifice meter, Pitot tube, Reynolds experiment –Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel. Hydraulic gradient line and total energy line Momentum equation and its pipe bend.

UNIT III

Basics of Turbo Machinery

Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes - jet striking centrally and at tip, flow over radial vanes, velocity diagrams, work done and efficiency.

ELEMENTS OF HYDROELECTRIC POWER STATION: Types of power plants, storage requirements, power generation concepts, estimation of power from a given catchment area, head and efficiencies.

UNIT - IV

HYDRAULIC TURBINES

Classification of turbines, design of Pelton wheel, Francis turbine and Kaplan turbine – working proportion, work done, efficiency, draft tube-theory, functions and efficiency. Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, surge tank.

UNIT V

Hydraulic Pumps

Classification: centrifugal pumps – types, working, work done, manometric head, losses and efficiencies, specific speed, Cavitation, performance characteristic curves, NPSH.Reciprocating pump (only theory)

Text Books

1. Hydraulics And Fluid Mechanics Including Hydraulics Machines by Dr. P.N.Modi, Dr. S.M. Seth, Standard book house, 2009.
2. Fluid Mechanics & Hydraulic Machines by R.K.Rajput, S Chand & Co Ltd, 3rdRev. Edition, 2006.

Reference Books

1. Fluid mechanics - fundamentals & applications by Yunus A. Çengel, John Cimbala, McGraw-Hill Higher Education, 2006
2. Fluid Mechanics and Hydraulic Machines by R.K. Bansal , Lakshmi Publications,2005

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16EC2103 – SWITCHING THEORY AND LOGIC DESIGN

II Year B. Tech. EEE I Semester
Prerequisite(s): None

L	T	P/D	C
3	1	-/-	3

Course Objectives:

Develop ability to

1. Understand basic concepts of various number systems used in digital systems.
2. Understand Boolean algebra and various Boolean simplification theorems.
3. Understand simplification of Boolean functions using k-map and tabular method.
4. Understand design and analysis of combinational and sequential logic circuits.
5. Understand the concepts of various memories and PLDs.
6. Understand symmetric functions and design the same using relay contacts.
7. Understand Threshold logic and design switching functions using threshold elements.

Course Outcomes:

At the end of the course, student would be able to

CO 1. Perform conversions from one number system to another.
CO 2. Simplify switching functions using Boolean minimization theorems, map method and tabulation method.
CO 3. Analyze and design combinational and sequential logic circuits. Analyze and design logic circuits that are hazard free.
CO 4. Synthesize logic circuits using PLDs.
CO 5. Synthesize symmetric functions using relay contact networks.
CO 6. Design switching circuits using threshold elements.

UNIT I

Number Systems

Number Systems, Base Conversion Methods, Binary arithmetic, Complements of Numbers, Codes-Binary Codes, Binary Coded Decimal (BCD) Code and its Properties, Unit Distance Codes, Alpha Numeric Codes, Error Detecting and Correcting Codes.

Boolean Algebra and Switching Functions: Switching algebra, Basic Theorems and Properties, Switching Functions, Canonical and Standard Form, Algebraic Simplification of Digital Logic Gates. Properties of XOR Gates, Universal Gates, Multilevel NAND/NOR realizations.

UNIT II

Minimization of switching functions

Introduction, Minimization with theorems, The Karnaugh Map Method, Four, Five and six Variable maps. Prime implicants and essential prime implicants. Don't care map entries, using the map for simplifying Boolean expressions, Tabular method, partially specified expressions, Multi-output minimizations.

UNIT III

Design of Combinational Circuits

Design using Conventional Logic gates, Data Selectors, Encoders, Priority Encoder, Decoders, comparators, Adders, multiplexers, De-multiplexers, realization of switching functions using MUX, Parity generators and code converters. Static Hazards and Hazard Free Realizations.

Memory Elements and Programmable Logic Devices

Types of Memory Elements (RAM and ROM). Basic PLDs - ROM, PROM, PLA and PAL. Realization of Switching functions using PLDs.

UNIT IV

Synthesis of Symmetric Networks

Relay Contacts, Analysis and Synthesis of Contact Networks, Symmetric Networks, Identification of Symmetric Functions and realization of the same.

Threshold Logic:

Threshold Element, Capabilities and Limitations of Threshold logic, Elementary Properties, Synthesis of threshold networks (Unate function, Linear seperability, Identification and realization of threshold functions, Map based synthesis of two-level Threshold networks).

UNIT V

Sequential Machines Fundamentals

Introduction, NAND/NOR latches, SR, JK, JK Master slave, D and T Flip-flops, Excitation functions of SR, JK, JK Master Slave, D and T Flip-flops. State table, State Diagram, State Assignment. Finite State Model - Basic Definitions. Synthesis of Synchronous Sequential circuits - Sequence Detector, Serial Binary adder, Binary counter and Parity bit generator.

Counters and Shift Registers

Ripple Counter, Shift Registers and their types, Ring Counters, Twisted Ring Counters.

Text Books:

1. Switching and Finite Automata Theory- Zvi Kohavi & Niraj K. Jha, 2nd Edition, 2009, Cambridge University Press.
2. Digital Design- Morris Mano, PHl, 3rd Edition.

Reference Books:

1. Introduction to Switching Theory and Logic Design - Fredriac J. Hill, Gerald R. Peterson, 3d Ed, John Wiley & Sons lnc.
2. Digital Fundamentals - A Systems Approach - Thomas L. Floyd, Pearson, 2013.
3. Digital Logic Design - Ye Brian and Holds Worth, Elsevier.
4. Fundamentals of Logic Design- Charles H. Roth, Cengage Learning, 5th, Edition, 2004.
5. Digital Logic Applications and Design, John M. Yarbrough, Thomson Publications, 2006.
6. Digital Logic and State Machine Design - Comer, 3d, Oxford, 2013.

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16EE2101 – ELECTROMAGNETIC FIELD THEORY

II Year B.Tech. EEE I Semester
Prerequisite(s): 16PH1101 Engineering Physics
16MA1101 Mathematics I

L	T	P/D	C
4	1	-/-	4

Course Objectives:
Develop ability to

1. Understand Electrostatic Fields and their applications namely, calculation of electric field using Coulomb's law and Gauss's law.
2. Understand Magnetostatic Fields and their applications namely, calculation of magnetic field using Biot-Savart's law and Ampere's law.
3. Estimate the force due to an electric dipole moment in Magnetic Fields.
4. Understand Faraday's laws of Electromagnetic induction and their applications.
5. Understand the concepts of time varying Electric and Magnetic fields and Maxwell's equations.

Course Outcomes (COs):
On completion of this course, student would be able to

CO 1: Calculate the field intensity for distribution of charges namely, point, line and surface.
CO 2: Determine potential difference due to any type of charge.
CO 3: Compute magnetic field intensity with different current distributions by applying Biot-Savart's law and Ampere's circuital law respectively, one each at a time.
CO 4: Calculate magnetic forces for circular, square and solenoid with different current distributions.
CO 5: Determine the relation between time varying Electric and Magnetic fields and hence deduce Maxwell's equations for time varying electromagnetic fields

UNITI

Electrostatic Fields: 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 – Gauss law – Application of Gauss Law – Maxwell's first law, div (D)=ρ_v.

UNIT II

Electric dipole: Electric dipole – Dipole moment – potential and EFI due to an electric dipole – Torque on an Electric dipole in an electric field. 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*:*Magnetic circuits-Faraday's laws of electromagnetic induction-concept of self and mutual inductance-dot convention-coefficient of coupling-composite magnetic circuit-analysis of series and parallel magnetic circuits.

Static magnetic fields – Biot-Savart's law – 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, div(B)=0.

UNIT – IV

Ampere's Circuital Law and its Applications: 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, Curl (H)=Jc, Field due to a circular loop, rectangular and square loops.

UNIT V

Electromagnetic Fields andTime varying fields: Magnetic force - Moving charges in a Magnetic field – Lorentz force equation – force on a current element in a magnetic Field. Magnetic dipole and dipole moment – a differential current loop as a magnetic dipole – Torque on a current loop placed in a magnetic field. Energy stored and density in a magnetic field. Time varying fields – Faraday's laws of electromagnetic induction – Its integral and point forms – Maxwell's fourth equation, Curl (E)=-dB/dt – Statically and Dynamically induced EMFs – Simple problems -Modification of Maxwell's equations for time varying fields – Displacement current.

Text Books

1."Engineering Electromagnetics" by William H. Hayt and John. A. Buck Mc. Graw-Hill Companies, 7th Edition 2009.
2. "Electromagnetic Fields" by Sadiku, Oxford Publications

Reference Books

1. "Introduction to Electro Dynamics", D J Griffiths, Printice hall of ndiapvt.Ltd.
2. "Electromagnetics-Problems and solutions", William H.Hayt&John.A. Buck McGraw Hill Companies.
3. "Electromagnetic Fields", Y.Mallikarjuna Reddy, Universities Press.
4. "Network Analysis", By M.E Van Valkenberg
5. Electric Circuits - A.Chakrabarhty, DhanipatRai& Sons.

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16EE2102– ELECTRICAL CIRCUITS

II Year B.Tech. EEE I Semester
Prerequisite(s): 16PH1101Engineering Physics
16MA1101 Mathematics-I
16MA1201 Mathematics-II

L	T	P/D	C
4	1	-/-	4

Course Objectives:
Develop ability to

1. Understand the basic concepts of DC and single phase AC circuits using different types of input waveforms.
2. Understand the network topology using nodal and mesh analysis and comprehend R,R-L,R-C and R-L-C networks by constructing locus diagrams.
3. Understand the concept of resonance in series and parallel networks.
4. Understand three phase AC circuit parameters and comprehend DC and AC circuits through network theorems.
5. Understand transient response of R-L, R-C and R-L-C series and parallel circuits, for DC and AC excitations.
6. Understand the concept of complex frequency.
7. Understand different types of two-port network parameters, their relation and transformations.
8. Understand different types of filters and basic concepts of Fourier transforms.

Course Outcomes (COs):
On completion of this course, student would be able to

CO 1: Explain basic circuit concepts, responses and determine voltage and current parameters of circuits by using different techniques.
CO 2: Draw locus diagrams for R, R-L, R-C and R-L-C series and parallel networks and analyze circuits using different techniques of network topology.
CO 3: Calculate resonance parameters for series and parallel networks.
CO 4: Analyze three phase AC circuits and calculate voltage and current parameters of circuit elements using network theorems.
CO 5: Evaluate transient response of different circuits, for DC and AC excitations using differential equations and Laplace transforms methods.
CO 6: Interpret the parameters of complex frequency.
CO 7: Determine two-port network parameters
CO 8: Analyze different types of filters and compute Fourier integrals and Fourier transforms for different systems.

UNIT I

Introduction to Electrical Circuits: Circuit Concept, R-L-C Parameters, Voltage and Current Sources, Independent and Dependent Sources, Source Transformation, Voltage – Current relationship for Passive Elements. Kirchhoff's Laws, Network Reduction Techniques – Series, Parallel, Series Parallel, Star –to-Delta or Delta-to-Star Transformations, Nodal Analysis, Mesh Analysis, Super node and Super mesh for DC Excitations

Single Phase A.C. Circuits: R.M.S. and Average values and form factor for different periodic wave forms, Steady State Analysis of R, L and C (in Series, Parallel and Series Parallel Combinations) with Sinusoidal Excitation, Concept of Reactance, Impedance, Susceptance and Admittance, Phase and Phase difference, Concept of Power Factor, Real and Reactive powers, J-notation, Complex and Polar forms of representation, Complex power.

UNIT II

Locus diagrams, Resonance, Network Topology: Locus diagrams - series R-L, R-C, R-L-C and parallel combination with variation of various parameters - Resonance-series, parallel circuits, concept of band width and Q factor.

Network Topology: Definitions, Graph, Tree, Basic cut-set and Basic Tie set Matrices for Planar Networks, Loop and Nodal methods for analysis of Networks with Dependent & Independent Voltage and Current Sources, Duality & Dual Networks.

UNIT III

Network Theorems (With AC and DC): Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Millman's, Compensation and Tellegen's Theorems

Three phase AC 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 IV

DC Transients: Transient response of R-L, R-C, R-L-C Circuits, (Series and parallel combination) for DC excitation and for Sinusoidal excitation, Initial conditions-Solution method using differential equation, Initial conditions-Solution method using Laplace transforms

Concept of Complex Frequency: The concept of complex frequency, physical interpretation of complex frequency, Transform impedance and transform circuits, series and parallel combination of elements Terminal pairs of 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.

UNIT V

Two Port networks: Two port network parameters: Z, Y, ABCD and hybrid parameters and their relation, Cascaded networks, Concept of transformed network: Two port network parameters using transformed variables,

Filter Circuits: Low pass, High pass, Band pass, Band Elimination, Prototype filter design, constant k-type and m-derived filters.

Text Books

1. Engineering circuit analysis by William Hayt and Jack E.Kemmerly, McGra Hill Company, 6th edition
2. Electric Circuits - A. Chakrabarhty, Dhanpat Rai and Sons.

Reference Books

1. Network Analysis By M.E Van Valkenberg
2. Network analysis by N.Srinivasulu
3. Electric Circuit Analysis - K.S.Suresh Kumar, Pearson Education.
4. Electrical Circuits - David A.Bell, Oxford University Press.
5. Network Analysis and Circuits - M.Arshad, Infinity Science Press.
6. Circuits - A.Bruce Carlson, Cengage Learning.
7. Electrical Circuits: An Introduction - KCA Smith and RE Alley, Cambridge University Press.
8. Network analysis - N.C Jagan and C. Lakhminarayana, BS publications.
9. Circuits and Networks by A.Sudhakar and Shyammohan S Pilli, Tata McGraw-Hill

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16ME21L3 – FLUID MECHANICS AND HYDRAULIC MACHINERY LAB

II Year B.Tech. EEE I Semester
Prerequisite(s):None

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

Course Objectives:
Develop ability to
1. Understand fundamental principles of fluid mechanics to solve practical mechanical engineering problems of water conveyance in pipes and pipe networks.
2. Understand application of hydraulic machinery.
3. Conduct performance tests on pumps and turbines.
4. Understand operating characteristics and factors affecting performance of hydraulic machinery (pumps and turbines).

Course Outcomes (COs):
On completion of this course, student would be able to
CO 1: Demonstrate basic knowledge of fluid mechanics in solving problems and design of pressure pipe systems used in engineering
CO 2: Verify Bernoulli's principle.
CO 3: Determine friction factor for a given pipe.
CO 4: Calibrate flow discharge measuring device used in pipes, channels and tanks.
CO 5: Apply basics of hydraulic machinery and their operation in water systems.
CO 6: Test performance of pumps and turbines.
CO 7: Conduct experiments and interpret data in flow measurement, hydraulic machinery.

List of experiments
1. Impact of jet on vanes
2. Calibration of venture meter
3. Calibration of orifice meter.
4. Determination of friction factor for a given pipe line.
5. Determination of loss of head due to sudden contraction.
6. Verification of Bernoulli's theorem.
7. Performance test on pelton wheel.
8. Performance test on Francis turbine.
9. Performance test on Kaplan turbine.
10. Performance test on single stage centrifugal pump.
11. Performance test on multi stage centrifugal pump.
12. Performance test on reciprocating pump.

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16EE21L1 – FIELD THEORY AND CIRCUITS LAB

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

II Year B.Tech. EEE I Semester
Prerequisite(s): 16PH1202 Semiconductor Physics
16PH12L2 Semiconductor Physics Lab
16MA1101 Mathematics-I
16MA1201 Mathematics-II

Course Objectives:
Develop ability to
1. Verify Kirchhoff's current law and voltage law.
2. Experimentally prove network theorems using hardware and as well as with PSPICE.
3. Be familiar with various electrical instruments vis-à-vis their usage.
4. Understand the concepts of electric field and magnetic field using different circuits.

Course Outcomes (COs):
On completion of this course, student would be able to
CO 1: Distinguish the basic circuit components and Use them in real electrical circuit.
CO 2: Use basic electrical measurement instruments in different types of measurements.
CO 3: Demonstrate the laws and principles of electrical circuits.
CO 4: Identify the relationships and differences between theory and practice.
CO 5: Apply different theorems to different practical circuits.
CO 6: Determine the locus of different electrical circuits.
CO 7: Demonstrate the laws of electromagnetic fields.
CO 8: Compute the field intensities.

List of Experiments

PART-A: Hardware Experiments(Any ten of the following must be conducted)
1. Introduction to working of Voltmeters, Ammeters, Wattmeters, CROs and Multimeters
2. Thevenin's, Norton's and Maximum Power Transfer theorems.
3. Superposition principle, Reciprocity and Millman's theorem
4. Verification of compensation theorem and RMS value of complex wave..
5. Locus diagram of R-L and R-C series circuits, Series and Parallel resonance.
6. Determination of self and mutual inductances and co efficient of coupling.
7. Two port network parameters.
8. Measurement of Active, Reactive power for Star and Delta connected balanced loads
9. Measurement of 3-phase power by two watt meter method for unbalanced loads.
10. Observation of magnetic field outside a Straight Conductor; determining the magnetic field intensity in the coil; Calculation of magnetic force between two current carrying conductors.
11. Demonstration of Faraday's Law of Electro Magnetic Induction; Concept of Magnetic Levitation

PART-B: PSPICE Simulation (Any two of the following must be conducted)
1. Simulation of DC circuits
2. DC Transient response
3. Mesh analysis
4. Nodal analysis

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16EN21L1 –ADVANCED ENGLISH COMMUNICATION SKILLS (AECS) LAB

II Year B.Tech EEE –I Semester
Prerequisite(s):16EN1101- English - I
16EN11L1English-I Lab
16EN1201English- II
16EN12L1 English-IILab

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

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Course Objectives:

Develop ability to

1. Improve fluency in English through well developed vocabulary exercises.
2. Listen to conversational English language spoken by native English speakers and respond appropriately in different social, cultural and professional contexts.
3. Communicate ideas relevantly, coherently and cogently in written form, presentations and interviews.

Course Outcomes:

On completion of this course, student would be able to

CO 1: Take part in social and professional communication with ease.

CO 2: Improve vocabulary and express the same contextually.

CO 3: Demonstrate reading techniques namely, skimming and scanning.

CO 4: Write formal letters prepare resume, and reports: project and technical reports.

CO 5: Make presentations.

CO 6: Participate in group discussions expressing ideas relevantly, coherently and cogently.

Syllabus

The following course content with activities/tasks is prescribed for the Advanced Communication Skills (ACS) Lab sessions:

1. **Activities on Fundamentals of Inter- Personal Communication and Building Vocabulary – Starting a conversation** – responding appropriately and relevantly- using the right body language- role play in different situations, discourse skills- using audio-visual aids, synonyms and antonyms word roots, one-words substitutions, prefixes and suffixes, study of word origins, business vocabulary, analogy, idioms and phrases, collocations and uses of vocabulary.
2. **Activities on Reading Comprehension**- General Vs Local Comprehension reading for facts, guessing meanings from contexts. Scanning, skimming, and inferring meaning, critical reading, and effective goggling.
3. **Activities on Writing Skills-** Structure and presentation of different types of writing – Letter writing / Resume Writing / e-correspondence / technical report writing/ portfolio writing/ planning for writing / improving writing skills.

4. **Activities on Presentations Skills**- Oral presentations (individual and group) through **JAM** sessions / seminars / **PPT** s and written presentations through Posters/ Projects/ Reports/ e-mails assignments etc.
5. **Activities on Group Discussion and Interview Skills-** Dynamics of group discussion, intervention, summarizing, modulation of voice body language, relevance fluency and organization of ideas and rubrics for evaluation/ Concept of process. Pre- interview planning opening strategies, answering strategies interview through Tele – Conference andVideo – Conference and Mock Interviews.

Books recommended

1. *Technical communication* by Meenakshi Raman and Sangeetha Sharma, Oxford University Press 2009.
2. *Advanced Communication Skills Laboratory Manual* by Sudha Rani, D,Pearson Education 2011.
3. *Technical Communication* by Paul .V. Anderson. 2007. CENGAGE Learning pvt ltd New Delhi.
4. *Business and Professional Communication by Keys for Work place Excellence* by Kelly M Quintanillaand Shawn T. Wahi . Sage South Asia Edition. Sage publication .2011.
5. *The Basics of Communications: A Relational Perspective* by Steve Duck and David T. McMahan. Sage South Asia Edition. Sage Publications 2012.
6. *English Vocabulary in Use* series, Cambridge University Press 2008.
7. *Management Shapers Series* by Universities Press (India) Pvt Ltd., Himayath Nagar Hyderabad 2008.
8. *Handbook for Technical Communication* by David A Mc Murrey and Jaoanne Buckely 2012. CENGAGE learning.
9. *Communication Skills* by Leena Sen , PHI Learning pvt ltd, New Delhi 2009.
10. *Handbook for Technical Writing* by David A Mc Murrey and Joanne Buckely CENGAGE learning 2008.
11. *Job hunting* by Colm Downes , Cambridge University Press 2008.
12. *Master Public Speaking* by Anne Nicholls, JAICO Publishing House, 2006.
13. *English for Technical Communication for Engineering Students* by Aysha Viswamohan, Tata Mc Graw- Hill 2009.
14. Books on TOEFL/ GRE/GMAT/CAT/ IELTS by Barron's / DELTA / Cambridge University Press.
15. *International English for Call Centers* by Barry Tomalin and Suhashini Thomas , Macmillanpublishers2009.

B.TECH EEE
II - YEAR
II-SEM

DETAILED SYLLABUS

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16EE2201 – POWER ELECTRONICS

II Year B.Tech. EEE -II Semester
Prerequisite(s): 16EE2102 Electrical Circuits
16PH1201 Semiconductor Physics

L	T	P/D	C
4	1	-/-	4

Course Objectives:
Develop ability to
1. Understand various power semiconductor devices and applications to power electronics.
2. Understand the operation of converters in the rectification mode.
3. Understand the need, function and different control techniques of choppers.
4. Understand the need and function of single phase and three phase A.C voltage regulators.
5. Understand the performance parameters of single phase and three phase inverters, along with their operation and control.

Course Outcomes (COs):
On completion of this course, student would be able to
CO 1: Obtain the V-I characteristics of SCR, MOSFET, IGBT along with their commutation, firing and protection.
CO 2: Analyze AC to DC power conversion through single phase and three phase controlled rectifiers.
CO 3: Analyze DC-to-DC power conversion through step-up and step-down choppers.
CO 4: Analyze AC- to- AC power conversion through AC voltage controllers.
CO 5: Apply the knowledge of DC-to-AC power conversion through single phase and three phase inverters using different types of PWM (pulse width modulation) techniques.

UNITI
Power Semiconductor Devices
Power semiconductor switches: Static and dynamic characteristics, drive circuits and switching aid circuits and 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 – SCR - UJT firing circuit —– Series and parallel connections of SCR's – Snubber circuit details – Specifications and Ratings of SCRs, BJT, IGBT - Numerical problems.

UNIT II
Single Phase and Three Phase Converters
Phase control technique – Single phase Line commutated converters – Midpoint and Bridge connections – Half controlled converters with Resistive, RL loads and RLE load– Derivation of average load voltage and current - Active and Reactive power inputs to the converters without and with Freewheeling Diode –Numerical problems Fully controlled converters, Mid point and Bridge connections with Resistive, RL loads and RLE load– Derivation of average load voltage and current – Active and Reactive power inputs to the converters without and with Freewheeling Diode, Effect of

source inductance –Numerical problems. 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 (both single phase and three phase) - Waveforms –Numerical Problems.

UNIT III

Choppers

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

UNIT IV

AC- AC Converters

AC voltage controllers – Single phase two SCRs in anti parallel – With R and RL loads – modes of operation of Triac – 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 mid-point cyclo-converters with Resistive and inductive load (Principle of operation only) –Waveforms

UNIT V

Single Phase and Three Phase Inverters

Inverters – Single phase inverter – Basic series inverter – Basic parallel Capacitor inverter bridge inverter – Waveforms –three phase inverters. Voltage control techniques for inverters Pulse width modulation techniques – Numerical problems.

Current source and voltage source inverters, active and reactive power handling; three phase voltage source and PWM inverters; PWM techniques; active frontend rectifier; a typical trigger / drive circuit.

Text Books

1. Power Electronics – by M. D. Singh and K. B. Kanchandhani, Tata McGraw – Hill Publishing company, 1998.
2. Power Electronics ,Dr.P.S.Bimbhra, Khanna Publishers

Reference Books

1. Power Electronics: converters, Application and design - Ned Mohan, T.MUndeland and W.P Robbin
2. Power Electronics-by P.C.Sen, TataMcGraw-Hill Publishing
3. Power Electronics – by VedamSubramanyam, New Age International (P) Limited, Publishers
4. Power Electronics - by V.R.Murthy , 1 edition -2005, OXFORD University Press st
5. Thyristorised Power Controllers – by G. K. Dubey, S. R. Doradra, A. Joshi and R. M. K. Sinha, New Age International (P) Limited Publishers, 1996.
6. Power Electronics : Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2 edition, 1998

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16EE2202 – ELECTRICAL MACHINES-I

II Year B.Tech. EEE II Semester
Prerequisite(s): 16EE2101 Electromagnetic Field Theory

L	T	P/D	C
3	1	-/-	3

Course Objectives:
Develop ability to

1. Understand the fundamental principles of Magnetic Circuits, Electro-mechanical energy conversion.
2. Understand the fundamental principles of Electrical machines and the characteristics of DC Machines and Transformers**.**
3. Understand the machine windings and the MMF pattern of armature and field windings.
4. Understand operation and characteristics of DC machines and Transformers.
5. Examine the performance of DC Machines and Transformers.

Course Outcomes (COs):
On completion of this course, student would be able to

CO 1: Analyze structure of DC Electrical machines and their role invarious applications.
CO 2: Apply the basic concepts of magnetic circuits to DC machines and Transformers.
CO 3: Conduct various performance tests on DC machines and Transformers.
CO 4: Evaluate various electrical and mechanical quantities associated with DC machines and Transformers.
CO 5: Distinguish DC motors and generators based on their characteristics.

UNIT I
Magnetic Circuits and Electro-Mechanical Energy Conversion

Magnetic Circuits-Introduction to magnetic circuits – Ampere's circuit law, i-H and B-H relations – Flux linkage, inductance and energy –Magnetization curve, hysteresis loss and eddy current loss.

Electro-Mechanical Energy Conversion-forces and torque in magnetic field systems – energy balance –energy and force in a singly excited magnetic field system, determination of magnetic force - co-energy– multi excited magnetic field systems.

UNIT II
DC Generators

Construction and Operation-DC Generators – Principle of operation – Action of commutator – constructional features – armature windings – lap and wave windings – simplex and multiplex windings – use of laminated armature – E.M.F Equation – Problems

Armature reaction in DC Generator -Armature reaction – Cross magnetizing and de-magnetizing AT/pole – compensating winding –commutation – reactance voltage – methods of improving commutation.

UNIT III

Types of DC Generators

Types of DC Generators -Methods of Excitation – separately excited and self excited generators – build-up of E.M.F - critical field resistance and critical speed - causes for failure to self excite and remedial measures.

Load Characteristics of Generators - Load characteristics of shunt, series and compound generators – parallel operation of DC series generators – use of equalizer bar and cross connection of field windings – load sharing.

UNIT IV

DC Motors and Transformers

DC Motors – Principle of operation – Back E.M.F. - Torque equation – characteristics and application ofshunt, series and compound motors – Armature reaction and commutation.Speed control of DC Motors - Speed control of DC Motors: Armature voltage and field flux control methods. Ward-Leonard system.Principle of 3 point and 4 point starters – protective devices.Principle of operation – Constructional features of single phase and three phase transformers – EMF equation – Transformer on No load and Load –Phasor diagram -equivalent circuit – Regulation –Efficiency-All day Efficiency- three phase transformer connections- parallel operation of single phase and three phase transformer- Auto transformers.

UNIT V

Testing of DC Machines and Transformers

Testing of DC Machines- Losses – Constant and 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. Testing of transformer: polarity test, load test, open circuit and short circuit test, Sumpner's test – All day efficiency. Generalized theory and Kron's primitive machine model-Modeling of dc machines Reference - frame theory and per unit system

Text Books

1. Electrical Machines by P.S Bimbra, Khanna publications
2. Electrical machinery by A.E Fritzergerald, C.Kingsly and S.Umans Mc Graw Hill Publications

Reference Books

1. Say M.G "Performance and Design of Alternating Machines ' CBS Publishers andDistributors, New Delhi, First Indian Edition, Reprint 1998
2. Irving L.Kosow, "Electric Machinery and Transformers", Prentice Hall of India Private Ltd., New Delhi, Second Edition, Reprint 2007
3. Stephen J.Chapman, "Electric Machinery Fundamentals', "McGraw Hill Intl. Edition, New Delhi, Fourth Edition, 2005
4. Electrical Machines by B.L.Thereja.
5. Electrical Machines by –S.K Bhattacharya
6. Electrical Machines by –I.J.NagrathandD.P.Kothari

GEETHANJALI COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous)
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16EE2203 – POWER SYSTEMS-I

II Year B.Tech. EEE- II Semester
Prerequisite(s): 16EE2102Electrical circuits.
16ME2104 Fluid Mechanics and Hydraulic Machinery

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

Course Objectives:
Develop ability to
1. Understand basic principles of power generation, transmission and distribution.
2. Understand the functioning of hydel, thermal and nuclear power stations.
3. Understand functioning of D.C and A.C distribution systems.
4. Understand the classification and layout of Air Insulated and Gas Insulated (GIS) Substations.
5. Understandstatic VAR compensators for improving power factor and economic aspects of power generation.

Course Outcomes (COs):
On completion of this course, student would be able to
CO 1: Distinguish and analyze different types of power generation, transmission and distribution methods.
CO 2: Identify hydel, thermal and nuclear power stations and draw their layout.
CO 3: Analyze the parameters of D.C and A.C distribution systems.
CO 4: Classify Air Insulated and Gas Insulated Substations (GIS) and list their advantages.
CO 5: Design static VAR compensators for improving power factor and calculate generation parameters and tariff.

UNIT I

Introduction to Power Systems and Hydel Power plant

Introduction to different sources of energy and general discussion on their application to generation, general introduction to power transmission by DC and AC overhead lines and underground cables and their comparison, per unit system, single line diagram

Hydel Power Plant: classification of plants, base load and peak load station, turbines, head gate, penstock, surge tank, scroll case, draft tube and tail race, power plant auxiliaries.

Electrical system: Excitation system, AVR: magnetic amplifier and thyristor converter type/DVR. Main transformer, unit transformer and station reserve transformer, commissioning tests of alternators and transformers.

UNIT II

Thermal and Nuclear Power Stations

Thermal Power Stations: 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.
Gas Power Stations: Principle of Operation and Components (Block Diagram Approach Only)

UNITIII

General aspects of D.C and A.C Distribution Systems

Classification of Distribution Systems- Requirements and Design features of Distribution Systems-Voltage Drop Calculations (Numerical Problems) in D.C Distributors for the following cases: Radial D.C Distributor fed one end and at both the ends (equal/unequal Voltages) and Ring Main Distributor.

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 IV

Air Insulated and Gas Insulated Substations (GIS)

Classification of substations: Air insulated substations-Indoor and Outdoor substations: Substations layout showing the location of all the substation equipment. Bus bar arrangements and control equipments 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 (GIS) – Advantages of Gas insulated substations, different types of gas insulated substations, single line diagram of gas insulated substations, bus bar, construction aspects of GIS, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations.

UNIT V

Power Factor and Voltage Control

Causes of low p.f -Methods of improving p.f -Phase advancing and generation of reactive KVAR using static Capacitors-Most economical p.f. for constant KW load and constant KVA type loads, Numerical Problems.Dependency of Voltage on Reactive Power flow. Methods of Voltage Control: Shunt Capacitors, Series Capacitors, Synchronous Capacitors, Tap changing and Booster Transformers

Economic Aspects of Power Generation and Tariff

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

Text Books

1. Principles of Power Systems - V.K Mehta and Rohit Mehta S. Chandand Company Ltd, New Delhi 2004
2. Electrical Power Systems, PSR Murthy, BS Publications.

Reference Books

1. A Text Book on Power System Engineering by R K Rajput, Laxmi Publications (P) New Delhi 2004
2. Electrical Power Generation, Transmission and Distribution by S.N.Singh., PHI, 2003.
3. Electrical Power Systems by C.L.Wadhawa New age International (P) Limited, Publishers 1997.
4. Generation of Electrical Energy, Dr B R Gupta, S. Chand.

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16EE2204 – SIGNALS AND SYSTEMS

II Year B.Tech.EEE- II Semester
Prerequisite(s): 16EE2102 Electrical Circuits
16MA1101 Mathematics-I
16MA1201 Mathematics-II

L	T	P/D	C
3	1	-/-	3

Course Objectives:
Develop ability to
1. Distinguish different types of Signals, Systems and basic operations on a signal.
2. Understand the concept of orthogonality and approximation of a signal in terms of mutually orthogonal signals.
3. Understand the conversion of both periodic and aperiodic continuous/discrete time domain signal into frequency domain using Fourier series, Fourier transform and Z-transform.
4. Understand concepts of convolution and correlation.
5. understand properties and characteristics of a linear time invariant system
6. Understand usage of Laplace and Z transforms in analysis of continuous time and discrete time systems.

Course Outcomes (COs):
On completion of this course, student would be able to
CO 1: Classify the given signal into energy / power, periodic / aperiodic, continuous / discrete, analog / digital.
CO 2: Perform operations on independent and dependent variable of a given signal.
CO 3: Analyze a given signal/system from its magnitude and phase response using Fourier, Laplace and Z transforms
CO 4: Measure the similarity between two signals and also measure energy/power of individual signals
CO 5: Solve linear differential/difference equations using Laplace / Z- transform.

UNIT I
Signal Analysis
Introduction to signals and systems, classification of signals, basic operations on signals, elementary signals, classification of systems, Analogy between vectors and signals, Orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, Closed or complete set of orthogonal functions, Orthogonality in complex functions

UNIT II
Fourier Representation of Continuous Time Signals
Fourier Series: Fourier series representation of Continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Complex Fourier spectrum, Gibb's phenomenon

Fourier Transforms: Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Fourier transforms involving impulse function. Inverse Fourier transforms, Introduction to Hilbert Transform.

UNIT III

Signal Transmission through Linear Systems:

Linear Time Invariant (LTI) system, Linear Time Variant (LTV) system, Transfer functions of a LTI system. Impulse response of LTI system, Distortion less transmission through a system Convolution and Correlation: Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Convolution property of Fourier transforms, Response of a system using convolution.

UNIT IV

Laplace Transforms

Laplace Transforms: Review of Laplace transforms, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of Laplace Transforms, relation between Laplace Transforms and Fourier Transforms, Inverse Laplace transform, Partial fraction expansion, solution of differential equations using Laplace transform.

UNIT V

Z–Transforms

Z–Transforms: Concept of Z- Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence (ROC) in Z-Transform, Inverse Z-transform, properties of Z-transforms, solution of difference equations using Z transform.

Text Books

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

Reference Books

1. Signals and Systems: Continuous and Discrete (4th Edition) by Rodger E.Ziemer , William H Tranter , D. R. Fannin, Pearson Education Limited.
2. Signals and systems, Schaum's outlines – Hwei Hsu McGraw Hill Professional, 1995

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16CH2201 – ENVIRONMENTAL STUDIES

II Year B.Tech. EEE II Semester
Prerequisite(s): None

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

Course Objectives:
Develop ability to
1. Identify the importance of ecosystem and its functions.
2. Understand the natural resources and their usage in day to day life.
3. Understand the concept of bio-diversity, its values and conservation.
4. Be aware of the causes of different types of pollution and its control.
5. Understand various environmental impacts, requirement of various policies and legislations towards environmental sustainability.

Course Outcomes (COs):
On completion of this course, student would be able to
CO 1: Explain ecosystem and its functions namely, food chain, ecological pyramids etc.
CO 2: Acquire knowledge about different types of natural resources such as land, water, minerals, non-renewable energy and their excessive usage leading to detrimental effects on environment.
CO 3: Comprehend ecosystem diversity, its values and importance of hot spots to preserve the same.
CO 4: Explain different types of pollution, its control and impact on global environment.
CO 5: Recognize various environmental impacts and the importance of various acts and policies towards environmental sustainability.

UNITI
Ecosystem
Scope and importance of ecosystem, Classification of ecosystem, Introduction to biotic and abiotic components, Forest and desert ecosystem, Functions of eco system food chains, food webs and ecological pyramids, Flow of energy in an ecosystem, Biogeochemical cycles, Nitrogen cycle and Carbon cycle, Phosphorous cycle and Hydrological cycle.

UNIT II
Natural Resources
Classification of resources, Water resources-Use and over utilization of surface and ground water, Mineral resources-Environmental effects of extracting and using mineral resources –Case study, Land resources – Land degradation, man induced landslides, Energy resources – renewable, solar energy, wind energy, applications, Non renewable resources- fossil fuels, nuclear energy, Chernobyl and Fukushima Daiichi nuclear disasters.

UNITIII

Biodiversity and Biotic Resources

Introduction, definition, genetic, species and ecosystem diversity, Types of diversity, Alpha, Beta and Gamma, Value of biodiversity- Consumptive use, productive use, ethical, aesthetic and intrinsic values , Hotspots of biodiversity in India, Threats to biodiversity, Conservation of biodiversity – In-situ and Ex-situ methods, bioaccumulation and biomagnifications.

UNITIV

Environmental Pollution and Control Technologies

Classification of Pollution, Air pollution causes, effects and remedial measures , Water pollution, causes, effects and remedial measures, Noise Pollution, Emission standard limits, Acid rains. Waste water treatment technologies- Common and Combined Effluent Treatment Plants (CETP), Thermal Pollution causes, effects and remedial measures, Solid Waste Management , Green house effect and Global warming, Ozone layer depletion and its effects .

UNIT V

Environmental Policy, Legislation and EIA

Definition of Impact and Types of Impact, Steps involved in Environmental Impact Assessment (EIA) methodology, methods of base-line data acquisition, Impacts of development on different environmental components, Prediction of Impacts, Methods of rain-water harvesting traditional and modern methods, National Environmental Policy. Air conservation act, Water conservation act, Forest conservation act.

Towards Sustainable Future: Concept of Sustainable development, Threats of sustainable development, Environmental Education, Conservation of resources, Concept of Green building.

Text Books

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha - University Grants Commission.
2. Environmental Studies by Anubha Kaushik and C.P. Kaushik.

Reference Books

1. Textbook of Environmental Sciences and Technology by M. Anji Reddy, B S Publication
2. Environmental Studies by R. Rajagopalan, Oxford University Press.
3. Introduction to Environmental Management by Mary.k. Theodare, Louis Theodare, CRC Press, Taylor and Francis group.
4. Fundamentals of Ecology by Eugene P.Odum, Gary W.Barrett, Thomson International.

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16EE22L1 – POWER ELECTRONICS AND SIMULATION LAB

II Year B.Tech. EEE- II Semester
Prerequisite(s): 16PH1201Semiconductor Physics

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

Course Objectives:
Develop ability to

1. Understand the characteristics of power electronics devices namely, SCR, MOSFET and IGBT.
2. Understand various types of gate firing circuits of SCR.
3. Understand the operation of AC Voltage Controller and single phase fully controlled bridge with R and R-L loads.
4. Understand different methods of forced commutation circuits.
5. Understand the operation of the chopper, single phase parallel inverter, and single phase cyclo converter with R and R-L loads.
6. Understand the operation of single phase and three phase half controlled converter with R and R-L load.
7. Understand the Single Phase Series Inverter with R and R-L Loads.
8. Understand Single phase dual converter with R-L load
9. Simulate single phase full converter and AC voltage controller, Buck chopper, resonant pulse commutation and single phase inverter with PWM control.

Course Outcomes:
On completion of this course, student would be able to

CO 1: Determine the characteristics of power electronics devices i.e. SCR, MOSFET and IGBT.
CO 2: Distinguish different types of gate firing circuits.
CO 3: Evaluate the operation of AC Voltage Controller and single phase fully controlled bridge with R and R-L loads.
CO 4: Distinguish different methods of forced commutation circuits.
CO 5: Evaluate the operation of the chopper, single phase parallel inverter and single phase cyclo converter with R and R-L loads.
CO 6: Evaluate the operation of single phase and three phase half controlled converter with R and R-L load.
CO 7: Evaluate the Single Phase Series Inverter with R and R-L Loads.
CO 8: Evaluate Single phase dual converter with R-L load
CO 9: Simulate single phase full converter and AC voltage controller, Buck chopper, resonant pulse commutation and single phase inverter with PWM control.

List of Experiments

Any eight of the thirteen Experiments

1. Study of Characteristics of SCR, MOSFET and IGBT
2. Gate firing circuits for SCR's
3. Single Phase AC Voltage Controller with R and RL Loads
4. Single Phase fully controlled bridge converter with R and RL loads
5. Forced Commutation circuits (Class A, Class B, Class C, Class D and Class E)
6. DC Jones chopper with R and RL Loads
7. Single Phase Parallel, inverter with R and RL loads
8. Single Phase Cyclo converter with R and RL loads
9. Single Phase Half controlled converter with R load
10. Three Phase half controlled bridge converter with R-load
11. Single phase series inverter with R and RL loads
12. Single phase bridge converter with R and RL loads
13. Single phase dual converter with RL load.

Any two of the three experiments

1. PSPICE simulation of single-phase full converter using RLE loads and single-phase AC voltage controller using RLE loads.
2. PSPICE simulation of resonant pulse commutation circuit and Buck chopper.
3. PSPICE simulation of single phase Inverter with PWM control.

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16EE22L2 – ELECTRICAL MACHINES-I LAB

II Year B.Tech. EEE -II Semester
Prerequisite(s): 16EE2101Electromagnetic Field Theory

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

Course Objectives:
Develop ability to
1. Understand the magnetization characteristics of DC shunt generator.
2. Understand the philosophy of load test on DC shunt and compound generators.
3. Understand the Brake test and retardation test on DC shunt motor.
4. Examine Hopkinson's test on DC shunt machines and Field test on DC Series machines.
5. Understand Swinburne's test and speed control of DC shunt motor.
6. Understand Open Circuit and Short Circuit tests on single phase transformer.
7. Understand Sumpner's Test on a pair of identical single phase transformers.
8. Understand Parallel operation of two single phase Transformers.
9. Understand conversion of three phase supply to two phase supply using Scott connection.

Course Outcomes (COs):
On completion of this course, student would be able to
CO 1: Evaluate the critical field resistance and critical speed of DC shunt generator.
CO 2: Calculatethe performance characteristics namely, power efficiency, output power (BHP), torque and speed of a DC series and shunt machine.
CO 3: Experimentally validate theoretical efficiency of DC shunt machineunder full load condition.
CO 4: Evaluate efficiency of a single phase Transformer and find the equivalent circuit parameters.
CO 5: Evaluate efficiency of a pair of identical single phase transformers on full load condition.
CO 6: Analyze the conversion of three phase supply to two phase supply.

List of Experiments
Any ten of the twelve Experiments
1. Magnetization characteristics DC shunt generator. Determination of critical field Resistance critical speed.
2. Load test on DC shunt generator. Determination of characteristics.
3. Brake test on DC shunt motor. Determination of performance curves.
4. Load test on DC compound generator. Determination of characteristics.
5. Hopkinson's test on DC shunt machines. Predetermination of efficiency.
6. Fields test on DC series machines. Determination of efficiency.
7. Swinburne's test and speed control of DC shunt motor. Predetermination of efficiencies.
8. Retardation test on DC shunt motor. Determination of losses at rated speed.

9. OC and SC Test on single phase Transformer.
10. Sumpner's Test on single phase Transformer's.
11. Parallel operation of two single phase Transformers.
12. Three phase to two phase conversion.

Additional Experiments

1. Parallel operation of DC shunt Generator.
2. Magnetization characteristics of self excited Generator.

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16EE22L3 – SIGNALS AND SYSTEMS SIMULATION LAB

II Year B.Tech. EEE -II Semester
Prerequisite(s): 16EE2102 Electrical Circuits
16MA1101 Mathematics-I
16MA1201 Mathematics-II

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

Course Objectives:

Develop ability to

1. Understand simulation of various signals/sequences and their synthesis
2. Understand various operations such as addition, multiplication, amplitude/time scaling, shifting and folding of signals / sequences
3. Understand the characteristics of an LTI system and find its response for various input signals such as unit impulse, unit step and sinusoidal signal.
4. Understand the principle of convergence of Fourier Series of a given signal and express the signal in its frequency domain

Course Outcomes (COs):

On completion of this course, student would be able to

CO 1. Synthesize a given waveform using standard test signals and sequences.
CO 2. Analyze the effect of various transformations applied on independent and dependent variables of a signal
CO 3. Find the symmetry (even/odd) of signals /sequences
CO 4. Classify a system based on its characteristics and find its response for various excitations
CO 5. Convert time domain signal into frequency domain using Fourier transform and plot its magnitude and phase spectrum.

Note:
All the experiments are to be simulated using MATLAB / SCILAB / LabView / OCTAVE or equivalent software

List of Experiments

1. Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sine.
2. Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
3. Finding the Even and Odd parts of Signal/Sequence and Real and Imaginary parts of a Complex Signal.
4. Convolution between (i) signals and (ii) sequences.
5. (a) Auto Correlation of(i) signals and (ii) sequences.
   (b) Cross Correlation between (i) signals and (ii) sequences.
6. Verification of Linearity and Time Invariance Properties of a given Continuous / Discrete System.
7.
   a) For the given LTI system, compute Unit sample, Unit step and Sinusoidal responses.
   b) Verifythe physical realizability and stability properties.
   c) Locating the poles and zeros in s-plane and z-plane.
8. Verification of Gibbs Phenomenon.
9. Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.
10. Waveform Synthesis using Laplace Transform.

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16HS22L1 – GENDER SENSITIZATION

II Year B.Tech. EEE -II Semester
Prerequisite(s): None

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

Course objectives:

Develop ability to

1. Sensitize with regard to gender issues.
2. Provide a critical perspective on the requirements of healthy socialization of both genders.
3. Create awareness and understanding on some of the key biological changes of both genders.
4. Apprise on the importance of sharing domestic work and the economic contribution of women.
5. Create awareness on the impact of gender violence on society.
6. Create consciousness on the contribution of women of Telangana in its development.

Course Outcomes (COs):
On completion of this course, student would be able to
CO 1: Demonstrate sensitivity with regard to gender issues.
CO 2: Show healthy socialization among both the genders that can be observable.
CO 3: Show empathy on some of the key biological changes of both genders.
CO 4: Realize the importance of sharing domestic work and economic contribution of women.
CO 5: Realize the impact of gender violence on society.
CO 6: Show awareness on the contribution of women of Telangana in its development.

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-2)
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. Mother and Fathers. Further reading: Rosa Parks-The Brave Heart.

UnitII
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 are many? Struggles with discrimination .
Additional reading: our Bodies, our Health (*Towards a world of equals: Unit-13)*

Unit III
Gender and Labour
House work: the invisible Labour (*Towards a world of equals: Unit-3)*
"My mother doesn't work". "share the load".
Women's work: its politics and economics (*Towards a world of equals: Unit-7)*
Factand fiction. Unrecognized and work. Further reading: Wages and condition of work.

Unit IV
Issues of Violence
Sexual Harassment: Say No! ***(Towards a world of equals: Unit-6)***
Sexual Harassment, 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.

Text Book(s):
"Towards a World of Equals: A Bilingual Textbook on Gender" Written by A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rsheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu.

Note: Since it is inter disciplinary 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.

Reference Books

1. Sen, Amarthya. "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 Strugle. New Delhi: Kali for Womwn, 1989.
2. Tripti Lahiri. "Bythe Numbers: Where Indian Women Work." Women's Studies Journal (14 November 2012) Available online at: http// blogs.wsj.com/ India real time/2012/11/14/by-the-number-where Indian-women-work/>
3. K. Sathyanarayana and Susie Tharu (Ed) "Steel Nibs Are sprouting: New Dalit writing South India", Dossier 2: Telugu and Kannada http://harpercollins.co.in/BookDatails.asp?Book cod=3732
4. Vimala. "Vantillu (The Kitchen)". Women Writing in India: 600 BC to the present. Volume //: the 20th Century Ed. Susie Tharu and K. Llita. Delhi: Oxford University Press, 1995. 599-601.
5. Shatugna, 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 Sangatana. "We were Making History....." Life Stories of Women in the Telangana People's stuggle. New Delhi: Kali for Women, 1989.
7. Menon, Nivedita. "Seeing like a Feminist." New Delhi: Zubban-Penguin Books, 2012
8. Jayaprabha A. "Chupulu (Stares)". Women Writing in India: 600BC to the present. Volume //. The 20th Century Ed. Susie Tharu and K. Llita. Delhi: Oxford University Press, 1995. 596-597.
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14. S. Benhabib. "Situating the Self: Gender, Community, and Post Modernism in Contemporary Ethics", London: Routledge, 1992
15. Viginia Woolf. "A Room of one's Own." Oxford: Black Swan. 1992
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B.TECH EEE
III - YEAR
I-SEM

DETAILED SYLLABUS

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16EE3101– CONTROL SYSTEMS

III Year B.Tech. EEE I Semester

L	T	P/D	C
4	1	-/-	4

Prerequisite(s):16PH1101 Engineering Physics
16MA1202 Mathematics III
16EE2204 Signals and Systems

Course Objectives:
Develop ability to
1. Understand importance of open and closed loop control systems in everyday life and the basic concepts of block diagrams reduction.
2. Understand various standard test signals used to predetermine the performance of the system and to define time domain specifications, error constants of the systems exhibiting transient and steady state response.
3. Understand the concept of stability of a bounded input and bounded output system.
4. Understand the concept of frequency response analysis plots in determining the stability of the system.
5. Understand the concept of state space Analysis

Course Outcomes (COs):
On completion of this course, student would be able to
CO1. Develop the block diagram model of physical systems
CO2. Apply various standard test signals to predetermine the performance of the system and also obtain the time domain analysis solutions, error constants for systems exhibiting transient and steady state response
CO3. Apply different techniques such as Routh-Hurwitz and Root locus to obtain desired system performance
CO4. Use different plots such as Bode Plot, Polar Plot and Nyquist Plot to determine the stability of the system and to use a appropriate compensator to obtain desired system performance
CO5. Apply the concepts of state space to analyze various control systems.

UNIT – I
Introduction to Control Systems
Concepts of Control Systems- Classification of control systems, Open Loop and closed loop control systems and their differences- Different examples of control systems- Feed-Back Characteristics Effects of feedback, Transfer Function Representation- -Block diagram algebra – Representation by Signal flow graph - Reduction using mason's gain formula, Mathematical models – Differential equations of mechanical systems-conversion of mechanical system into electrical system**.**

UNIT – II

Time Response Analysis

Standard test signals-Impulse Response and transfer functions, 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 in S-Domain

The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability.

Root Locus Technique

The root locus concept - construction of root loci

UNIT – IV

Frequency Response Analysis

Introduction, Frequency domain specifications, Bode diagrams-Stability Analysis, determination of Phase margin and Gain margin from Bode Plots, Polar Plots, Nyquist Plots Stability Analysis, Importance of Compensation techniques – Lag, Lead, Lead-Lag Controllers in frequency Domain.

UNIT – V

State Space Analysis of Continuous Systems

Concepts of state, state variables and state model, derivation of state models from transfer function, Derivation of transfer function from state models, State Transition Matrix and it's Properties, Concepts of Controllability and Observability.

Text Books:

1. Control Systems - A. Anand Kumar,2nd edition, PHI.
2. Control Systems Engineering - I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers.

Reference Books:

1. Control Systems Engineering - S. Palani, TMH.
2. Control Systems - Dhanesh N. Manik, Cengage Learning.
3. Control Systems - N. K. Sinha, New Age International (P) Limited Publishers.
4. Control Systems Theory and Applications - S. K. Bhattacharya, Pearson.
5. Control Systems - N. C. Jagan, BS Publications.
6. Control Systems –K Alice Mary, P Ramana, university press.
7. Control Systems - A.NagoorKani ,2nd edition, RBA publications.

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16EE3102 – POWER SYSTEMS – II

III Year B.Tech. EEE I Semester

L	T	P/D	C
4	1	-/-	4

Prerequisite(s):16EE2203 Power Systems - I
16EE2102 Electrical Circuits

Course Objectives:
Develop ability to
1. Compute different parameter calculations of transmission lines.
2. Estimate the efficiency and regulation of transmission lines.
3. Understand the effect of power system transients and to identify the factors that govern the performance of the transmission lines.
4. Design over head line insulators and to estimate the sag and tension in transmission lines.
5. Understand the concepts of underground cables.

Course Outcomes (COs):
On completion of this course, student would be able to
CO1. Model the transmission lines.
CO2. Determine the performance characteristics of transmission lines.
CO3. Obtain the lattice diagrams under all conditions.
CO4. Develop string insulators for all voltage levels
CO5. Model the underground cables and determine its performance under all conditions

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 Short and Medium Length 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.
Performance of Long Transmission Lines
Long Transmission Line-Rigorous Solution, evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations, Incident, Reflected and Refracted Waves -Surge Impedance and SIL of Long

Lines, Wave Length and Velocity of Propagation of Waves – Representation of Long Lines – Equivalent-T and Equivalent Pie network models (numerical problems).

UNIT – III

Power System Transients

Types of System Transients – Travelling or Propagation of Surges – 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).

Various Factors Governing the Performance of Transmission line

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. Corona – Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference.

UNIT – IV

Overhead Line Insulators

Types of Insulators, String efficiency and Methods for improvement, Numerical Problems – voltage distribution, calculation of string efficiency, Capacitance grading and Static Shielding.

Sag and Tension Calculations

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.

UNIT – V

Underground Cables

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, HV Cables.

Text Books:

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarthy, DhanpatRai& Co Pvt. Ltd.
2. Electrical power systems – by C.L.Wadhwa, New Age International (P) Limited, Publishers,1998.

Reference Books:

1. Power system Analysis-by John J Grainger William D Stevenson, TMC Companies, 4th edition
2. Power System Analysis and Design by B.R.Gupta, Wheeler Publishing.
3. Power System Analysis by HadiSaadat – TMH Edition.
4. Modern Power System Analysis by I.J.Nagaraj and D.P.Kothari, Tata McGraw Hill, 2nd Edition.

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16EE3103 – ELECTRICAL MACHINES-II

L	T	P/D	C
3	1	-/-	3

III Year B. Tech. EEE I Semester
Prerequisite(s):16EE2202 Electrical Machines - I

Course Objectives:
Develop ability to

1. Understand construction, working principle, phasor diagram analysis, characteristics and torque equations of poly phase induction motor and single phase induction motors.
2. Understand performing tests on induction motors and determination of performance indices using circle diagram and also speed control of induction motors.
3. Understand construction, working principle, phasor diagram analysis, characteristics of synchronous machines.
4. Understand determination of regulation of synchronous generator by different method and parallel operation of synchronous alternators.
5. Understand the concepts of improving power factor by synchronous motors and its applications.

Course Outcomes (COs):
On completion of this course, student would be able to

CO1. Analyze construction, operation, characteristics of Induction motors and also able to determine torque.
CO2. Compute power, torque and efficiency of induction motor by performing suitable tests and also able to do speed controlling of induction motor.
CO3. Analyze construction, operation, production of EMF and suppression of harmonics in a synchronous machine.
CO4. Determine the regulation of synchronous alternator to analyze its losses (voltage drop) and able to compensate reactive power using synchronous motors.
CO5. Select appropriate AC machine for any application and appraise it significance

UNIT – I

Poly-Phase Induction Machines

Poly-Phase Induction motors- Construction- Types- production of rotating magnetic field – principle of operation – rotor EMF & rotor frequency – rotor reactance, rotor current and PF at standstill & during operation. Rotor power input, rotor copper loss and mechanical power developed and their inter relation – torque equation – deduction from torque equation – expression for maximum torque and starting torque – torque slip characteristics – double cage and deep bar rotors – equivalent circuit – phasor diagram – crawling and cogging. Induction generator – principle of operation.

UNIT – II

Circle Diagram Of Induction Motor

Circle diagram – no load and blocked rotor tests – predetermination of performance indices – methods of starting and starting current and torque calculations.

Speed Control Of Induction Motor

Change of frequency and poles, cascade connection. Injection of an EMF into rotor circuits (Qualitative treatment only)

Single Phase Induction Motor

Constructional features – double revolving and cross field theory – equivalent circuit – torque slip characteristics – types of single phase induction motors.

UNIT – III

Synchronous Machines & Characteristics

Constructional features of round rotor and salient pole machines – armature winding – integral slot and fractional slot windings; distributed and concentrated windings – distribution, pitch and winding factor – E.M.F equation. Harmonics in generated EMF – suppression of harmonics – armature reaction – leakage reactance – synchronous reactance and impedance – experimental determination – phasor diagram and load characteristics – salient pole machines – two reaction analysis – phasor diagrams.

UNIT – IV

Regulation Of Synchronous Generator

Synchronous impedance method, MMF method, ZPF method and ASA method – experimental determination of $\mathbf{X_d}$&$\mathbf{X_q}$(slip test) – regulation of salient pole alternators.

Parallel Operation of Synchronous Generator

Synchronizing alternators with infinite bus bars – synchronizing power 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 reactance.

UNIT – V

Synchronous Motors

Theory of operation – phasor diagram – variation of current and power factor with excitation – synchronous condenser – synchronous phase modifier – Mathematical analysis for power developed.

Power Circles

Excitationand power circles – hunting and its suppression – methods of starting – synchronous induction motor – merits and demerits of synchronous motors – applications of synchronous motors.

Text Books

1. Dr. P.S. Bimbra, Electrical Machinery – khanna publications
2. A.E Fitzagerald, Charles kingsley and S.D Umans, Electric Machinery**,** Tata Mc Graw hill, 2003

Reference Books

1. “Theory of AC machines”, A.S langsdorf, Tata McGraw hill, 2001
2. “Electric machines”, C.I Hubert, pearson edition,2003.
3. “Problems in Electrical Engineering”, Parkar smith, N.N, CBS publishers and distributors.
4. “Electrical machines”, Nagrath I.J. and Kothari D.P, Tata Mc Graw hill, 2010.

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16EC3102 – MICROPROCESSORS AND MICROCONTROLLERS

III Year.B.Tech. EEE-I Semester.

L	T	P/D	C
3	1	- / -	3

Prerequisite(s): 16EC2103 Switching Theory and Logic Design

Course Objectives:
Develop ability to:

1. Understand concepts of 8086 microprocessor ,addressing modes and programming of 8086.
2. Understand interfacing of 8086,with memory and other peripherals
3. Study the Features of 8051 Microcontroller.
4. Design Microprocessor and Microcontroller based system

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

CO 1: Design and develop ALP programs for 8086 Microprocessor for executing various requirements.
CO 2: Develop interfaces with external peripherals and I/O devices and design necessary programs for communication with them.
CO 3: Design methods to communicate data serially.
CO 4: Write Interrupt Service Routines (ISRs) to handle different types of interrupts generated in 8086 and 8051
CO 5: Develop ALP programs for 8051 Microcontrollers.

UNIT – I
8086 Architecture
Overview of 8086, 8086 Architecture, Register organization, memory segmentation, Physical memory organization, Signal description of 8086, Minimum mode signals, Maximum mode signals, Common function signals, Timing diagrams.

UNIT – II
Instruction set and assembly language programming of 8086
Instruction formats, Addressing modes, Instruction set, Assembler directives, Macros, Simple programs involving logical, branch and call instructions, sorting, evaluating arithmetic expressions, string manipulations.

UNIT – III
I/O interface
8255-PPI, various Modes of operation and interfacing to 8086, Modes of operation and interfacing to 8086, Interfacing keyboard, display, D/A and A/D converter.

Interfacing with advanced devices
Memory interfacing to 8086, Interrupts, Interrupt structure of 8086, vector interrupt table, interrupt service routine.
Communication interface
Serial communication standards, serial data transfer schemes, 8251USART architecture and interfacing.

UNIT – IV
Introduction to microcontrollers
Overview of 8051 microcontrollers, Architecture, memory organization, Memory interfacing, I/O ports, Addressing modes, Instruction set of 8051, Simple programs.

UNIT – V
8051 real time control
Interrupts: Interrupt structure of 8051, vector interrupt table, interrupt service routine. Programming external hardware interrupts
Timers/counters: Various modes of timers/counters, Programming 8051 timers/counters, Programming timer interrupts
Serial communication: serial communication standards, serial data transfer schemes, UART operation, Programming the serial communication interrupts

Text Books:
1. Douglas V.Hall, Microprocessor and interfacing,TMGH,2nd edition 2006
2. Advanced Microprocessors and peripherals, A.K Ray and K.M Burch and TMH,2nd Edition 2006.

Reference Books:
1. Kenneth J . Ayala, The 8051 Microcontroller.3rd Ed., Cengage Learning
2. Micro controllers and Applications - Ajay. V. Deshmukh, TMGH,2005
3. Microcomputer systems, the 8086/8088 Family, architecture, Programming & Design, Yu-Chang Liu & Glenn A Gibson, PHI, 2nd Edition.

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16MB3121 – INTELLECTUAL PROPERTY RIGHTS
(Open Elective - I)

III Year B. Tech. EEE I Semester
Prerequisite(s): Nil

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

Course objectives: Develop ability to

1. Understand the various concepts, importance and types of intellectual property rights.
2. Discuss the purpose of trademarks.
3. Analyze the fundamental laws of copy rights and patents.
4. Understand trade secret laws, trade secret litigation and unfair completion.
5. Understand the latest developments in IPR.

Course outcomes (COs):

At the end of the course, student would be able to:

CO1: Acquire knowledge on intellectual property rights
CO2: Track the regulation process of trademark. Discuss the functions of trademark.
CO3: Identify the importance of copyrights, patents searching process and transfer of Ownership
CO4: Know about secret laws, unfair competition, false advertising.
CO5: Reciprocate to new developments of intellectual property rights.

UNIT - I:

Introduction to Intellectual property: Concepts, types of intellectual property, international organizations, agencies and treaties, and importance of intellectual property rights.

UNIT - II:

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

UNIT - III:

Law of Copy Rights: Fundamentals of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right laws.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.

UNIT - IV:

Trade Secrets: Trade secrete law, determination of trade secret status, liability for misappropriations of trade secrets, protection for submission, trade secret litigation. Unfair competition-misappropriation right of publicity, false advertising.

UNIT - V:

Latest development of intellectual property Rights: new developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international - trade mark law, copy right law, international patent law, and international development in trade secrets law.

Text Books

1. Intellectual property right, Deborah, E. Bouchoux, cengage learning.
2. Intellectual property right - Unleashing the knowledge economy, Prabuddha Ganguli, Tata McGraw Hill Publishing Company Ltd.

References

1. Cornish, William Rodolph & Llewelyn, David. Intellectual property: patents, copyright, trademarks and allied rights. Sweet & Maxwell, 8/e, 2013.
2. Cornish, William Rodolph. Cases and materials on intellectual property. Sweet & Maxwell, 5/e, 2006.
3. Lo, Jack and Pressman, David. How to make patent drawings: a patent it yourself companion. Nolo, 5/e 2007.

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16CS3123– JAVA PROGRAMMING
(Open Elective - I)

III Year. B. Tech. EEE - I Semester

Prerequisite(s): Nil

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

Course Objectives
Develop ability to
1. Understand basic concepts of object oriented programming.
2. Understand the primitive data types built into the Java language and features of strongly typed language.
3. Understanding scope, lifetime, and the initialization mechanism of variables and parameter passing mechanisms.
4. Understand file streams and database connectivity using Java language

Course Outcomes (COs)
After completion of the course, student would be able to
CO1. Apply the concepts of OOPs in problem solving.
CO2. Use data abstraction, inheritance, polymorphism, encapsulation and method overloading principles in structuring computer applications.
CO3. Identify classes, objects, members of a class and relationships among them needed for a specific problem.
CO4. Use Java standard class library with necessary exception handling mechanisms in constructing computer applications.
CO5. Develop java programs using multi-threading, files and database concepts and their connectivity.

UNIT-I
Object Oriented Characteristics - Data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, classes and objects, procedural and Object oriented programming paradigms
Java Programming - History of Java, comments, data types, variables, constants, scope and life time of variables.

UNIT-II
Operators, operator hierarchy, expressions, type conversion and casting, enumerated types, control flow block scope, conditional statements, loops break and continue statements. simple java program, arrays, console input and output, formatting output, constructors, methods, parameter passing, static fields and methods, access control, this keyword, overloading methods and constructors recursion, garbage collection, building strings, exploring string class.

UNIT-III

Interfaces - Interfaces vs. Abstract classes, defining an interface, implementing interfaces, accessing implementations through interface references, extending interface.

Inner classes - Uses of inner classes, local inner classes, anonymous inner classes, static inner classes, examples.

Packages - Definition, Creating and Accessing a package, understanding CLASSPATH, importing packages.

UNIT –IV

Exception handling – Dealing with errors, benefits of exception handling, the classification of exceptions- exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, rethrowing exceptions, exception specification, built in exceptions, creating own exception sub classes.

Multi-Threading - Differences between multiple processes and multiple threads, thread states, creating threads, interrupting threads, thread priorities, synchronizing threads, inter thread communication, producer consumer pattern.

UNIT –V

Files: streams – byte streams, character streams, text input/ Output binary input/ output
Random access file operations, file management using File class.

Connecting to Database - JDBC type 1 to 4 drivers, connecting to a data base, querying a data base and processing the results, updating data with JDBC.

TEXT BOOK(S)

1. Java fundamentals- A comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH, 1st Edition, 2013.

REFERENCE BOOK(S)

1. Core Java 2–Volume1, Cay S. Horstmann and Gary Cornell
2. Java for Programmers, PJ. Dietel and H.M Deitel Pearson education.
3. Object Oriented Programming through Java. P.Radha Krishna. Universities Press.
4. Thinking in Java, Bruce Eckel, Pearson Education.

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16EC3124 – ELECTRONIC MEASURING INSTRUMENTS
(Open Elective - I)

III Year. B. Tech. EEE - I Semester

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

Prerequisite: Nil
Note: No detailed mathematical treatment is required.

Course Objectives:
1. It provides an understanding of various measuring systems functioning and metrics for performance analysis.
2. Provides understanding of principle of operation, working of different electronic instruments viz. signal generators, signal analyzers, recorders and measuring equipment.
3. Provides understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

Course Outcomes:

On completion of this course, Students would be able to
1. Identify the various electronic instruments based on their specifications for carrying out a particular task of measurement.
2. Measure various physical parameters by appropriately selecting the transducers.
3. Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals.

Unit-I:
Block Schematics of Measuring Systems and Performance Metrics: Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag.

Unit-II:
Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, and Specifications.

Unit-III:
Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments. CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes.

Unit-IV:
Recorders: X-Y Plotter, Curve tracer, Galvanometric Recorders, Servo transducers, pen driving mechanisms, Magnetic Recording, Magnetic recording techniques.

Unit-V:

Transducers: Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers.

TEXT BOOKS:

1. Electronic Measurements and Instrumentation: B.M. Oliver, J.M. Cage TMH Reprint 2009.
2. Electronic Instrumentation: H.S.Kalsi – TMH, 2nd Edition 2004.

REFERENCES:

1. Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
2. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W.D. Cooper: PHI 5th Edition 2003.
3. Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010.
4. Industrial Instrumentation: T.R. Padmanabham Springer 2009.

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16ME3125 – NANO MATERIALS AND TECHNOLOGY
(Open Elective - I)

III Year B.Tech. EEE I Semester

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

Prerequisite(s): Nil

Course Objectives:

1. This course is primarily intended to expose the students to a highly interdisciplinary subject
2. To enable the students understand the basic concepts of Nanotechnology
3. To enhance the knowledge of students in nanomaterials
4. To familiarize the students with the properties of nanomaterials and their applications
5. To expose the students MEMS / NEMS devices and their applications

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

CO1 Able to design a component / material that would provide us a " better tomorrow" via Nanotechnology
CO2 Understand synthesis and properties of nanostructured materials.
CO3 Analyze magnetic and electronic properties of quantum dots
CO4 Understand structure, properties and applications of Carbon nanotubes.
CO5 Understand applications of nanoparticles in nanobiology and nanomedicine

UNIT I
Introduction: Importance of Nano-technology, Emergence of Nano-Technology, Bottom-up and Top-down approaches, challenges in Nano Technology.

UNIT II
Zero Dimensional Nano-structures: Nano particles through homogenous nucleation; Growth of nuclei, synthesis of metallic Nano particles, Nano particles through heterogeneous nucleation; Fundamentals of heterogeneous nucleation and synthesis of nano particles using micro emulsions and Aerosol.

UNIT III
One Dimensional Nano-structures: Nano wires and nano rods, Spontaneous growth: Evaporation and condensation growth, vapor-liquid-solid growth, stress induced recrystallization. Template based synthesis: Electrochemical deposition, Electro-phoretic deposition. Electro- spinning and Lithography.

UNIT IV

Two dimensional Nano-Structures: Fundamentals of film growth. Physical vapour Depostion (PVD): Evaporation molecular beam epitaxy (MBE), Sputtering, Comparison of Evaporation and sputtering. Chemical Vapour Deposition (CVD): Typical chemical reactions, Reaction kinetics, transportant phenomena, CVD methods, diamond films by CVD.

UNIT V

Thin films: Atomic layer deposition (ALD), Electrochemical deposition (ECD), Sol-Gel films. **Special Nano Materials**: Carbon fullerence and nano tubes: carbon fullerness, formation, properties and applications. Carbon nano tubes: formation and applications.

Text books:

1. Guozhong Cao - Nano structures and Nano materials: Synthesis, properties and applications - Imperial College press in 2004, 2nd edition.
2. Rechard Booker and Earl Boysen, Nanotechnology, Willey, 2006.

References:

1. T. Pradeep, Nano: The Essentials; Tata McGraw-Hill, 2008.
2. W.R. Fahrner, Nanotechnology and Nanoelectronics; Springer,2006.

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16CE3126 – GLOBAL WARMING AND CLIMATE CHANGE
(Open Elective - I)

III Year B.Tech. EEE I Semester

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

Prerequisite(s): Nil

Course Objectives:
Develop ability to
1. Understand the importance of Ozone layer in the atmosphere.
2. Comprehend composition of atmosphere.
3. Understand impacts of climate change on ecosystem.
4. Understand initiatives taken by different countries to reduce emission of greenhouse gases.
5. Know measures to mitigate greenhouse gases.

Course Outcomes:
At the end of the course, student would be able to
CO 1: Define greenhouse gases and their influence on global warming.
CO 2: Explain physical and chemical characteristics of atmosphere and structure of atmosphere. .
CO 3: Explain impacts of climate change on agriculture, forestry and ecosystem.
CO 4: Explain initiatives taken by countries to reduce global warming.
CO 5: Suggest mitigation measures taken to reduce global warming and climate change.

Syllabus:

UNIT–I
Earth's Climate System: Role of ozone in environment - Ozone layer – Ozone depleting gases – Green House Effect – Radioactive effects of Greenhouse gases – The Hydrological cycle – Green House Gases and Global Warming – Carbon Cycle.

UNIT–II
Atmosphere and Its Components: Importance of Atmosphere – Physical and chemical characteristics of Atmosphere – Vertical structure of the atmosphere – Composition of the atmosphere – Atmospheric stability – Temperature profile of the atmosphere – Lapse rates – Temperature inversion – Effects of inversion on pollution dispersion.

UNIT–III
Impacts of Climate change: Causes of Climate change: Changes of Temperature in the environment – Melting of ice pole – sea level rise – Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for different regions – Uncertainties in the projected impacts of Climate Change – Risk of Irreversible Changes.

UNIT–IV

Observed changes and its Causes: Climate change and Carbon credits – CDM – Initiatives in India- Kyoto Protocol – Paris Convention - Intergovernmental Panel on Climate change – Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Global Climate Models (GCM) - Evidences of Changes in Climate and Environment- on a Global scale and in India.

UNIT–V

Climate change and mitigation measures: Clean Development Mechanism – Carbon Trading – Examples of future clean technology – Biodiesel – Natural Compost – Eco-friendly plastic – Alternate Energy – Hydrogen – Bio-fules – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding. Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry – Carbon sequestration – Carbon capture and storage (CCS) – Waste (MSW & Bio-waste, Biomedical, Industrial waste) – International and Regional cooperation.

Text Books:

1. Climate Change: An Indian Perspective (Environment and Development), Dr. Sushil Kumar Dash, Cambridge University Press India Pvt Ltd, 2007.
2. Adaptation and mitigation of climate change – Scientific Technical Analysis, Cambridge University Press, Cambridge, 2006.

Reference Books:

1. Atmospheric Science, J.M. Wallace and P.V Hobbs, Elsevier/ Academic Press, 2006.
2. "Climate Change and Climate Variability on Hydrological Regimes", Jan C. Van Dam, Cambridge University Press, 2003.
3. **http://www.ipcc.ch/**

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16EE31L1 – CONTROL SYSTEMS AND SIMULATION LAB

III Year B.Tech. EEE I Semester

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

Prerequisite(s): 16EE21L1 Field Theory and Circuits Lab
16EE22L3 Signals and Systems Simulation Lab

Course Objectives:

Develop ability to

1. Understand the concept of Time Response analysis of second order system.
2. Understand the characteristics of Synchros.
3. Understand the concept of Transfer Function representation of a DC machine.
4. Understand effect Of P, PI, PD ,PID Controller on a given second order system
5. Know the types of Compensators.
6. Understand the method of controlling temperature using PI,PD, PID Controller.
7. Understand the characteristics of AC Servo motor
8. Write a program to determine the stability analysis of Non Linear Time Invariant System
9. Write a program to simulate state space model for classical transfer function

Course Outcomes:

On completion of this course, student would be able to

CO1. Determine the time domain specifications for a given system.
CO2. Draw the characteristics of synchro transmitter and receiver.
CO3. Determine the Transfer Function of DC machine.
CO4. Analyze the effect of P,PI,PD,PID controller DC servomotor
CO5. Evaluate the gain margin and phase margin of a given system using Lag and Lead Compensators.
CO6. Measure the temperature using different controllers.
CO7. Draw the characteristics of AC servo motor
CO8. Simulate the stability analysis of a Non Linear Time Invariant system (using MATLAB/PSPICE software)
CO9. Simulate a state space model for a given classical transfer function(using MATLAB software)

LIST OF EXPERIMENTS

1. Time response of second order system
2. Characteristics of synchros
3. Transfer function Of DC shunt motor
4. Effect Of P,PI,PD,PID controller on a second order system (DC servomotor)
5. Lag and Lead Compensation- magnitude and phase plot
6. Transfer function of DC Generator

7. Temperature control using P,I,D controllers.
8. Characteristics of AC servo motor

ANY TWO OF THE FOUR SIMULATION EXPERIMENTS (USING MATLAB/ PSPICE*)*

9. Stability analysis (Root Locus Plot, Bode Plot, Nyquist Plot) of Non Linear Time Invariant System using MATLAB.
10. State space model for classical transfer function using MATLAB- verification.
11. Effect of feedback on DC servomotor using MATLAB.
12. Frequency response analysis (Bode Plot, Polar Plot, Nyquist Plot) using PSPICE

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16EE31L2 – ELECTRICAL MACHINES – II LAB

III Year B. Tech. EEE I Semester

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

Prerequisite(s): 16EE22L2 Electrical Machines – I Lab

Course Objectives:
Develop ability to
1. Understand performing a experiment on three – phase induction motor to analyze its characteristics by direct and indirect tests.
2. Determine equivalent circuit parameters of a single – phase and three-phase induction motors.
3. Examine the performance of single phase induction motor by load test.
4. Determine Regulation of alternator by different methods.
5. Understand determination of $\mathbf{X_d}$, $\mathbf{X_q}$ and sequence impedance of a synchronous machine.
6. Draw **'V'** and **'Inverted V'** curves of a three-phase synchronous motor.

Course Outcomes (COs):
On completion of this course, student would be able to
CO1. Draw performance characteristics of a three phase induction motor.
CO2. Calculate equivalent circuit parameters of a single – phase and three-phase induction motors.
CO3. Analyze performance of single phase induction motor.
CO4. Distinguish Regulation of three phase alternator by different methods.
CO5. Evaluate $\mathbf{X_d}$, $\mathbf{X_q}$ and sequence impedance of a synchronous machine.
CO6. Improve power factor of synchronous motor by varying excitation.

LIST OF EXPERIMENTS
1. Brake test on three-phase induction motor.
2. No-load and blocked rotor tests on three-phase induction motor.
3. Equivalent circuit of a single-phase induction motor.
4. Equivalent circuit of a three-phase induction motor
5. Load test on single phase induction motor.
6. Regulation of a three-phase alternator by synchronous impedance &**MMF** methods.
7. Regulation of a three-phase alternator by **ZPF**&**ASA** methods.
8. Determination of $\mathbf{X_d}$ and $\mathbf{X_q}$ of a salient pole synchronous machine.
9. **'V'** and **'Inverted V'** curves of a three-phase synchronous motor.
10. Measurement of sequence impedance of a three-phase alternator.

ADDITIONAL EXPERIMENTS
11. Efficiency of three-phase alternator.
12. Load test on three-phase alternator.

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16EC31L1 – MICROPROCESSORS AND MICROCONTROLLERS LAB

III Year.B.Tech. EEE-I Semester.

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

Prerequisite(s):16EC2103 – Switching Theory and Logic Design

Course Objectives:
Develop ability to:
1. Write Assembly Language Programs for various arithmetic and logical operations using 8086.
2. Interface various I/O devices to 8086 processor kits.
3. Write Assembly Language Programs for various arithmetic and logical operations using 8051.
4. Interface various I/O devices to 8051 microcontroller kits.
5. Write and execute interfacing programs in Assembly Language for 8086 processor and 8051 microcontroller.

Course Outcomes:
At the end of the course, student would be able to:
CO1. Write programs in assembly language using the instruction set of 8086 through MASM software and as well as using 8086 Kit.
CO2. Interface different I/O devices with 8086 and establish communication between them.
CO3. Write programs in assembly language using instruction set of 8051 and execute the same.
CO4. Verify the operations of the timer, counter and serial port (UART) of 8051.
CO5. Interface different I/O devices with 8051 and establish communication between them.

List of experiments: (Minimum 12 experiments are to be conducted using MASM/ Keilsoftwares and/or Hardware Kits).

Part A:

8086: Kit and/or MASM Programming (Minimum 4 experiments to be conducted)
1. Programs for 16 bit arithmetic operations (using various addressing modes)
2. Program for sorting an array
3. Program for searching for a number or character in a string
4. Program for String manipulations
5. Program to generate Fibonacci Series

Interfacing with 8086 Microprocessor: (Minimum 3 experiments to be conducted)
6. Interfacing ADC and DAC to 8086.
7. Parallel communication between two microprocessors using 8255.
8. Serial communication between two microprocessor kits using 8251.
9. Verification of various modes of operation of 8255.

Part B:(Minimum 5 experiments to be conducted)

8051: Kit and/or Keil Programming

10. Programming using arithmetic, logical and bit manipulation instructions of 8051
11. Program and verify Timer/Counter in 8051.
12. Program and verify interrupt handling in 8051.
13. Verification of UART operation in 8051.

Interfacing with 8051 Microcontroller

14. Communication between 8051 kit and PC.
15. Interfacing keyboard/Display to 8051.

Additional Experiments:

1. Interfacing LCD to 8051.
2. Wave form generation using Keil.
3. Programs using DOS/BIOS interrupts.

Equipment Required:

1. 8086 Trainer Kits.
2. 8051 Trainer Kits.
3. Interface cards :
    - 8 bit ADC & DAC,
    - Experimental card for 8051,
    - 8251/8253 study cards,
    - Keyboard/Display,
    - LCD Display,
    - 8255 Study card

Software Required:

1. MASM
2. Keil µVision5

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16MA31P1 – LOGICAL REASONING

III Year.B.Tech. EEE – I Sem

L	T	P/D	C
-	-	2/-	1

Prerequisite(s): None

Course Objectives:
Develop ability to
1. Understand and compute LCM, HCF, Square Roots & Cube Roots.
2. Calculate averages; solve problems on time, distance and work done.
3. Understand relation between capital investment, period of investments and shares.
4. Think analytically and logically to solve a given problem.
5. Understand concepts of clocks and calendars.

Course Outcomes:
On completion of this course, student would be able to
CO1. Apply cogent methods to evaluate LCM, HCF, Square Roots & Cube Roots.
CO2. Apply various principles to solve mathematical problems on time, distance and work done involving lesser computations.
CO3. Apply relation between Capital investments, period of investments and shares to solve numerical problems which involves shorter computational time.
CO4. Demonstrate analytical and logical thinking by solving various problems which include relations and puzzle solving abilities.
CO5. Solve problems related to time.

UNIT – I
Numbers
Classification of numbers, Divisibility rules, Finding the units digit, Finding remainders in divisions involving higher powers, LCM and HCF Models**,** Decimal fractions, Simplifications, Square Roots & Cube Roots, Surds and Indices.

UNIT – II
Averages
Definition of Average, Rules of Average, Problems on Average, Problems on Weighted Average, Finding average using assumed mean method**.**
Time and Distance
Relation between speed, distance and time, Converting kmph into m/s and vice versa, Problems on average speed, Problems on relative speed, Problems on trains.
Time and Work
Problems on Unitary method, Relation between Men, Days, Hours and Work, Problems on Man-Day-Hours method, Problems on alternate days, Problems on Pipes and Cisterns.

UNIT – III

Partnership

Introduction, Relation between capitals, Period of investments and Shares.

Simple Interest

Definitions, Problems on interest and amount, Problems when rate of interest and time period are numerically equal.

Compound Interest

Definition and formula for amount in compound interest, Difference between simple interest and compound interest for 2 years on the same principle and time period.

UNIT – IV

Analytical Reasoning puzzles

Problems on Linear arrangement, Problems on Circular arrangement, Problems on Double line-up, Problems on Selections, Problems on Comparisons.

Blood relations

Defining the various relations among the members of a family, Solving Blood Relation puzzles, Solving the problems on Blood Relations using symbols and notations.

UNIT – V

Clocks

Finding the angle when the time is given, Finding the time when the angle is known, Relation between Angle, Minutes and Hours, Exceptional cases in clocks.

Calendars

Definition of a Leap Year, Finding the number of Odd days, Framing the year code for centuries, Finding the day of any random calendar date.

Odd man out

Problems on number Odd man out, Problems on letter Odd man out, Problems on verbal Odd man out.

Text Books:

1. Quantitative Aptitude for Competitive Examinations by R.S. Aggarwal, S Chand Publication.
2. Quantitative Aptitude for Competitive Examination by AbhijitGuha, McGraw Hill Education.

Reference Books:

1. Quantitative Aptitude for the CAT by Nishit K. Sinha, Pearson Education
2. Wiley's Quantitative Aptitude by P.A. Anand, Wiley; First Edition edition.

B.TECH EEE
III - YEAR
II-SEM

DETAILED SYLLABUS

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16EE3201 – COMPUTER METHODS IN POWER SYSTEMS

III Year B.Tech. EEE II Semester

L	T	P/D	C
3	1	-/-	3

Prerequisite(s):16EE3102 Power systems –II

Course Objectives:
Develop ability to
1. Study the various Network Matrices in Power Systems.
2. Analyze Various power Flow methods.
3. Study various Faults in Power Systems.
4. Learn Steady State Stability analysis.
5. Learn Transient State Stability analysis.

Course Outcomes (COs):
On Completion of this course, students would be able to
CO1. Formulate the Y BUS matrix for a small power grid by hand and differentiate among PV,PQ, reference/swing/slack buses in power flow analysis, Z BUS matrix for a power system.
CO2. Develop proper mathematical models like Guass-Seidel method for analysis of a selected problem like load flow study, mathematical models like Newton-Raphson method for analysis of a selected problem like load flow study.
CO3. Perform a wide-variety of per-unit conversions & Fault Analysis.
CO4. Determine power system stability indicators.
CO5. Obtain Maximum operational Load power limit of a system for steady state analysis.

UNIT – I
Power System 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 Matrix 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 (Derivations and Numerical Problems).- 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 solutions 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/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 – DC load Flow

UNIT – III

Short Circuit Analysis

Per-Unit System of Representation. Per-Unit equivalent reactance network of a three phase Power System, Numerical Problems. Symmetrical fault Analysis: Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors, 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 impedance, Numerical Problems.

UNIT – IV

Power System 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

Power System Transient State Stability Analysis

Derivation of Swing Equation. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation.- Solution of Swing Equation: Point-by-Point Method. Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.

Text Books:

1. power system Analysis Operation and control, AbhijitChakrabarthi , SunitaHaldar, 3 ed , PHI,2010.
2. Modern Power system Analysis – by I.J.Nagrath&D.P.Kothari: Tata McGraw-Hill Publishing company, 2nd edition.

Reference Books:

1. Computer Techniques in Power System Analysis by M.A.Pai, TMH Publications
2. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
3. Computer techniques and models in power systems, By K.Umarao, I.K.International
4. Power System Analysis by HadiSaadat – TMH Edition.

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16EE3202 – ELECTRIC DRIVES

L	T	P/D	C
3	1	-/-	3

III Year B.Tech. EEE II Semester
16EE2201 Power Electronics

Course Objectives:
Develop ability to
1. Understand concepts related to DC motor control through phase controlled rectifiers.
2. Understand concepts of four quadrant operation of DC motors.
3. Understand the operation of DC motor control with choppers.
4. Understand speed control applications of Induction motors using AC voltage controllers, voltage source inverters and current source inverters.
5. Understand Synchronous motor control using cycloconverters.

Course Outcomes (COs):
On completion of this course, student would be able to
CO1. Apply the knowledge of mathematics, to solve numericals based on control of DC motors through phase controlled rectifiers.
CO2. Apply the knowledge of four quadrant operation of DC motors for various motoring operations.
CO3. Apply the knowledge of choppers in controlling DC motors.
CO4. Apply the knowledge of AC voltage controller, voltage source inverters and current source inverters in the speed control of Induction motor applications.
CO5. Apply the knowledge of cycloconverters, for controlling Synchronous motors.

UNITI

Control of DC Motors through Phase Controlled Rectifiers: 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.
Three phase semi and fully controlled converters connected to d.c separately excited and d.c series motors – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque characteristics-Problems.

UNIT II

Four Quadrant Operation of DC Drives through Dual Converters:
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 – Closed loop operation of DC motor (Block Diagram Only)

UNIT III

Control of DC Motors By Choppers: Single quadrant, Two –quadrant and four quadrant chopper fed dc separately excited and series excited motors – Continuos current operation – Output voltage and current wave forms – Speed torque expressions – speed torque characteristics – Problems on Chopper fed d.c Motors – Closed Loop operation (Block Diagram Only)

UNIT – IV

Control of Induction Motors: Variable Voltage Characteristics Variable voltage characteristics-Control of Induction Motor by Ac Voltage Controllers – Waveforms – speed torque characteristics.

Control of Induction Motors: Variable Frequency Characteristics Variable frequency characteristics-Variable frequency control of induction motor by Voltage source and current source inverter and cyclo-converters- PWM control – Comparison of VSI and CSI operations – Speed torque characteristics – numerical problems on induction motor drives – Closed loop operation of induction motor drives (Block Diagram Only)

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 – Applications – Advantages and Numerical Problems – Closed Loop control operation of synchronous motor drives (Block Diagram Only), variable frequency control, Cyclo converter, PWM, VFI, CSI

Selection of drives and control schemes: For Steel rolling mills, Paper mills, Cement mills, Machine tools, Lifts and Cranes. Solar and battery powered drives

Text Books

1. Electric Drives, by Nisit K. De, P.K Sen, PHI Publications
2. Fundamentals of Electric Drives – by G K Dubey Narosa Publications

Reference Books

1. Power Electronic Circuits, Devices and applications by M.H.Rashid, PHI
2. Power Electronics – MD Singh and K B Khanchandani, Tata – McGraw-Hill Publishing company,1998
3. Modern Power Electronics and AC Drives by B.K.Bose, PHI.
4. Thyristor Control of Electric drives – Vedam Subramanyam Tata McGraw Hill Publilcations.
5. A First course on Electrical Drives – S K Pillai New Age International(P) Ltd. 2nd Editon.
6. Power Electronics Principles and Applications TMH by Joseph Vithayathil

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16EE3203 – INSTRUMENTATION AND MEASUREMENT TECHNIQUES

III Year B.Tech. EEE II Semester

L	T	P/D	C
3	1	-/-	3

Prerequisite(s): 16EE3101 Control Systems

Course Objectives:
Develop ability to
1. Understand the basic principles of all measuring instruments.
2. Understand the operation of potentiometers, instrument transformers and power factor meter.
3. Understand the concepts of measuring the RLC parameters, voltage, current, power factor, power and energy.

Course Outcomes (COs):
On completion of this course, student would be able to
CO1. Classify different types of measuring instruments their construction, operation and characteristics.
CO2. Determine the standardization values of potentiometers. Calculate the phase angle and ratio errors of instrument transformers.
CO3. Compute active and reactive powers in balanced and unbalanced systems, driving and braking torques of energy meter along with their errors and compensations.
CO4. Calculate the sensitivity of bridges and obtain the balanced condition for various DC and AC bridges.
CO5. Determine the characteristics of electrical transducer and their applications.

UNIT – I

Introduction to 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

Potentiometers

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

Instrument Transformers

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

UNIT –III

Measurement of Power

Single phase dynamometer wattmeter, LPF and UPF, Double element and three 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.

Measurement of Energy

Single phase induction type energy meter – driving and braking torques – errors and compensations – testing by phantom loading using R.S.S. meter. Three phase energy meter

UNIT – IV

Resistance Measurements

Method of measuring low, medium and high resistance – sensitivity of Wheat-stone's bridge – Carey Foster's bridge, Kelvin's double bridge for measuring low resistance, measurement of high resistance – loss of charge method.

A.C. Bridges

Measurement of inductance, Quality Factor - Maxwell's bridge, Hay's bridge, Anderson's bridge, Owen's bridge. Measurement of capacitance and loss angle - Desautybridge. Wien's bridge – Schering Bridge.

UNIT – V

Transducers and Oscilloscope

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, guage factor, Thermistors, Thermocouples, Piezo electric transducers, photovoltaic, photo conductive cells, photo diodes. Cathode ray oscilloscope-Cathode ray tube-time base generator-horizantal and vertical amplifiers -applications of CRO-Measurement of phase and frequency-lissajous patterns.

Text Book:

1. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, fifth Edition, Wheeler Publishing.
2. Electrical & Electronic Measurement & Instruments by A.K.SawhneyDhanpatRai& Co. Publications.

Reference Books:

1. Electrical Measurements – Buckingham and Price, Prentice – Hall.
2. Electrical Measurements: Fundamentals, Concepts, Applications – Reissland, M.U, New Age International (P) Limited, Publishers.
3. Principles of Measurement and Instrumentation – by A.S Morris, Pearson /Prentice Hall of India.

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16EE3204 – RENEWABLE ENERGY (WIND AND SOLAR)
(Professional Elective - I)

III Year B.Tech. EEE II Semester

L	T	P/D	C
3	1	-/-	3

Prerequisite(s): 16EE2201 Power Electronics

Course Objectives:
Develop ability to
1. To create the awareness of energy conservation in students
2. To have knowledge on environmental effects of energy conservation
3. To analyze solar and wind energy storage methods
4. To introduce photovoltaic systems
5. To understand details about manufacture, sizing and operating techniques of solar and wind energy systems.

Course Outcomes (COs):
On completion of this course, student would be able to
CO1. Familiarize the importance of Solar power.
CO2. Understand the techniques of storing and utilizing solar power.
CO3. Identify photovoltaic system components and system types.
CO4. Understand the techniques to use wind energy
CO5. Determine to extract energy from wind

UNIT – I
Principles of solar radiation
Role and potential of renewable source –Environmental impact of solar power – Sun and Earth – Solar Geometry – Extraterrestrial and terrestrial solar radiation– Solar radiation on tilted surface – Instruments for measurement of solar radiation – Solar radiation data.

UNIT – II
Solar Energy Collection and Storage
Flat plate and concentrating collectors –Classifications of concentrating collectors –Advanced collectors–Solar pond– Different methods of solar energy storage – Sensible, Latent heat storage – Solar applications – Solar heating/cooling technique – Solar distillation and drying.

UNIT – III
Photovoltaic systems
Solar cells– Equivalent circuit –V-I characteristics–Performance improvement – Photovoltaic modules– Design requirements –Types of Photovoltaic systems – Maximum Power Point Trackers

(MPPT) –algorithms Perturb & Observe – Incremental conductance method – Hill climbing method – Grid connected PV systems.

UNIT – IV
Wind Energy
Sources and potential – Basics of wind energy – Wind characteristics – Classification of wind turbines – Types of rotors – Savonious rotor – Darrieus rotor – Horizontal axis wind turbine – Vertical axis wind turbine.

UNIT – V
Wind Energy conversion
Extraction of wind energy – Betz criteria –Wind energy conversion systems –block diagrams – Applications.

Text Books:
1. "Non-conventional Energy Sources" by G.D Rai, Khanna Publishers.
2. "Renewable Energy Resources and emerging technologies"- PHI 2/e 2011 by D.P. Kothari, K.C Singal, R.Ranjan

Reference Books:
1. "Renewable Energy Resources", Twidell&Wier, CRC Press (Taylor & Francis)
2. "Fundamentals of Renewable Energy Systems", D.Mukherjee, S.Chakrabarti, New Age International.
3. "Introduction to renewable energy", Vaughn Nelson, CRC Press (Taylor & Francis)
4. "Non-conventional Energy Resources", By B.H.Khan

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16EE3205 – SPECIAL MACHINES
(Professional Elective - I)

III Year B.Tech. EEE II Semester

L	T	P/D	C
3	1	-/-	3

Prerequisite(s):16EE3103 Electrical Machines-II

Course Objectives:
Develop ability to:
1. Learn the constructional features, principle of operation, methods of control and applications of stepper motors.
2. Understand the constructional features, principle of operation, methods of control and applications of Switched reluctance motors.
3. Have an insight into the constructional features, principle of operation, methods of control and applications of PMBLDC motors.
4. Have a clear picture of the types, the constructional features, principle of operation, methods of control and applications of PMSM.
5. Gain knowledge in the types, the constructional features, principle of operation, methods of control and applications of SyRM.

Course Outcomes (COs):
On completion of this course, student would be able to
CO1. Understand the need for stepper motors and the various applications in industries.
CO2. Understand the operational characteristics and the applications of SRM.
CO3. Understand the various types of PMBLDC motors, rotor position sensors, methods of control and their applications.
CO4. Understand the various types of linear induction and synchronous motors.
CO5. Understand and characteristics of Hysteresis motor – AC series motors.

UNIT – I
Stepper Motors
Constructional features, Principle of operation, Variable Reluctance (VR) stepping motor-Single Stack, Multi-Stack, Permanent Magnet Step motor, Hybrid Step Motor, Torque Equation Open Loop Drive, Open loop and closed loop control of Step Motor, Applications.

UNIT – II
Switched Reluctance Motors
Constructional features, Principle of Operation, Torque equation, Torque-speed characteristics, Power Converter for SR Motor-Asymmetrical converter, DC Split converter, Control of SRM, Rotor Position sensors, Current Controllers, Applications.

UNIT – III

Permanent Magnet Synchronous Motor

Permanent magnets and their characteristics, Machine Configurations-SPM, SIPM, IPM and Interior PM with circumferential, Sensorless control, Applications.

Brushless Dc Motor

Construction, Principle of Drive operation with inverter, Torque speed Characteristics, Closed loop control, Sensorless control, Applications.

UNIT – IV

Linear Induction Motors and Linear Synchronous Motors

Linear induction motor, Construction details, LIM Equivalent Circuit, Steps in design of LIM, Linear Synchronous Motor: Principle and Types of LSM, LSM Control, Applications.

UNIT – V

Other Special Machines

Principle of operation and characteristics of Hysteresis motor – AC series motors – Linear motor – Permanent magnet DC and AC motors, Applications.

Text Books:

1. R.Krishnan, Electric Motor Drives, Pearson , 2007
2. B.K.Bose, Modern Power Electronics and AC Drives, PHI, 2005

Reference Books

1. Venkataratnam, Special electrical Machines, University Press, 2008
2. E.G.Janardanan, Special Electrical Machines, PHI, 2014
3. T.J.E.Miller, Brushless Permanent Magnet and Reluctance Motor Drive, Clarendon Press, Oxford, 1989
4. R. K. Rajput ,“Electrical machines”-5th edition.
5. Electric machines D.P.Kothari and I.J.Nagrath Tata Mc Graw hill publishing company Third Edition 2004.
6. Stepping motors and their microprocessor controls T.Kenjo, Oxford University press, New Delhi 2000.
7. Permanent magnet and Brushless DC motors T.Kenjo and S.Nagamori Clarendon press, London 1988.

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16EE3206 – UTILIZATION OF ELECTRICAL ENERGY
(Professional Elective - I)

III Year B.Tech. EEE II Semester

L	T	P/D	C
3	1	-/-	3

Prerequisite(s):16EE3103 Electrical Machines-II

Course Objectives:
Develop ability to
1. Understand the concepts of electric drives and their applications.
2. Understand electric heating concepts and their related applications.
3. Understand various electric welding concepts and related applications.
4. Understand fundamentals of illumination.
5. Understand the concepts of electric traction.

Course Outcomes (COs):
On completion of this course, student would be able to
CO1. Apply the knowledge of electric drives
CO2. Apply the concepts of electric heating.
CO3. Apply various electric welding concepts.
CO4. Calculate and determine the specific illumination level required in a building.
CO5. Calculate various parameters of electric traction.

UNIT – I
Electric Drives
Type of electric drives, choice of motor starting and running characteristicsSpeed control, temperature rise.Applications of electric drives.Types of industrial loads, continuous, intermittent and variable loads. Load equalization.

UNIT – II
Electric Heating and Welding
Advantages and methods of electric heating viz.;resistance heating Induction heating Dielectric heating. Comparison between welding methods. Electric welding, resistance welding, arc welding, and various electric welding equipment used for different applications. Comparison between A.C. and D.C. Welding.

UNIT – III
Illumination
Introduction, terms used in illumination. Laws of illumination,Polar curves Photometry, Integrating sphere Sources of light Discharge lamps, MV and SV lamps, CFL lamps, LED bulbs and LED tube

light and their comparison Basic principles of light control, Types and design of lighting 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 Regenerative braking. Mechanics of train movement Speed-time curves for different services Trapezoidal speed time curves. 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

Text Books:

1. "Utilisation of Electrical Power"byEr. R.K. Rajput
2. "Art & Science of Utilization of electrical Energy" – by Partab, DhanpatRai& Sons.

Reference Books:

1. "Utilisation of electric energy" By E. Openshaw Taylor University Press.
2. Generation,Distribution and Utilization of electrical energy, C.L.Wadhawa, New Age International (P) Limited.
3. Utilization of Electrical Power including Electric drives and Electric traction, N.V.Suryanarayana, New Age International (P) Limited.
4. Utilization of Electric Energy, VVL Rao, University Press.

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16EE3207 – LINEAR SYSTEM ANALYSIS
(Professional Elective - I)

III Year B.Tech. EEE I Semester

L	T	P/D	C
3	1	-/-	3

Prerequisite(s):16EE3101 Control Systems

Course Objectives:

Develop ability to
1. Model and analyze linear systems.
2. Use proper mathematical methods in the analysis.
3. Test polynomial of the given system.
4. Estimate the stability of any linear system.

Course Outcomes (COs):
On completion of this course, student would be able to
CO1. Analyze and synthesize the given linear system.
CO2. Apply proper mathematical techniques in the analysis.
CO3. Use appropriate tool for the polynomial testing.
CO4. Determine the stability of the given linear system.

UNIT – I
State Variable Analysis
Revision of State Variables, Formulation of State equations – Equivalent source method, Network topological method – Solution of state equations – Analysis of simple networks with state variable approach, Concepts of Controllability and Observability.

UNIT – II
Applications of Fourier Series and Fourier Transforms
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.
Laplace Transform Applications
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
Applications of Z-Transforms
Fundamental difference between continuous and discrete time signals, discrete time complex, exponential and sinusoidal signals, periodicity of discrete time complex exponential and sinusoidal signals, Modeling of Discrete time systems, Discrete time convolution, Analysis with Z-transform.

UNIT – IV

Testing of Polynomials

Elements of realisability-Hurwitz polynomials-positive real functions-Proper ties-Testing Sturm's Test, examples.

Network Synthesis

Synthesis of one port LC networks-Foster and Cauer methods-Synthesis of RL and RC one port networks-Foster and Cauer methods.

UNIT – V

Stability Analysis of Linear Systems

Stability in the sense of Lyapunov. Lyapunov's stability and Lyapunov's instability theorems. Direct method of Lyapunov for the Linear continuous time autonomous systems.

Text Books:

1. Network and Systems - D Roy Chowdhary, New Age International
2. Network Analysis and Synthesis - UmeshSinha- Satya Prakashan Publications

Reference Books:

1. Linear System Analysis-AN Tripathi, New Age International
2. Engineering Network Analysis and Filter Desgin- Gopal G Bhisk & Umesh
3. Linear system analysis by A.Cheng, Oxford publishers.

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16EE3208- ENERGY AUDIT
(Professional Elective - II)

L	T	P/D	C
3	1	-/-	3

III Year B.Tech. EEE II Semester
Prerequisite(s): 16EE3103 Electrical Machines-II
16EE3102 Power systems –II

Course Objectives:
Develop ability to
1. Know the necessity of conservation of energy
2. Generalize the methods of energy management
3. Illustrate the factors to increase the efficiency of electrical equipment
4. Detect the benefits of carrying out energy audits..

Course Outcomes (COs):
CO1: Tell energy audit of industries
CO2: Predict management of energy systems
CO3: Sequence the methods of improving efficiency of electric motor
CO4: Analyze the power factor and to design a good illumination system
CO5: Determine pay back periods for energy saving equipment

UNIT-I:
Basic Principles of Energy Audit: Energy audit- definitions, concept , types of audit, energy index, cost index ,pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit.

UNIT-II:
Energy Management: Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting- Energy manger, Qualities and functions, language, Questionnaire – check list for top management.

Unit -III: Energy Policy Planning and Implementation
Key Elements: Force Field Analysis, Energy Policy-Purpose, Perspective, Contents and Formulation.
Format and Ratification, Organizing: Location of Energy Manager, Top Management Support,Managerial functions, Role and responsibilities of Energy Manager, Accountability. Motivating –Motivation of employees, Requirements for Energy Action Planning.
Information Systems: Designing, Barriers, Strategies, Marketing and Communicating Training and Planning.

Unit -IV: Energy Balance & MIS
First law of efficiency and Second law of efficiency, Facility as an Energy system, Methods for

preparing process flow, Materials and Energy Balance diagram, Identification of losses, Improvements. Energy Balance sheet and Management Information System (MIS),Energy Modeling and Optimization.

Unit -V: Energy Audit Instruments

Instruments for Audit and Monitoring Energy and Energy Savings, Types and Accuracy

TEXT BOOKS:

1. Energy management by W.R. Murphy AND G. Mckay Butter worth, Heinemann publications.
2. Energy management by Paul o' Callaghan, Mc-graw Hill Book company-1st edition, 1998

Reference Books:

1. Energy Management: W.R.Murphy, G.Mckay (Butterworths).
2. Energy Management Principles: C.B.Smith (Pergamon Press).
3. Efficient Use of Energy : I.G.C.Dryden (Butterworth Scientific)
4. Energy Economics -A.V.Desai (Wieley Eastern)
5. Industrial Energy Conservation : D.A. Reay (Pergammon Press)
6. Energy Management Handbook – W.C. Turner (John Wiley and Sons, A Wiley Interscience Publication)
7. Industrial Energy Management and Utilization – L.C. Witte, P.S. Schmidt, D.R. Brown (Hemisphere Publication, Washington)
8. Industrial Energy Conservation Manuals, MIT Press, Mass, 1982
9. Energy Conservation guide book Patrick/Patrick/Fardo (Prentice Hall)
10. ASHRAEE Energy Use (4 Volumes)
11. CIBSI Guide –Users Manual (U.K.)
12. CRC Handbook of Energy Efficiency – CRC Press.

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16EE3209 – SWITCHED MODE POWER SUPPLIES (SMPS)
(Professional Elective - II)

III Year B.Tech. EEE II Semester

L	T	P/D	C
3	1	-/-	3

Prerequisite(s):16EE2203 Power Systems-I
16EE3102 Power systems –II
16EE3101 Control Systems

Course Objectives:
Develop ability to
1. Understand concepts of power electronics for designing converters.
2. Understand the concepts related to magnetic circuits and their design.
3. Understand the voltage and current control modes of SMPS.
4. Understand the electromagnetic interference effects.
5. Understand the concepts of designing UPS and SMPS

Course Outcomes (COs):
On completion of this course, student would be able to
CO1. Apply the knowledge of power electronics in designing converter circuits.
CO2. Apply the concepts of magnetic circuits in design of SMPS.
CO3. Apply the knowledge of voltage and current control modes of SMPS.
CO4. Evaluate the affects of electromagnetic interference
CO5. Apply the knowledge of SMPS for applications like,fluorescent lamps - power supplies for portable electronic gadgets

UNIT – I
Introduction
Linear regulator Vs. Switching regulator – Topologies of SMPS – isolated and non isolated topologies – Buck –Boost – Buck boost – Cuk – Polarity inverting topologies – Push pull and forward converters half bridge and fullbridge – Fly back converters Voltage fed and current fed topologies. EMI issues.

UNIT – II
Design Concepts
Magnetic Circuits and design – Transformer design - core selection – winding wire selection – temperature rise calculations - Inductor design. Core loss – copper loss – skin effect - proximity effect. Power semiconductor selection and its drive circuit design – snubber circuits. Closing the feedback loop – Control design – stability considerations

UNIT – III

Control Modes

Voltage Mode Control of SMPS.. Transfer Function and Frequency response of Error Amp. Transconductance Error Amps . PWM Control ICs (SG 3525,TL 494,MC34060 etc.)

Control Modes

Current Mode Control and its advantages.Current Mode versus Voltage Mode. Current Mode PWM Control IC(eg.UC3842).

UNIT – IV

Electro Magnetic Interference (Emi)

EMI Filter Components, Conducted EMI suppression, Radiated EMI suppression,Measurement.

Protection

Over current protection, Over voltage protection, Inrush current protection.

Thermal Model

Thermal Resistance, Cooling Considerations, Selection of Heat sinks, Simple Heat sinkcalculations.

UNIT – V

Applications of SMPS

Active front end – power factor correction – High frequency power source for fluorescent lamps - power supplies for portable electronic gadgets.

Resonant converters

Principle of operation – modes of operation – quasi resonant operation- advantages.

Text Books:

1. Abraham I Pressman - Switching power supply design – 2nd edition 1998 Mc-Graw hill Publishing Company.
2. Mohan N. Undeland . T & Robbins W, Power Electronics Converters, Application andDesign. John Wiley, 3rd edition, 2002

Reference Books:

1.SanjayaManiktala - Switching power supplies A to Z. – 1st edition 2006, Elsevier Inc.
2. Daniel M Mitchell : DC-DC Switching Regulator Analysis. McGraw Hill Publishing Company
3. Ned Mohan et.al : Power Electronics. John Wiley and Sons.
4. OtmarKilgenstein : Switched Mode Power Supplies in Practice. John Wiley and Sons.
5. Mark J Nave : Power Line Filter Design for Switched-Mode Power Supplies. Van NostrandReinhold,New York
6.Keith H Billings - Switch mode power supply handbook – 1st edition 1989 Mc-Graw hill Publishing Company
7.Switched Mode Power Supplies, Design and Construction, H. W. Whittington, B. W. Flynn and D. E. MacPherson, Universities Press, 2009 Edition.
8. Umanand L., Bhat S.R., Design of magnetic components for switched Mode Power Converters. , Wiley Eastern Ltd.,1992
9. Robert. W. Erickson, D. Maksimovic .Fundamentals of Power Electronics., Springer International Edition, 2005
10. Course Material on Switched Mode Power Conversion, V. Ramanarayanan.

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16EE3210 – POWER QUALITY
(Professional Elective - II)

III Year B.Tech. EEE II Semester

L	T	P/D	C
3	1	-/-	3

Prerequisite(s):16EE2203 Power Systems-I
16EE3102 Power systems –II

Course Objectives:
Develop ability to
1. Study the various issues affecting power quality, their production, monitoring and suppression.
2. Formulating expressions and calculation of Sag and learn about compensators.
3. Analyze over voltages and switching Phenomenon.
4. Study of Various Harmonics in Power Systems.
5. Analyze Power Quality Monitoring in Power systems.

Course Outcomes (COs):
CO1. Apply Imbalances, fluctuations , Power frequency variations.
CO2. Solve some practical problems related to Voltage Sag and Estimation of Sag severity.
CO3. Understand Various Over voltages and Switching Phenomenon.
CO4. Identification and implementation of Harmonics in Power system.
CO5. Apply Various Monitoring techniques in Power Quality.

UNIT – I
Introduction to Power Quality
Terms and definitions: Overloading - under voltage - over voltage. Concepts of transients - shortduration variations such as interruption - long duration variation such as sustained interruption. Sags and swells - voltage sag - voltage swell - voltage imbalance - voltage fluctuation - power frequency variations. International standards of power quality. Computer Business Equipment Manufacturers Associations (CBEMA) curve.

UNIT – II
Voltage Sags and Interruptions
Sources of sags and interruptions - estimating voltage sag performance. Thevenin'sequivalentsource - analysis and calculation of various faulted condition. Voltage sag due to induction motorstarting. Estimation of the sag severity - mitigation of voltage sags, active series compensators.Static transfer switches and fast transfer switches.

UNIT – III

Overvoltages

Sources of over voltages - Capacitor switching – lightning - Ferro resonance. Mitigation of voltage swells - surge arresters - low pass filters - power conditioners. Lightning protection – shielding – line arresters - protection of transformers and cables. An introduction to computer analysis tools for transients, PSCAD and EMTP.

UNIT – IV

Harmonics

Harmonic sources from commercial and industrial loads, locating harmonic sources.Power system response characteristics - Harmonics Vs transients. Effect of harmonics - harmonic distortion -voltage and current distortion - harmonic indices - inter harmonics – resonance. Harmonic distortion evaluation - devices for controlling harmonic distortion - passive and active filters.

UNIT – V

Power Quality Monitoring

Monitoring considerations - monitoring and diagnostic techniques for various power quality problems - modeling of power quality (harmonics and voltage sag) problems by mathematical simulation tools - power line disturbance analyzer –quality measurement equipment - harmonic / spectrum analyzer - flicker meters – disturbance analyzer. Applications of expert systems for power quality monitoring.

Text Books:

1. Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H.WayneBeaty, ‘Electrical PowerSystems Quality’ McGraw Hill,2003.(For Chapters1,2,3, 4 and 5)

Reference Books:

1. G.T. Heydt, 'Electric Power Quality', 2nd Edition. (West Lafayette, IN, Stars in aCircle Publications, 1994). (For Chapter 1, 2, 3 and 5)
2. M.H.J Bollen, ‘Understanding Power Quality Problems: Voltage Sags and Interruptions’, (NewYork: IEEE Press, 1999). (For Chapters 1, 2, 3 and 5)
3. J. Arrillaga, N.R. Watson, S. Chen, 'Power System Quality Assessment', (New York: Wiley,1999). (For Chapters 1, 2, 3, 4 and 5)4. PSCAD User Manual

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16EE3211 – IMAGE PROCESSING
(Professional Elective - II)

III Year B.Tech. EEE II Semester

L	T	P/D	C
3	1	-/-	3

Prerequisite(s):16EE2204- Signals and Systems

Course Objectives:
Develop ability to
1. Understand basics terminologies in image processing.
2. Understand different types of images and image transforms.
3. Understand various methods used for image enhancement.
4. Understand image restoration and various techniques used for it.
5. Understand the concepts of edge detection in image processing.

Course Outcomes (COs):
On completion of this course, student would be able to
CO1. Determine the basic features of different types of images.
CO2. Perform image transformation and identify the best method for image transformation.
CO3. Perform image enhancement and identify the best method for image enhancement.
CO4. Perform image restoration and identify the best method for image restoration
CO5. Perform edge detection using different methods

UNIT – I
Basics
Applications of image processing. Notion of pixel, resolution, quantization, photon noise. Geometric transformations, source-to-target and target-to-source mapping, planar homography, rotational homography, change detection and mosaicing.

UNIT – II
Image Formation
Pin-hole versus real aperture lens model, lens as a 2D LSI system, blur circle, Doubly block circulant system matrix, pill box and Gaussian blur models, space invariant and space variant blurring. 3D Shape from Focus: Depth of field, focal stack, focus operators, focus measure curve, Gaussian interpolation, 3D recovery, focused image recovery. Image Transforms: 1D Orthogonal transforms, Kronecker product, 2D orthogonal transforms from 1D, 2D DFT, 2D DFT for image matching, 2D DCT, Hadamard, PCA for face recognition, image denoising.

UNIT – III
Image Enhancement
Thresholding methods (peak-valley, Otsu, Chow-Kaneko), histogram equalization and modification, Noise models, mean, weighted mean, median, weighted median, non local means filter, frequency

domain filtering, illumination compensation by homomorphic filtering, segmentation by k-means clustering, higher-order statistics based clustering.

UNIT – IV

Image Restoration

Well-posed and ill-posed problems, Fredholm integral equation, condition number of matrix, conditional mean, Inverse filter, Wiener filter, ML and MAP restoration, image super-resolution.

UNIT – V

Edge Detection

Gradient operators, Prewitt, Sobel, Roberts, compass operators, LOG, DOG, Canny edge detectors, non-maxima suppression, hysteresis thresholding.

Text Books

1. Gonzalez and Woods: Digital image processing.
2. A.K. Jain: Fundamentals of digital image processing.

Reference Books

1. Al Bovik: Handbook of image and video processing.
2. J.S. Lim: Two dimensional signal and image processing.

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16MB3231- SUPPLY CHAIN MANAGEMENT
(Open Elective - II)

III Year. B. Tech. EEE - II Semester
Prerequisite(s): Nil

L	T	P/D	C
3	-	-	3

Course Objectives: Develop ability to:
1. Distinguish the different functional areas in businesses management, understand the cross functional integrations and map supply chains of various business sectors.
2. Identify different types of distribution/ modes of transport/ network design.
3. Analyze the operational issues in SCM.
4. Recognize the drivers of supply chain.
5. Interpret the importance of relationships with suppliers and customers.

Course Outcomes:

At the end of the course, student would be able to:
CO 1: Understand the role of an Engineer as well as Manager in Supply chain management
CO 2: Appreciate the importance of logistics in integrating different functional areas.
CO 3: Integrate operations with functional areas.
CO 4: Visualize the role of logistics and distribution as supply chain drivers
CO 5: Understand the importance of supplier and customer relationship management.

UNIT I
Introduction to Supply Chain Management: Understanding the Supply Chain, Supply Chain Performance: Achieving Strategic Fit and Scope including: Customer and Supply Chain Uncertainty, Competitive and Supply Chain Strategies, Product development strategy, Marketing and sales strategy, Supply chain strategy, Scope of strategic fit; Supply Chain Drivers and Metrics.

UNIT II
Logistics Management: Designing distribution networks and applications to e-Business, Network design in the Supply Chain, Designing global supply chain, network design, 3 PL, 4 PL, Transportation in supply chain management.

UNIT III
Planning and managing inventories: Managing Economies of Scale in a Supply Chain: Cycle Inventory, Managing Uncertainty in a Supply Chain: Safety Inventory, Determining the Optimal Level of Product Availability. Demand Forecasting in a Supply Chain, Aggregate Planning in a Supply Chain, Sales and Operations Planning: Planning Supply and Demand in a Supply Chain, Coordination in a Supply Chain. E- Procurement, Global alliances.

UNIT IV

Managing Cross-Functional Drivers in a Supply Chain: Importance of sourcing decisions in Supply Chain Management, Price and Revenue management, role of Information Technology in a Supply Chain, Sustainability and the Supply Chain. Customer Relationship management.

UNIT V

Logistics and supply chain relationships: Identifying logistics performance indicators- channel structure- economics of distribution- channel relationships- logistics service alliance. Managing global logistics and global supply chains: Logistics in a global economy- Views of global logistics- global operating levels interlinked global economy. Global supply chain, Supply chain management in Global environment Global strategy- Global purchasing- Global logistics- Global alliances- Issues and Challenges in global supply chain management.

Text Books:

1. Sunil Chopra, Peter Meindle, D.V Kalra, Supply Chain Management 6/e, Pearson.
2. Donald J. Bowersox and David J. Closs, Logistics Management: The Integrated Supply Chain Process, TMH, 2006.
3. SridharaBhat: Logistics and Supply Chain Management, EXCEL, 2009.

Reference:

The Toyota Way Paperback by Jeffrey Liker

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16CS3232- KNOWLEDGE MANAGEMENT
(Open Elective - II)

III Year. B. Tech. EEE II Semester

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

Pre requisites: Nil

Course Objectives:
Develop ability to
1. Understand Knowledge Management systems for access and coordination of knowledge assets.
2. Understand technologies namely, intranets, groupware, weblogs, instant messaging, content management systems and email in both individual and organizational contexts.
3. Use case studies, research methods of knowledge organization.

Course Outcomes:
At the end of the course, the student would be able to:
CO1. Evaluate and implement Knowledge Management Systems to facilitate individual and group work.
CO2. Develop a thorough review of Knowledge Management concepts, both historical and speculative.
CO3. Originate and distribute research on a Knowledge Management System topic.
CO4. Analyze and design KM processes and systems.

UNIT I - KNOWLEDGE MANAGEMENT
KM Myths – KM Life Cycle – Understanding Knowledge – Knowledge, intelligence – Experience – Common Sense – Cognition and KM – Types of Knowledge – Expert Knowledge – Human Thinking and Learning.

UNIT II - KNOWLEDGE MANAGEMENT SYSTEM LIFE CYCLE
Challenges in Building KM Systems – Conventional Vs KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – Nonaka's Model of Knowledge Creation and Transformation. Knowledge Architecture.

UNIT III - CAPTURING KNOWLEDGE
Evaluating the Expert – Developing a Relationship with Experts – Fuzzy Reasoning and the Quality of Knowledge – Knowledge Capturing Techniques, Brain Storming – Protocol Analysis – Consensus Decision Making – Repertory Grid- Concept Mapping – Black boarding.

UNIT IV - KNOWLEDGE CODIFICATION

Modes of Knowledge Conversion – Codification Tools and Procedures – Knowledge Developer's Skill Sets – System Testing and Deployment – Knowledge Testing – Approaches to Logical Testing, User Acceptance Testing – KM System Deployment Issues – User Training – Post implementation.

UNIT V - KNOWLEDGE TRANSFER AND SHARING

Transfer Methods – Role of the Internet – Knowledge Transfer in e-world – KM System Tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Decision Making Architecture – Data Management – Knowledge Management Protocols – Managing Knowledge Workers.

TEXT BOOK(S)

1. Elias.M. Award & Hassan M. Ghaziri – "Knowledge Management" Pearson Education.

REFERENCE BOOK(S)

1. Guus Schreiber, Hans Akkermans, AnjoAnjewierden, Robert de Hoog, Nigel Shadbolt, Walter Van de Velde and Bob Wielinga, "Knowledge Engineering and Management", Universities Press, 2001.
2. C.W. Holsapple, "Handbooks on Knowledge Management", International Handbooks on Information Systems, Vol 1 and 2, 2003

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16EC3234 – BASICS OF COMMUNICATION SYSTEMS
(Open Elective - II)

III Year B.Tech. EEE II Semester

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

Pre requisite(s): Nil

Note: Only Block Diagram Approach with Qualitative Treatment of the topics is required. Detailed mathematical treatment is not required.

Course Objectives:

1. Introduce the students to modulation and various analog and digital modulation schemes.
2. They can have a broad understanding of satellite, optical, cellular, mobile, wireless and telecom concepts.

Course Outcomes:

After Completion of this course, the students would be able to:
1. Distinguish various types of modulations.
2. Explain different communication modules and their implementation.
3. Distinguish various wireless and cellular, mobile and telephone communication systems.

Unit I:
Introduction: Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels.

Unit II:
Simple description on Modulation: Analog Modulation-AM, FM, Pulse Modulation-PAM, PWM, AM Radio, FM Radio, Transmitters and Receivers

Unit III:
Telecommunication Systems: Telephones Telephone system, Paging systems, Internet Telephony.
Networking and Local Area Networks: Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN.

Unit IV:
Satellite Communication: Satellite Orbits, Satellite communication systems, Satellite subsystems, Ground Stations, Satellite Applications, Global Positioning systems.

Optical Communication: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

Unit V:

Cellular and Mobile Communications: Cellular telephone systems, AMPS, GSM, CDMA, WCDMA.

Wireless Technologies: Wireless LAN, PANs and Bluetooth, ZigBee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

Text Books:

1. Principles of Electronic Communication Systems, Louis E. Frenzel, 3e, McGraw Hill publications, 2008.
2. Kennedy, Davis, Electronic Communications systems, 4e, TMH, 1999

Reference Books:

1. Tarmo Anttalainen, Introduction to Telecommunications Network Engineering, Artech House Telecommunications Library.
2. Theodore Rappaport, Wireless Communications-Principles and practice, Prentice Hall, 2002.
3. Roger L. Freeman, Fundamentals of Telecommunications, 2e, Wiley publications.
4. Wayne Tomasi, Introduction to data communications and networking, Pearson Education, 2005.

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16ME3235 – MANUFACTURING PROCESSES
(Open Elective - II)

III Year B.Tech. EEE II Semester

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

Pre requisite(s): Nil

Course Objectives:
1. Understand about sand casting and metal casting techniques.
2. Impart the knowledge of various welding processes.
3. Understand about the importance rolling, forging and sheet metal operations.
4. Understand about the processing of plastics.

Course Outcomes:
CO1 Analyze and select the suitable casting technique for making the components.
CO2 Differentiate the different types of welding processes are needed for various materials and importance of welding
CO3 Recognize and adopt the methods involved in forming processes, sheet metal operations, rolling, forging etc.,
CO4 Perform the methods involved in press work
CO5 Know the various manufacturing methods in processing of plastics.

UNIT – I
Casting : Steps involved in making a casting – Advantage of casting and its applications; Patterns - Pattern making, Types, Materials used for patterns, pattern allowances and their construction; Properties of moulding sands. Methods of Melting - Crucible melting and cupola operation – Defects in castings; Casting processes – Types – Sand moulding, Centrifugal casting, die- casting, Investment casting, shell moulding; Principles of Gating – Requirements – Types of gates, Design of gating systems – Riser – Function, types of Riser and Riser design.

UNIT – II
Welding: Classification – Types of welds and welded joints; Gas welding - Types, oxy-fuel gas cutting. Arc welding, forge welding, submerged arc welding, Resistance welding, Thermit welding. Inert Gas Welding _ TIG Welding, MIG welding, explosive welding, Laser Welding; Soldering and Brazing; Heat affected zone in welding. Welding defects – causes and remedies; destructive and non-destructive testing of welds.

UNIT – III
Forming: Hot working, cold working, strain hardening, recovery, recrystallization and grain growth. Stamping, forming and other cold working processes. Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning. Types of presses and press tools. Forces and power requirement in the above operations.

UNIT – IV

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tube extrusion and pipe making, Hydrostatic extrusion. Forces in extrusion

UNIT – V

Forging Processes: Forging operations and principles – Tools – Forging methods – Smith forging, Drop Forging – Roll forging – Forging hammers : Rotary forging – forging defects – cold forging, swaging, Forces in forging operations.

TEXT BOOKS:

1. Manufacturing Technology / P.N. Rao/TMH

REFERENCE BOOKS :

2. Production Technology / R.K. Jain
3. Metal Casting / T.V Ramana Rao / New Age
4. Principles of Metal Castings / Rosenthal.
5. Welding Process / Parmar /
6. Production Technology /Sarma P C /
7. Manufacturing Engineering and Technology/Kalpakjin S/ Pearson Edu.

GEETHANJALI COLLEGE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
Cheeryal (V), Keesara (M), Medchal Dist - 501 301, Telangana State

16CE3236 – BUILDING TECHNOLOGY
(Open Elective - II)

III Year B.Tech. EEE II Semester

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

Course Objectives:
Develop ability to
1. Study the basic building materials, properties and their applications.
2. Grasp the knowledge of planning of buildings.
3. Understand the concepts of fire safety, ventilation and plumbing services provided for a building.

Course Outcomes:
At the end of the course, student would be able to
CO 1: Explain characteristics of building materials.
CO 2: Apply basic principles to develop stable and sustainable buildings.
CO 3: Explain the principles of planning of building including building bye-laws.
CO 4: Identify different materials, quality and methods of fabrication and construction.
CO 5: Adopt standard building provisions for natural ventilation and lighting.
CO 6: Explain principles of acoustics in building and plumbing.

Syllabus:

UNIT – I
Stones: Uses of stones as building materials, Characteristics of good building stones. Types of stones and their significance.

Bricks: Characteristics of good building bricks. Types of bricks and their significance.

Cement and Concrete: Ingredients of cement – Types of cement, properties and uses of cement. Overview on concrete.

UNIT – II
Building: Basic definitions, Types, components, economy and design, principles of planning of buildings and their importance, building bye-laws.

Ventilation: Definitions and importance of circulation; Lighting and ventilation; how to consider these aspects during planning of building.

UNIT – III

Repairs in Buildings: Inspection, control measures and precautions for various construction defects, General principles of design of openings, and various types of fire protection measures to be considered while planning a building.

Vertical transportation in buildings: Types of vertical transportation, Stairs, different forms of stairs, planning of stair cases, other modes of vertical transportation – lifts, ramps, escalators.

UNIT – IV

Prefabrication systems: Prefabrication systems in residential buildings – walls, openings, cupboards, shelves, etc., planning and modules and sizes of components in prefabrication.

Air conditioning: Process and classification of air conditioning, Dehumidification. Systems of air conditioning, ventilation, functional requirements of ventilation.

UNIT – V

Acoustics: Acoustics, effect of noise, properties of noise and its measurements, Principles of acoustics of building. Sound insulation – Importance and measures.

Plumbing services: Water supply system, maintenance of building pipe line, Sanitary fittings, principles governing design of building drainage.

Text Books:

1. Building Materials, P.C. Varghese, Prentice Hal India Learning Pvt. Ltd., 2015.
2. Building Construction, B.C.Punmia, Er. Ashok Kumar Jain and Dr.Arun Kumar Jain, Laxmi Publications, 2016.

Reference Books:

1. Building Materials, S.K. Duggal, New Age, 2016.
2. Building Materials, S.S. Bhavikatti, Vikas Publishers, 2016.
3. Engineering Materials and Building Construction, Rangwala, Charotar Publishing House, 2015.
4. A Text book of Building Construction, Arora and Bindra, Dhanpat Rai Publications, 2014.

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16EE32L1 - COMPUTER METHODS IN POWER SYSTEMS LAB

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

III Year B.Tech. EEE II Semester

Prerequisite(s):16EE21L1 Field Theory and Circuits Lab

Course Objectives:
Develop ability to
1. To find equivalent circuit of 3-winding transformer
2. To outline sub -transient reactance of a salient polo synchronous machine.
3. To find Various Fault analysis,
4. To Apply various simulation softwares to find load frequency control
5. To find Voltage stability and economic load dispatch problems in power systems.

Course outcomes:
On completion of thiscourse, students would be able to
CO1. Draw the equivalent circuit of 3 -winding transformer
CO2. Review sequence impedances of salient pole synchronous machine and 3-ph transformer.
CO3. Apply Fault calculations for various faults in power systems.
CO4. Apply MATLAB SIMULINK for simulation of power system problems of Load frequency controls.
CO5. Apply MATLAB SIMULINK for simulation of power system problems of Stability and Economic Load Dispatch Problems.

LIST OF EXPERIMENTS
PART : A
1. Determination of Equivalent circuit of a 3-Winding Transformer.
2. Determination of Sequence Impedances of a Cylindrical Rotor Synchronous Machine.
3. Fault Analysis-I
   i. Single Line to Ground fault (L-G).
   ii. Line to Line fault (L-L).
4. Fault Analysis-II
   i. Double Line to Ground fault (L-L-G).
   ii. Triple Line to Ground fault (L-L-L-G).
5. Determination of Sequence Impedances of Three Phase Transformer

PART –B: (Experiments are conducted using MATLAB SIMULINK software)
6. Simulation of single area load frequency control
7. Simulation of two area load frequency control
8. Simulation of power system stabilizer

9. Simulation of voltage stability problem
10. Solution of Economic load dispatch problem

Additional Experiments :

11. Contingency studies using load flows for generator & line outages.
12. Contingency studies using Z_{BUS}.

Note: PART-B experiments and additional experiments are to be conducted by using suitable software.

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16EE32L2 – INSTRUMENTATION AND MEASUREMENT TECHNIQUES LAB

III Year B.Tech. EEE II Semester

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

Pre requisite(s): 16EE31L2 Electrical Machines-II Lab

Course Objectives:
Develop ability to
1. Verify the basic principles measuring instruments.
2. Be familiar with various electrical instruments like potentiometers, instrument transformers, power factor meter, AC and DC bridges and transducers.
3. Understand the concepts of measuring the RLC parameters, voltage, current, power factor, power and energy.

Course Outcomes (COs):
On completion of this course, student would be able to
CO1. Distinguish the basic types of meters used for measurements.
CO2. Determine the standardization values of potentiometer.
CO3. Calculate the phase angle and ratio errors of instrument transformers.
CO4. Compute active and reactive powers in balanced and unbalanced systems.
CO5. Calculate unknown resistance, inductance and capacitance of DC and AC bridges.
CO6. Compute the breakdown strength of transformer oil.
CO7. Distinguish the types of transducers.

LIST OF EXPERIMENTS
Any ten of the following experiments are required to be conducted.
1. Calibration and Testing of single phase energy Meter
2. Calibration of dynamometer power factor meter
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter
4. Kelvin's double Bridge – Measurement of resistance – Determination of Tolerance.
5. Dielectric oil testing using H.T. testing Kit
6. Schering bridge & Anderson bridge.
7. Measurement of 3 phase reactive power with single-phase wattmeter.
8. Measurement of parameters of a choke coil using 3 voltmeter and 3 ammeter methods.
9. Calibration LPF wattmeter – by Phantom testing
10. LVDT and Capacitance pickup – characteristics and Calibration
11. Resistance strain gauge – strain measurements and Calibration
12. Measurement of % ratio error and phase angle of given C.T. by comparison.

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16MB32P1-HUMAN VALUES AND PROFESSIONAL ETHICS

III Year. B. Tech. EEE - II Semester

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

Pre-requisites: Nil

Course Objectives: Develop the ability to

1. Learn the importance of human values in holistic personality development.
2. Understand the importance of humane environment
3. Initiate trust on fellow human, support human relations.
4. Improve and grow through human relations
5. Promote growth through peace and humanistic education.

Course Outcomes (COs):

At the end of the course, student would be able to:

CO1: Build on personal value system.
CO2: Focus on co existence.
CO3: Translate “Vishwas” to “Samman”
CO4: Understanding existence as co existence
CO5: Compete in professional ethics.

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 (AkhandSamaj), Universal Order (SarvabhaumVyawastha) - 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 techologies 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. SubbaRaju, 2013, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition.

REFERENCE BOOKS:

1. Ivan IIIich, 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 JeevanVidyaekParichay, 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. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) KrishiTantraShodh, 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.
10. M Govindrajan, S Natrajan& V. S Senthilkumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

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