VIDYA JYOTHI INSTITUTE OF TECHNOLOGY

An Autonomous Institution

Aziznagar Gate, C.B. Post, Hyderabad – 500075, Telangana, India.

B.Tech Syllabus (R-19)

Department of

Electrical and Electronics Engineering

Definitions of Key Words

Academic Year: An academic year is referred as the period consisting of two consecutive semesters with 16 weeks each of instructional period followed by both the semester exams.

Course: A plan of study of a particular subject leading to an examination. All the courses need not carry the same weight. A course may be designed to comprise of lectures/ tutorials/ laboratory work/ field work/ outreach activities/ project work/ vocational training/ viva/ seminars/ assignments/ presentations etc. or a combination of some of these.

Choice Based Credit System (CBCS): Choice Based Credit System (CBCS) is the programme in which the students have a choice to choose from the prescribed courses and can learn at their own pace and the entire assessment is graded-based on a credit system.

Credit Point: It is the product of Grade Point and Number of Credits for a course.

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

Cumulative Grade Point Average (CGPA): It is a measure of overall cumulative performance of a student of all the semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to 2nd decimal place.

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

Letter Grade: It is an index of the performance of students in a said course.
Grades are denoted by letters O, A+, A, B+, B, C, P and F.
Programme: An Educational Programme leading to the award of a Degree.

Semester: Each semester will consist of 16-18 weeks of academic work equivalent to 90 actual teaching days.

Semester Grade Point Average (SGPA): It is a measure of performance of the work done by the student in a semester. It is the ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to 2nd decimal place.

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

Types of Courses: The Courses in under B. Tech, program may be of three kinds' viz., Core,

Elective and Mandatory.

a) Core Course:

There may be a Core Course in every semester and are to be compulsorily studied by a student and is essential requirement for a given Programme.

b) Elective Course:

Elective Course is a course which can be chosen by the students from a pool of subjects. In general, the elective course is,

- Supportive to the discipline of study
- Providing an expanded scope of the course subjects
- Nurturing student's proficiency/skill/Research.
- In case an elective is "Discipline centric" and is offered by the student's department itself, the elective is called **Professional elective**.
- On the other hand, if the elective is offered by the other departments or if the choice is given to the students to choose from other disciplines, the elective is called an "**Open Elective**."

c) Mandatory Courses (Non-Credit Courses)

AICTE considers that the Course work of certain subjects is essential and as such for the award of a B.Tech degree a pass in these subjects is made mandatory. Therefore, such types of courses are referred as **mandatory courses**. As the AICTE also feels that only a familiarity with the subject content of these courses is essential, only a pass in each of these courses is required. Therefore, these subjects are included in the curriculum as non-Credit courses.

ACADEMIC REGULATIONS FOR B. TECH. (REGULAR)

Applicable for the students of B. Tech. (Regular) from the Academic Year 2019-20 onwards.

1. Courses of Study:

The following Four-year Bachelor of Technology (B.Tech.) Programmes under Choice Based Credit System (CBCS) are offered with effect from the Academic Year 2018-19 onwards:

S. No.	Branch	Branch Code
I	Civil Engineering	01
II	Electrical and Electronics Engineering	02
III	Mechanical Engineering	03
IV	Electronics and Communication	04
V	Computer Science and Engineering	05
VI	Information Technology	12

2. Admission Procedure

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

2.2. The Government orders with regard to the admissions in vogue shall prevail.

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

3. Award of B. Tech. Degree

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

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

3.2 The external examination in all the subjects shall be conducted at the end of each semester for all the eight semesters.

3.3 Students joining the B.Tech. Programme shall have to complete the programme within 8 years from the year of joining. Similarly, the students joining the B.Tech. Programme in the third semester directly through Lateral Entry Scheme (LES) shall have to complete the programme within 6 years from the year of joining otherwise they shall forfeit they will not be permitted to pursue their studies nor will be allowed to write the exams.

4. Course Structure:

4.1 The course shall be of four Academic year's duration, each academic year having two semesters. Each semester shall have a minimum **16** weeks of instruction, with a minimum of **90** Instructional Days per Semester.

4.2 **Credits:**

Credits shall be assigned to each Subject/ Courses in an L: T: P: C (Lecture Periods: Tutorial Periods: Practical Periods: Credits) Structure, based on the following general pattern.

Type of course		Clock hour/ week			
		L	**T**	**P**	**C**
Theory	1)	04	01	-	04
	2)	03	01	-	03
	3)	02	01	-	02
Practical		0	0	03	02
Drawing	1)	0	04	-	02
	2)	02	02	-	03
	3)	00	06	-	03
Mini project, Comprehensive Viva Voce Seminar, Major project		-	-	-	15

5. Attendance Requirements

5.1 A student is eligible to write the Semester End examinations only if he / she acquire a minimum of 75% of attendance in aggregate of all the subjects/Courses in that Semester.

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

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

5.4 Students, whose shortage of attendance is not condoned, are not eligible to write semester end examinations of that semester. Such students are detained and their registration for the examination stands cancelled.

5.5 A student detained due to shortage of attendance in a semester may seek re-admission into that semester, as and when offered, within four weeks from the date of the commencement of class work with the academic regulations of the batch into which he/she gets admitted.

5.6 A student will be promoted to the next semester if he/she satisfies the attendance requirement of the present semester.

5.7 For all mandatory, noncredit courses offered in a semester, a "Satisfactory Participation Certificate" shall be issued to the student, only after securing 75% attendance in such course. Letter Grade shall be allotted for these courses.

The courses offered in 8 semesters spread over 4 years have been classified into 8 categories under CBCS

S. No.	Subject categories	No. of Credits
1	Humanities and Social Sciences (HS) Subjects, English, Management and the courses dealing with personality development	**15**
2	Basic Sciences (BS) Subjects including Mathematics, Physics and Chemistry	**30**
3	Engineering Sciences (ES), Engg. Workshop, Drawing, Fundamentals of computer Science and courses dealing with the basics of Electrical/ Electronics/ Mechanical engineering	**30**
4	Professional Core (PC) Subjects, Courses dealing with the concerned engineering branch	**81**
5	Professional Elective (PE) Subjects. The students opt electives offered by the department	**12**
6	Open Elective (OE) Subjects. Courses offered by the other braches representing technically important subjects from emerging areas.	**9**
7	Project Work, Seminar and/ or Internship in Industry or elsewhere along with mini project.	**11+2+2 =15**
8	Mandatory Courses (MC)	**Nil**
	Total Number of credits	**192**

B. Tech Year wise distribution of credits under CBCS

S. No.	Year	Semest	Credits	Total
1	1st Year	I	25	**48**
		II	23	
2	2nd Year	I	24	**48**
		II	24	
3	3rd Year	I	24	**48**
		II	24	
4	4th Year	I	24	**48**
		II	24	
Total No. of Credits				**192**

6. Promotion regulations

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

6.2 A student shall be promoted from B.Tech., II Year to III Year only if he/she fulfills the academic requirements of securing 50% of total credits (48 out of 96 credits, up to II year II semester, from all the examinations, whether or not the candidate takes the examinations.

6.3 A student shall be promoted from B.Tech., III year to IV year only if he/she fulfills the academic requirements of securing 50% of total credits (72 out of 144 credits) up to III year II semester), from all the examinations, whether or not the candidate takes the examinations.

7. Minimum Academic Requirements

The following minimum academic requirements are to be satisfied in addition to the

requirements mentioned in item no.5.

7.1 A student shall be deemed to have satisfied the minimum academic requirements and has earned the credits allotted to each theory/ practical/ design/ drawing subject/ project and secured not less than 35% marks in Semester End Examination (SEE), and minimum 40% of marks in the sum total of the internal evaluation and end examination taken together.

7.2 The student has to pass the failed courses by appearing the supplementary examinations as per the requirement for the award of degree.

7.3 A student shall register and put up minimum Attendance and earn all 192 Credits for the award of degree.

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

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

7.6 When a Student is detained due to lack of Credits in any year, he may be readmitted after fulfilment of the Academic Requirements, with the Academic Regulations of the Batch into which he gets readmitted. If there are any Professional Electives / Open Electives, the same may also be re-registered if offered. However, if those Electives are not offered in later Semesters, then alternate Electives may be chosen from the same set of Elective Subjects offered under that category.

7.7 After securing 192 Credits as specified for the successful completion of the entire UGP, an exemption of 6 Credits (two subjects with 3 credits each) may be permitted to drop resulting in 186 Credits for UGP performance evaluation. Accordingly, the performance of student in 186 Credits shall be taken into account for the calculation of 'the final CGPA and shall be indicated in the Grade Card. However, the student's performances in the earlier individual Semesters, with the corresponding SGPA for which already Grade Cards are given, will not be altered. Further, the optional drop out for such 6 Credits shall not be allowed for i) Open elective Subjects ii) Laboratory courses iii) Industrial Training/ Mini-Project iv) Seminar v) Major Project vi) Comprehensive Viva.

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

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

8 Evaluation - Distribution and weightage of Marks

8.1 The performance of a student in each semester shall be evaluated Subject-wise (irrespective of Credits assigned) for a maximum of 100 marks for Theory or Seminar or

Drawing/Design or Industry Oriented Mini-Project or Minor Course, etc. For Practical's a maximum of 75 Marks shall be evaluated. However the B. Tech. Project work (Major Project) will be evaluated for 200 Marks. These evaluations shall be based on 25% CIE (Continuous Internal Evaluation) and 75% SEE (Semester End Examinations) and a Letter Grade corresponding to the % marks obtained shall be given.

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

8.3 For theory subjects, during the semester there shall be 2 midterm examinations. Each midterm examination will be conducted for 20 marks and consists of Part-A (Short Answer Questions) for 6 marks and Part-B (Long Answer Questions) for 14 marks with duration of 90 Minutes. First midterm examination shall be conducted for 2.5 units of syllabus and second midterm Examination shall be conducted for remaining 2.5 units. The Average marks secured by a student in I and II Midterm examination are considered and shall be taken as the final marks secured by the student towards Continuous Internal Evaluation in the theory subject.

8.4 In case a few students are absent due to health reasons or any other unavoidable circumstances, or if the performance of some of the students is very poor, all such cases will be referred to a standing committee consisting of the Controller of examinations (Chairman), HoD of the concerned dept. and the Academic coordinator. On the recommendation of the committee, a makeup test will be conducted on payment of fee fixed by the examination branch.

8.5 The Semester End Examination will be conducted for 75 marks which consist of two parts viz. i). Part-A for 25 marks, ii). Part –B for 50 marks. Part-A is compulsory, which consists of ten questions (numbered from 1 to 10) two from each unit carrying 2/3 marks each. Part-B consists of five questions (numbered from 11 to 15) carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" "or" choice (i.e., there will be two questions from each unit and the student should answer any one question).

8.6 For practical subjects there shall be a continuous evaluation during the Semester for 25 marks. Out of the 25 marks for internal evaluation, day-to-day work in the laboratory shall be evaluated for 15 marks and internal practical examination shall be evaluated for 10 marks conducted by the concerned laboratory teacher.

8.7 The Practical End Semester Examination shall be conducted with an external examiner and the laboratory teacher for 50 marks. The external examiner shall be appointed by the Principal from the panel of examiners recommended by Chairman, Board of Studies in respective Branches.

8.8 For the subject having design and/ or drawing, (such as Engineering Graphics, Engineering Drawing, and Machine Drawing), the distribution shall be 25 marks for Internal Evaluation (5 marks for day-to-day work and 20 marks for internal tests) and 50 marks for Semester End Examination. There shall be one internal test in a semester and shall be considered for the award of marks for internal test.

8.9. There shall be an industry-oriented mini-Project, to be taken up during the vacation after III year II Semester examination. However, the mini project and its report shall be evaluated in IV year I Semester at the time of practical exams. The industry oriented mini project shall

be submitted in report form and should be presented before the committee, which shall be evaluated for 50 marks. The committee consists of an external examiner, Head of the department, the supervisor of mini project and a senior faculty member of the department. There shall be no internal marks for industry oriented mini project.

8.10. There shall be a seminar presentation in IV-year II Semester. For the seminar, the student shall collect the information on a specialized topic and prepare a technical report, showing his understanding of the topic, and submit it to the department. It shall be evaluated by the departmental committee consisting of Head of the Department, Seminar Supervisor and a Senior Faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for the seminar.

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

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

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

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

9. Malpractice Rules

S. No.	Nature of Malpractices/ Improper conduct during examinations	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 subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/ year. The hall ticket of the candidate is to be cancelled.

3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all Semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional 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 subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all Semester end examinations. The continuation
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass.	Cancellation of the performance in that subject.

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

8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If a student of the college, who is not a candidate for the particular examination or any person not connected with the examination or college indulges in any type of malpractice or improper conduct mentioned in clauses 6 to 8.	Student of the college will be expelled from the examination hall and cancellation of the performance in that subject and all other subjects. If the candidate has already appeared including practical examinations and project work shall not be permitted for the remaining examinations of the subjects of that semester/ year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and a police case will be registered against him/ her.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that the year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during Special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/ year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the head of Institute for further action for a suitable punishment.	

All the cases pertaining to malpractices in examinations will be referred to a committee constituted by the Chief Controller of Examination and the committee will suggest action as per the guidelines mentioned above.

10. Grading Procedure:

10.1. Marks will be awarded to indicate the performance of each student in each theory subject, or Lab/Practical, or Seminar, or Project, or Mini-Project, Minor Course etc., based on the % marks obtained in CIE+SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified, 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 and corresponding percentage of marks shall be followed.

Letter Grade	Performance	Grade Points	% of marks Secured (Class Intervals)
O	Outstanding	10	Greater than or equal to 90%
A+	Excellent	9	80% and less than 90%
A	Very Good	8	70% and less than 80%
B+	Good	7	60% and less than 70%
B	Average	6	50% and less than 60%
C	Pass	5	40% and less than 50%
F	Fail	0	Below 40%
Ab	Absent	0	Absent

10.3. A student obtaining F Grade in any subject shall be considered 'Failed' and will be required to reappear as 'Supplementary Candidate' in the end Semester Examination (SEE), as and when offered. In such cases; his Internal Marks (CIE Marks) in those Subject(s) will remain same as those he 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 Subject/ Course (s) only for the sake of 'Grade Improvement' or 'SGPA/CGPA Improvement'. However, he has to repeat all the Subjects/ Courses pertaining to that Semester, when he is detained.

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

10.7. The Student passes the Subject/ Course only when he gets GP $\geq$ 5 (P Grade or above).

11. Registration/ Dropping

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

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

11.3. A series of open Electives will be offered to the students in III year I & II sems. and IV year I sem., which can be registered by the students as and when the notifications are issued at the end of II year II sem. and III year II sem. Prior permission for registration of open Electives as an additional course is compulsory.

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

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

11.6. Any student may be barred from registering for any course for specific reasons like disciplinary reasons or any other activities carried out by a student, which detrimental to the discipline of the college.

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

11.8. After Dropping, minimum credits registered shall be 20.

12. Earning of Credits

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

13. Passing Standards:

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

13.2. (i) In spite of securing P Grade or above in some (or all) Subjects/ Courses in any Semester, if a Student receives a SGPA < 5.00 and/ or CGPA < 5.00 at the end of such a Semester, then he 'may be allowed' (on the 'specific recommendations' of the Head of the Department and subsequent approval from the Principal) to be promoted to the next year in the course. (ii) If a student gets **P** grade or an SGPA is less than 5, is eligible to re appear for one or more of the same Subject(s)/ course(s) in which he has secured P Grade(s) in that Semester, at the Supplementary Examinations to be held in the next subsequent Semester(s). In such cases, his Internal Marks (CIE Marks) in those Subject(s) will remain same as those obtained earlier. In these considerations, the newly secured Letter Grades will be recorded and taken into account for calculation of SGPA and CGPA, only if there is an improvement.

13.3. A Student shall be declared successful or 'passed' in any Non-Credit Subject/ Course, if he secures a 40% marks or **P** grade in the end sem exam conducted by the college

along with the other examinations.

13.4. 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 will show the details of the courses registered (Course Code, Title, No. of Credits, Grade Earned etc.), Credits earned, SGPA, and CGPA.

14. Eligibility for the award of B.Tech. Degree

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

14.1. The students should successfully complete all the components prescribed in the Programme of study to which he/ she is admitted.

14.2. The student should also obtain CGPA greater than or equal to 5.0.

14.3. Not having any pending disciplinary action.

15. Evaluating of Grade Point Averages:

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

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

Where Ci = number of credits for the course i, Gi = grade points obtained by the student in the course.

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

SGPA will be computed as follows;

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

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

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

CGPA will be computed as follows:

$$\frac{\sum [(\text{Course } credits) \text{ X } (Grade\ points)] \text{ (for all Courses passed up to that semester)}}{\sum [(\text{Course } credits)] \text{ (for all Courses registered until that semester)}}$$

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

15.4. Illustrative Example:

An illustrative example given in below Table below indicates the use of the above two equations in calculating SGPA and CGPA, both of which facilitate the declaration of academic performance of a student, at the end of a semester and at the end of successive semesters respectively. Both of them shall be normally calculated up to the second decimal position, so that the *CGPA,* in particular, can be made use of in rank ordering the student's performance in a class. If two students get the same *CGPA*, the tie should be resolved by considering the number of times a student has obtained higher *SGPA;* But, if it is not resolved even at this stage, the number of times a student has obtained higher grades like O, A, B etc shall be taken into account in rank ordering of the students in a class.

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

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

16. Award of Division

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

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

16.2. The marks obtained in Internal Evaluation (IE) and Semester End Examination (SEE) will be shown in the memorandum of marks.

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

16.4. Candidates disciplinary/ prevented from writing the end semester examinations due to reason in any semester are not eligible for the award of First Class with Distinction. Such candidate's even if the CGPA ≥ 8.0 shall be placed in first class.

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

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

16.7. The CGPA can be converted to equivalent percentage of marks by using the equation., % of Marks = (CGPA - 0.5) X 10.

17. Consolidated Grade Card

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

18. Withholding of Results

If a student is having any discipline related issues pending, the result of the student will be withheld and will not be allowed to move into the next semester. His/ her degree will be withheld in such cases and the matter will be referred to the academic council for final decision.

19. Transitory Regulations

19.1. Discontinued, detained for attendance, detained for want of credits, or failed students are eligible for readmission as and when the course is offered during the subsequent academic year as per the college admission procedures.

19.2. Students on transfer from a non- autonomous or from an autonomous college shall complete all the courses of the concerned programme not covered in the earlier organization. However, he/she should take the remaining courses in the programme along with the other students.

19.3. There shall be no branch transfers after the cutoff date of admissions made in the B.Tech. I year.

20. Transcripts

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

21. Supplementary Examinations

In addition to the Regular end semester examinations, Supplementary Examinations for the previous semesters will be conducted along with end sem. Examinations. A student can appear for any number of supplementary examinations till he/she clears all courses which he/she could not clear in the first attempt. However, the maximum stipulated period cannot be relaxed under any circumstances.

22. Graduation Ceremony

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

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

23. Termination from the Program

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

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

23.2. The student fails to satisfy the norms of discipline specified by the institute from time to time.

24. Non-Credit Courses (Mandatory Courses)

24.1. Requirement of 75% attendance as per the college regulations is compulsory of completing the mandatory courses.

24.2. Specified number of Mandatory Courses among the designated ones is compulsory requirement for all the students for the award of B.Tech. Degree.

24.3. Although these courses do not carry any credits, performance in these subjects is evaluated following the procedure adopted for other subjects with the same marks. However, their performance will be indicated in the student's memo of marks as Satisfactory/ Unsatisfactory.

24.4. Although mandatory courses are Non-Credit Course, all the students should secure a minimum of 40% marks in the end sem. exam conducted by the college along with the other examinations for the award of B.Tech, degree.

25. Amendments

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

26. General

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

26.2. The academic regulation should be read as a whole for the purpose of an interpretation.

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

26.4. The college may change the academic regulations, course structure & syllabi at any time.

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

Applicable for the students admitted into II Year B. Tech. (Lateral Entry Scheme) from the Academic Year 2019-20 and onwards.

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

2. **Promotion Rule**
   2.1. A student shall be promoted from B.Tech., II Year to III Year if he/ she gets at least a minimum of 24 out of 48 credits, up to II year II semester, from all the examinations, whether or not the candidate takes the examinations.
   2.2. A student shall be promoted from III year to IV year if he/ she gets a minimum of 48 out of 96 credits, up to III year II semester, from all the examinations, whether or not the candidate takes the examinations.
   2.3. A student shall register and put up minimum attendance in all 144 credits and earn all 144 credits to be eligible for the award of B.Tech degree.
   2.4. A student, who fails to earn 144 credits as indicated in the course structure within six academic years, shall forfeit his/ her admission in B.Tech. Course.

3. **Award of Class**
   A student, who satisfies all the requirements prescribed for the completion of the B.Tech. program, is eligible for the award of the said degree, in any one of the following four classes:

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

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

5. The malpractice rules and procedures for evaluating the SGPA and CGPA mentioned under points 9 - 27, are also applicable to the later entry students.

R19 B.Tech EEE COURSE STRUCTURE FOR B.TECH I YEAR

B. Tech. I Year I Semester

S. No.	Course Category	Course Title	L	T	P	Credits
1	BS-1	Mathematics-I	3	1	0	4
2	BS-2	Chemistry	3	1	0	4
3	BS-Lab 1	Chemistry Lab	0	0	3	1.5
4	H&S-1	English	2	0	0	2
5	H&S-Lab 1	English Language Skills Lab (ELSL)	0	0	2	1
6	ES-1	Programming for Problem Solving-I	2	0	0	2
7	ES-Lab 1	Programming for Problem Solving Lab-I	0	0	2	1
8	ES-2	Engineering Graphics & Modeling	1	0	3	2.5
Total			**11**	**2**	**10**	**18**

B. Tech. I Year II Semester

S. No.	Course Category	Course Title	L	T	P	Credits
1	BS-3	Mathematics-II	3	1	0	4.0
2	BS-4	Applied Physics	3	1	0	4.0
3	BS-Lab 2	Applied Physics Lab	0	0	3	1.5
4	ES-3	Basic Electrical Engineering	3	0	0	3.0
5	ES-Lab 2	Basic Electrical Engineering Lab	0	0	2	1.0
6	ES-Lab 3	Engineering Workshop	0	1	3	2.5
7	H&S-Lab 2	English Communication Skills Lab (ECSL)	0	0	2	1.0
8	ES-4	Programming for Problem Solving-II	2	0	0	2.0
9	ES-Lab 4	Programming for Problem Solving Lab-II	0	0	2	1.0
Total			**11**	**3**	**12**	**20**

R19 COURSE STRUCTURE FOR B.TECH II YEAR

B. Tech. II Year I Semester

S. No.	Course Category	Course Title	L	T	P	Credits
1	BS – 5	Complex Analysis & Fourier Transforms	3	0	0	3
2		Electronic Devices and Circuits	3	0	0	3
3	PC – 1	Power Systems –I	3	0	0	3
4	PC – 2	Network Analysis	3	0	0	3
5	PC – 3	Electro Magnetic Fields	3	0	0	3
6	PC – 4	Electrical Machines-I	3	0	0	3
7	PC Lab – 1	Basic Simulation Tools Lab	0	0	2	1
8	PC Lab – 2	Electrical Circuits Lab	0	0	2	1
9	MC – 1	Gender Sensitization	2	0	0	0
Total			**20**	**0**	**4**	**20**

B. Tech. II Year II Semester

S. No.	Course Category	Course Title	L	T	P	Credits
1	BS – 6	Numerical Methods and Partial Differential Equations	3	0	0	3
2	ES – 2	Fluid Mechanics and Hydraulic Machinery	3	0	0	3
3	H&S-2	Professional Communication	2	0	0	2
4.	PC – 5	Electrical Machines-II	4	0	0	4
5	PC – 6	Power Systems - II	3	0	0	3
6	PC – 7	Control Systems	3	0	0	3
7	PC Lab-3	Electrical Machines-I Lab	0	0	2	1
8	PC Lab-4	Electronic Devices and Circuits Lab	0	0	2	1
9	MC – 2	Environmental Science	2	0	0	0
Total			**20**	**0**	**4**	**20**

R19 COURSE STRUCTURE FOR B.TECH III YEAR

B. Tech. III Year I Semester

S. No	Course Category	Course Title	L	T	P	Credits
1	H&S –3	Managerial Economics and Financial Analysis	3	0	0	3
2	ES – 3	Switching Theory and Logic Design	3	0	0	3
3	PC – 8	Electrical Machines - III	3	0	0	3
4	PC – 9	Power Electronics	3	0	0	3
5	PE – 1	Electrical Energy Conservation and Auditing/ Electrical Estimation and Costing	3	0	0	3
6	OE – 1	Non-Conventional Energy Sources/ Fundamentals of Electrical Power Generation and Protection	3	0	0	3
7	PC Lab – 5	Electrical Machines-II Lab	0	0	2	1
8	H&S -Lab 3	Advanced Communication Skills Lab	0	0	2	1
9	MC – 3	Quantitative Methods & Logical Reasoning	2	0	0	1
Total			**20**	**0**	**4**	**21**

B. Tech. III Year II Semester

S. No	Course Category	Course Title	L	T	P	Credits
1	PC – 10	Electrical Measurements & Instrumentation	3	0	0	3
2	PC – 11	Computer Methods in Power Systems	3	0	0	3
3	PC – 12	Power Semiconductor Drives	3	0	0	3
4	PC – 13	Switch Gear and Protection	3	0	0	3
5	PE – 2	Integrated Circuit and Applications/Artificial Intelligence Techniques in Electrical Engineering	3	0	0	3
6	OE – 2	Energy Auditing and Conservation/Principles of Electric Power Utilization	3	0	0	3
7	PC Lab – 7	Control Systems and Simulation Lab	0	0	2	1
8	PC Lab – 8	Power Electronics and Simulation Lab	0	0	2	1
9	MC – 4	Personality Development & Behavioral Skills	2	0	0	1
Total			**20**	**0**	**4**	**21**

R19 COURSE STRUCTURE FOR B.TECH IV YEAR

B. Tech. IV Year I Semester

S. No	Course Category	Course Title	L	T	P	Credits
1	PC -14	Microprocessors and Interfacing Devices	3	0	0	3
2	PC -15	Power Systems Operation and Control	3	0	0	3
3	PE – 3	Electric Vehicles / Smart Grids	3	0	0	3
4	PE – 4	Electrical Distribution Systems/ Industrial Electrical Systems	3	0	0	3
5	OE-3	Electric Vehicles and Hybrid Vehicles/ Energy Storage Systems	3	0	0	3
6	PC Lab - 9	Microprocessors and Interfacing Lab	0	0	2	1
7	PC Lab - 10	Electrical Measurements Lab	0	0	2	1
8	-	Mini Project	0	0	0	3
Total			**15**	**0**	**4**	**20**

B. Tech. EEE IV Year II Semester

S. No	Course Category	Course Title	L	T	P	Credits
1	PC -16	Utilization of Electrical Energy	3	0	0	3
2	PC -17	Renewable Energy and Energy Storage Technologies	3	0	0	3
3	-	Technical Seminar	2	0	0	2
4	-	Comprehensive Viva-Voce	0	0	0	2
5	-	Major Project	0	0	0	10
Total			**8**	**0**	**0**	**20**

R19 COURSE STRUCTURE (for FAST TRACK)

B. Tech. III Year I Semester

S. No.	Course Category	Course Title	L	T	P	Credits
1	H&S – 3	Managerial Economics and Financial Analysis	3	0	0	3
2	ES – 3	Switching Theory and Logic Design	3	0	0	3
3	PC – 8	Electrical Machines - III	3	0	0	3
4	PC – 9	Power Electronics	3	0	0	3
5	PE – 1	Electrical Energy Conservation and Auditing/ Electrical Estimation and Costing	3	0	0	3
6	OE – 1	Non-Conventional Energy Sources / Fundamentals of Electrical Power Generation and Protection	3	0	0	3
7	PC Lab – 5	Electrical Machines -II Lab	0	0	2	1
8	H&S -Lab 3	Advanced Communication Skills Lab	0	0	2	1
9	MC – 3	Quantitative Methods & Logical Reasoning	2	0	0	1
Total			**20**	**0**	**4**	**21**

B. Tech. III Year II Semester

S. No.	Course Category	Course Title	L	T	P	Credits
1	PC – 10	Electrical Measurements & Instrumentation	3	0	0	3
2	PC – 11	Computer Methods in Power Systems	3	0	0	3
3	PC – 12	Power Semiconductor Drives	3	0	0	3
4	PC – 13	Switch Gear and Protection	3	0	0	3
5	PE – 2	Integrated Circuit and Applications/Artificial Intelligence Techniques in Electrical Engineering	3	0	0	3
6	OE – 2	Energy Auditing and Conservation/ Principles of Electric Power Utilization	3	0	0	3
7	PC Lab – 7	Control Systems and Simulation Lab	0	0	2	1
8	PC Lab – 8	Power Electronics and Simulation Lab	0	0	2	1
9	MC - 4	Personality Development & Behavioral Skills	2	0	0	1
10	PC -16	Utilization of Electrical Energy	3	0	0	3
Total			**23**	**0**	**4**	**24**

R19 COURSE STRUCTURE (for FAST TRACK)

B. Tech. IV Year I Semester

S. No.	Course Category	Course Title	L	T	P	Credits
1	PC -14	Microprocessors and Interfacing Devices	3	0	0	3
2	PC -15	Power Systems Operation and Control	3	0	0	3
3	PE - 3	Electric Vehicles / Smart Grids	3	0	0	3
4	PE – 4	Electrical Distribution Systems/ Industrial Electrical Systems	3	0	0	3
5	OE-3	Electric Vehicles and Hybrid Vehicles/ Energy Storage Systems	3	0	0	3
6	PC Lab – 9	Microprocessors and Interfacing Lab	0	0	2	1
7	PC Lab - 10	Electrical Measurements Lab	0	0	2	1
8	-	Mini Project		0	0	3
9	PC - 17	Renewable Energy and Energy Storage Technologies	3	0	0	3
Total			**18**	**0**	**4**	**23**

B. Tech. IV Year II Semester

S. No.	Course Category	Course Title	L	T	P	Credits
1	-	Technical Seminar	2	0	0	2
2	-	Comprehensive Viva-Voce	0	0	0	2
3	-	Major Project	0	0	0	10
Total			**2**	**0**	**0**	**14**

MATHEMATICS - I
(Matrices and Calculus)

B. Tech. I Year I Semester

L	T	P	C
3	1	0	4

Course Outcomes:

1. Write the matrix representation of system of linear equations and identify the consistency of the system of equations.
2. Find the Eigen values and Eigen vectors of the matrix and discuss the nature of the quadratic form.
3. Analyze the convergence of sequence and series.
4. Discuss the applications of mean value theorems to the mathematical problems, Evaluation of improper integrals using Beta and Gamma functions.
5. Examine the extrima of functions of two variables with/ without constraints.

UNIT-I:
Matrices and Linear System of Equations:
Matrices and Linear system of equations: Real matrices Symmetric, skew symmetric, orthogonal. Complex matrices: Hermitian, Skew Hermitian and Unitary. Rank-Echelon form, Normal form. Solution of Linear Systems Gauss Elimination, Gauss Jordan & LU Decomposition methods.

UNIT-II:
Eigen Values and Eigen Vectors:
Eigen values, Eigen vectors properties, Cayley-Hamilton Theorem (without Proof) Inverse and powers of a matrix by Cayley-Hamilton theorem Diagonolization of matrix- Quadratic forms: Reduction to Canonical form, Nature, Index, Signature.

UNIT-III:
Sequences & Series:
Basic definitions of Sequences and series, Convergence and divergence, Ratio test, Comparison test, Cauchy's root test, Raabe's test, Integral test, Absolute and conditional convergence.

UNIT-IV:
Beta & Gamma Functions and Mean Value Theorems:
Gamma and Beta Functions-Relation between them, their properties evaluation of improper integrals using Gamma / Beta functions.
Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Generalized Mean Value theorem (all theorems without proof) – Geometrical interpretation of Mean value theorems.

UNIT-V:
Functions of several variables:
Partial Differentiation and total differentiation, Functional dependence, Jacobian Determinant-Maxima and Minima of functions of two variables with constraints and without constraints, Method of Lagrange Multipliers.

Textbooks:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 36th Edition, 2010
2. Advanced Engineering Mathematics by Jain & Iyengar Narosa Publications.

Reference Books:

1. Calculus and Analytic geometry, G.B. Thomas and R.L. Finney, 9th Edition, Pearson, Reprint, 2002.
2. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
3. Advanced Engineering Mathematics (2nd Edition) Michael D. Greenberg.

CHEMISTRY

B. Tech. I Year I Semester

L	T	P	C
3	1	0	4

Course Outcomes:

1. Acquire knowledge of atomic, molecular and electronic changes related to conductivity.
2. Apply the various processes of treatment of water for both domestic and industrial purpose.
3. Apply the knowledge of electrode potentials for the protection of metals from corrosion.
4. Analyze the major chemical reactions that are used in the synthesis of compounds.
5. Apply the knowledge of polymers in every day's life.

UNIT- I:

Atomic and Molecular Structure:

Introduction, Concept of atomic and molecular orbitals, LCAO, Molecular orbitals of di-atomic molecules, Molecular orbital energy level diagrams of diatomic molecules (N_2, O2 & F_2). Pi-molecular orbitals of butadiene and benzene.

Crystal field theory (CFT): Crystal field theory, Crystal field splitting patterns of transition metal ion d- orbital- tetrahedral, octahedral and square planar geometries.

UNIT- II:

Water Technology:

Hardness of water, expression of hardness ($CaCO_3$ equivalent), units and types of hardness. Estimation of temporary and permanent hardness of water by EDTA method. Numerical problems based on hardness of water. Potable water: characteristics, treatment of water for domestic supply. Desalination of brackish water: reverse osmosis. Alkalinity of water and its determination. Boiler feed water and its treatment: Internal treatment (colloidal, phosphate calgon conditioning of water). External treatment (ion –exchange process).

UNIT- III:

Electrochemistry and Corrosion:

Electrode, electrode potential, galvanic cell, cell reactions and cell notation, cell EMF, types of electrodes (Calomel electrode and Quinhydrone electrode), Determination of P^H using quinhydrone electrode. Nernst equation, Numerical problems.

Batteries: Introduction to cell and battery, Primary (lithium cell) and secondary cells, (lead-Acid cell, and Lithium ion cells). Fuel cells – Hydrogen – Oxygen fuel cell, advantages and engineering applications of fuel cells.

Corrosion: Introduction, types of corrosion: chemical and electrochemical corrosion, factors affecting the rate of corrosion: nature of the metal, position of metal in galvanic series, purity of metal, nature of corrosion product, nature of environment: effect of temperature, effect of pH, humidity. Corrosion control methods: Cathodic protection: sacrificial anode method and impressed current cathode method. Protective coatings: metallic coatings (anodic and cathodic), methods of application on metals, electroplating (of copper), electroless plating (of Ni), organic coatings-paints.

UNIT-IV:

Stereochemistry:

Structural isomers and stereoisomers, configurations, symmetry and chirality, enantiomers, diastereomers, optical activity. Conformations of cyclic (cyclohexane) and acyclic systems (Ethane).

Organic Reactions and Synthesis of a Drug Molecule:

Introduction to reactions involving substitution (SN1 & SN2), addition (addition of HBr to propene, Markownikoff and Anti Markownikoff addition), elimination, oxidation (oxidation of alcoholsusing $KMnO_4$ & CrO_3), reduction (reduction of carbonyl compounds by $LiAlH_4$ & $NaBH_4$). Synthesis of a commonly used drug molecule- paracetamol and Asprin.

UNIT-V:

Polymer Chemistry:

Introduction, classification of polymers, types of polymerization (addition and condensation, mechanisms not included). Plastics- types of plastics -thermoplastics and thermosetting plastics. Preparation, properties and engineering applications of PVC, Teflon and Bakelite. Fibers: Nylon 6, 6 and Terelene (Dacron). Elastomers: natural rubber, structure, vulcanization. Synthetic rubbers: Buna-S, Butyl rubber & Thikol rubber. Conducting polymers: classification and applications.
Biodegradable polymers: Types, examples: Polyhydroxy butyrate (PHB), PolyHydroxybutyrate-co-b-Hydroxy valerate (PHBV), Polyglycolic acid (PGA), Polylactic acid (PLA), Poly (Î-caprolactone) (PCL). Applications of biodegradable polymers.

Textbooks:

1. Engineering Chemistry, P.C Jain & Monica Jain, Dhanpat Rai Publications, 2017.
2. Engineering Chemistry, Bharathi Kumari. Y, VGS Publications, 2018.

Reference Books:

1. March's Advanced Organic Chemistry by Smith, Wiley publications, 2017.
2. Engineering Chemistry by Shiva Sankar, TMH Publications, 2010.

CHEMISTRY LAB

B. Tech. I Year I Semester

L	T	P	C
0	0	3	1.5

Course Outcomes:

1. Determination of parameters like hardness, alkalinity and chloride content in water.
2. Estimation of rate constant of a reaction from concentration-time relationships.
3. Determination of physical properties like adsorption, surface tension and viscosity.
4. Synthesize a small drug molecule and analyze a salt sample.
5. Calculation of strength of compound using instrumentation techniques.

Choice of 10-12 experiments from the following:

1. Estimation of total hardness of water by EDTA method.
2. Determination of alkalinity of water.
3. Determination of chloride content of water.
4. Estimation of HCl by conductometric titration.
5. Estimation of mixture of acids by conductometric titration.
6. Estimation of HCl by potentiometric titration.
7. Estimation of Fe^{2+} by potentiometry using $KMnO_4$.
8. Determination of the rate constant of a reaction.
9. Determination of surface tension.
10. Determination of viscosity of a lubricant.
11. Chemical analysis of a salt.
12. Synthesis of a polymer/drug.
13. Adsorption of acetic acid by charcoal.
14. Determination of Saponification /acid value of an oil.

Reference Books:

1. Practical Engineering Chemistry by Mukkanti, B.S.Publications, 2010.
2. Volga's Qualitative Inorganic Chemistry, PEAR Publications 2010.

ENGLISH

L	T	P	C

B. Tech. I Year I Semester

2	0	0	2

Course Outcomes:

1. Infer the importance of scientific discoveries in promoting social responsibilities.
2. Comprehend the given texts and respond appropriately for technical and professional purposes.
3. Communicate confidently and transfer information into various forms of writing.
4. Understand the importance of health and nutrition for a better society.
5. Present various forms of business writing skills for successful careers.

UNIT-I:

'The Raman Effect' from the prescribed textbook **'English for Engineers'**

Grammar: Articles & Prepositions
Reading : Reading and Its Importance- Techniques for Effective Reading.
Writing : Organizing principles of paragraphs in documents.
Vocabulary: The concept of word Formation, synonyms, antonyms, and standard Abbreviations.

UNIT-II:

'Ancient Architecture in India' from the prescribed textbook **'English for Engineers'**

Reading : Improving Comprehension Skills – Techniques for good comprehension
Writing : Sentence Structures, Use of phrases and clauses in sentences
Writing Formal Letters - Eg. Letter of Complaint, Letter of Requisition, Job Application with Resume.
Vocabulary: Root words and acquaintance with prefixes and suffixes from foreign Languages in English, to form derivatives

UNIT-III:

'Blue Jeans' from the prescribed textbook **'English for Engineers'**

Grammar: Tenses: Types and uses.
Reading : Sub-skills of Reading- Skimming and Scanning
Writing : Identifying Common Errors in Writing
Subject-Verb agreement in number, gender and person
Information Transfer-Process writing

UNIT-IV:

'What Should You Be Eating' from the prescribed textbook **'English for Engineers'**

Reading: Intensive Reading and Extensive Reading
Writing : Nature and Style of Sensible Writing
Describing & Defining
Identifying common errors in writing

UNIT-V:

'How a Chinese Billionaire Built Her Fortune' from the prescribed textbook **'English for Engineers'**

Vocabulary : Technical Vocabulary and their usage
Reading : Reading Comprehension-Exercises for Practice
Writing : Cohesive Devices
Précis Writing
Technical Reports-Introduction, Characteristics of a Report – Categories of Reports, Formats- Structure of Reports (Manuscript Format) –Types of Reports - Writing a Report.

Textbooks:

1. English for Engineers, Sudarshana, N.P. and Savitha, C, Cambridge University Press, 2018.

Reference Books:

1. Effective Technical communication, Muhammed Rizvi, TMH, 2008.
2. Advanced English Grammar, Hewings, Cambridge University Press, 2010.

ENGLISH LANGUAGE SKILLS LAB

B. Tech. I Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes:

1. Reproduce speech sounds and improve fluency in language.
2. Understand syllables and consonant clusters for appropriate pronunciation.
3. Exhibit effective professional skills with rhetoric eloquence.
4. Deliver enthusiastic and well-practiced presentation.
5. Learn Task-Based Language Learning (TBLL) through various language learning activities effectively.

Exercise-I:
CALL Lab:
Introduction to Pronunciation- Speech Sounds, Vowels and Consonants- Practice for Listening
ICS Lab:
Ice-Breaking activity and JAM session

Exercise-II:
CALL Lab:
Silent Letters, Consonant Clusters, Homographs
ICS Lab:
Common Everyday Situations: Conversations and Dialogues

Exercise-III:
CALL Lab:
Syllables
ICS Lab:
Communication at Workplace, Social and Professional Etiquette

Exercise-IV:
CALL Lab:
Word Accent and Stress Shifts
ICS Lab:
Formal Presentations, Visual Aids in Presentations

Exercise-V:
CALL Lab:
Intonation, Situational dialogues for practice
ICS Lab:
Interviews, Types of Interviews

Reference Books:

1. A textbook of English Phonetics for Indian Students, T. Balasubramanian, Macmillan Publishers, 2010.
2. Speaking English Effectively, Mohan, Macmillan Publishers, 2010.

PROGRAMMING FOR PROBLEM SOLVING - I

B. Tech. I Year I Semester

L	T	P	C
2	0	0	2

Course Outcomes:

1. Design Algorithms and Flowcharts for real world applications using 'C'.
2. Know the usage of various operators in Program development.
3. Design programs involving decision and iteration structures.
4. Apply the concepts code reusability using Functions.
5. Analyze various searching and sorting techniques using Arrays.

UNIT-I:
Problem Solving Using Computers: Introduction, Algorithms, Flowcharts and Pseudo code, Applications of C language.
Overview of C Language: Introduction, Salient Features of C Language, Structure of a "C" Program.
C Language Preliminaries: Keywords and Identifiers, Constants, Variables, Data Types, and Input / Output Statements with suitable illustrative "C" Programs.

UNIT-II:
Operators: Assignment Operators, Relational and Logical Operators, Increment and Decrement Operators, Bitwise Operators, Ternary Operator, Type Conversion, Precedence and Associativity with suitable illustrative "C" Programs.

UNIT-III:
Statements in C:
Conditional/Decision Statements: if, if-else, Nested if-else, else-if ladder, and Switch-Statement with suitable illustrative "C" Programs.
Loop Control Statements: while, do-while and for with suitable illustrative "C" Programs.

UNIT-IV:
Functions: Introduction to Functions, benefits of functions, types of functions, Function calls, return vs exit ( ), Parameter Passing mechanism: Call-by-Value, Recursion, Storage Classes.

UNIT-V:
Arrays: Introduction to Arrays, One-Dimensional Arrays, Two-Dimensional Arrays, Arrays and Functions.
Searching and Sorting: Linear Search, Binary Search, Bubble Sort, Insertion Sort.
Textbooks:

1. COMPUTER SCIENCE: A Structured Programming Approach Using C, B.A.Forouzon and R.F. Gilberg, Third edition, CENGAGE Learning, 2016.
2. C and Data Structures, Ashok N. Kamthane, Pearson Education. 2010.

Reference Books:

1. Problem Solving Using C, M.T.Somashekara, PHI, 2nd Edition 2009.
2. Computer Fundamentals and Programming in C, A.K.Sharma, 2nd Edition, University Press.
3. Programming in C 2/e, Pradip Dey and Manas Ghosh, Oxford University Press, 2nd Edition 2011.
4. The Fundamentals of Computers, Rajaraman V., 4th th Edition, Prentice Hall of India, 2006.
5. Programming in C, R S Bichker, University Press, 2012.

PROGRAMMING FOR PROBLEM SOLVING LAB – I

B. Tech. I Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes:

1. Apply the specification of syntax rules for numerical constants and variables, data types.
2. Know the Usage of various operators and other C constructs.
3. Design programs on decision and control constructs.
4. Develop programs on code reusability using functions.
5. Implement various searching and sorting techniques using arrays.

Week 1:
Ubuntu and Linux Commands.

Week 2:
Designing of flowcharts and algorithms using raptor tool
1. Areas of Polygons.
2. Calculation of Simple and Compound Interest.
3. Swapping of Two numbers with and without temporary variable.
4. Checking whether a number is even or odd.
5. Sum of first 'n' natural numbers.
6. Checking a number whether it is divisible by any given number.
7. Evaluation of mathematical expressions.
8. Programs using scanf( ) and printf( ) statements.

Week 3:
Programs on operators. (Minimum 4 Programs)

Week 4, 5 & 6:
Programs on Conditional Statements. (Minimum 12 Programs)

Week 7,8 & 9:
Programs on Control Statements. (Minimum 12 Programs)

Week 10 &11:
Programs on Functions. (Minimum 6 Programs)

Week 12:
Programs on One Dimensional Arrays. (Minimum 3 Programs)

Week 13:
Programs on Two Dimensional Arrays. (Minimum 2 Programs)

Week 14:
Implementation of Linear Search and Binary Search.

Week 15:
Implementation of Bubble Sort and Insertion Sort.

Week 16:
Review

ENGINEERING GRAPHICS & MODELING

B. Tech. I Year I Semester

L	T	P	C
1	0	3	2.5

Course Outcomes:

1. Understand the concepts of engineering drawing of planes, solids and the CAD drawing software.
2. Applying the principles of engineering graphics while drawing the engineering components.
3. Analyse the sectional views for their configurations.
4. Evaluate the surfaces of solids developed for further processing in the engineering applications.

UNIT- I:

Introduction to Engineering Drawing: Principles of engineering graphics and their significance, usage of drawing instruments, conic sections, including the rectangular hyperbola– general method only. Cycloid, Epicycloid, Hypocycloid. Scales – plain & diagonal only.

Introduction to CAD: Introduction to CAD software and its importance, standard toolbar/menus and navigation tools used in the software, using basic commands limits ,units, grid, test , move, offset ,mirror, rotate, trim, extend, fillet etc. drawing lines using line command. Drawing spline, ellipse, circle, rectangle etc… Concept of layers and dimensioning.

UNIT- II:

Principles of Orthographic Projections: Conventions. Projections of points, projections of lines (first angle projection) inclined to both planes (traces and midpoint problem to be excluded).

Implementation of CAD: Drawing orthographic projections of points and lines using a CAD package.

UNIT – III:

Projections of the Planes: Projections of regular planes inclined to both the planes.

Projections of Solids: Projections of regular solids inclined to both the planes (prisms, pyramids, cones and cylinders, Change of potion method only).

Implementation in CAD: Drawing orthographic projection of planes and regular solids using a CAD package.

UNIT- IV:

Sections and Sectional Views of Right Angular Solids: Prism, Cylinder, Pyramid, Cone. Development of surfaces of right regular solids - Prism, Pyramid, Cylinder and Cone.

Implementation in CAD: Concept of hatching, drawing sectional views of solids and the development of right regular solids using a CAD package.

UNIT-V:

Principles of Isometric projection: Isometric scale, isometric views, conventions, isometric views of lines, planes, simple solids, conversion of isometric views to orthographic views and vice-versa, conventions.

Implementation in CAD: Drawing isometric views of simple solids. Drawing isometric views from giving orthographic views and vice-versa using a CAD package.

Note: Implementation in CAD (For Internal Evaluation Weightage Only)

Textbooks:

1. Engineering Drawing, Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Charotar Publishing House.

Reference Books:

1. Engineering Graphics, Agrawal B. & Agrawal C. M. (2012), TMH Publication, Text book on Engineering Drawing, Narayana, K.L. & P Kannaiah (2008) Scitech Publishers.
2. Engineering Drawing and Computer Graphics, Shah, M.B. & Rana B.C. (2008), Pearson Education.
3. http://docs.autodesk.com/ACDMAC/2013/ENU/PDFs/acdmac_2013_users_guide.pdf

MATHEMATICS II
(Ordinary Differential Equations and Vector Calculus)

B. Tech. I Year II Semester

L	T	P	C
3	1	0	4

Course Outcomes:

1. Classify the various types of differential equations of first order and first degree and apply the concepts of differential equations to the real world problems.
2. Solve higher order differential equations and apply the concepts of differential equations to the real world problems.
3. Find the Laplace Transform of various functions and apply to find the solutions of differential equations.
4. Evaluate the multiple integrals and identify the vector differential operators physically in engineering problems.
5. Evaluate the line, surface and volume integrals and converting them from one to another by using vector integral theorems.

UNIT-I:
First order Ordinary Differential Equations and their Applications:
Formation of Differential equations, Differential equations of first order and first degree: exact, linear and Bernoulli, Applications of ODE: Newton's law of cooling, law of natural growth and decay, orthogonal trajectories.

UNIT-II:
Higher Order Linear Differential Equations:
Linear differential equations of second and higher order with constant coefficients, RHS term of the type f(X) $= e^{ax}, \sin ax, \cos ax \; and \; x^k, e^{ax}V(x), x^kV(x)$. Method of variation of parameters

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

UNIT-IV:
Multiple Integrals & Vector Differentiation:
Multiple integrals - double and triple integrals – change of order of integration (Only Cartesian form)- change of variables (Cartesian to Polar for double integral, Cartesian to Spherical for triple integral). Gradient- Divergence- Curl and their related properties - Potential function - Laplacian and second order operators.

UNIT-V:
Vector Integration:
Line integral, work done, Surface and Volume integrals. Vector integrals theorems: Green's, Stoke's and Gauss Divergence Theorems (Only Statements & their Verifications).

Textbooks:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 36th Edition, 2010
2. Advanced Engineering Mathematics, Jain &Iyengar Narosa Publications.

Reference Books:

1. Calculus and Analytic geometry, G.B. Thomas and R.L. Finney, 9th Edition, Pearson, Reprint, 2002.
2. Advanced Engineering Mathematics, Erwin Kreyszig 9th Edition, John Wiley & Sons,2006.
3. Advanced Engineering Mathematics (2nd Edition) Michael D.Greenberg.

APPLIED PHYSICS

B. Tech. I Year II Semester

L	T	P	C
3	1	0	4

Course Outcomes:

1. Identify various optical phenomena of light.
2. Discuss the basic principles of quantum mechanics.
3. Classify solids based on the band theory.
4. Elucidate the characteristics of semiconductors and semiconductor devices.
5. Explain the working principle of lasers and optical fibers.

UNIT – I:

Wave Optics:

Principle of Superposition, coherence and methods to produce coherent sources, Interference Interference in thin films by reflection, Newton's Rings. Diffraction Fraunhofer and Fresnel Diffraction, Farunhofer diffraction due to single slit, Plane Diffraction Grating, resolving power of Grating. Polarization Polarization of light waves, Plane of vibration, plane of polarization, Double refraction, Nicol's Prism, Applications of Polarization.

UNIT-II:

Introduction to Quantum Mechanics and Free Electron Theory:

Classical free electron Theory, Electrical Conductivity and Ohm's Law Drawbacks, Sommerfeld theory (Qualitative).Introduction to quantum physics: Black body radiation and Planck's Law(Qualitative), wave-particle duality, de-Broglie hypothesis of matter waves, Davisson and Germer experiment, Heisenberg uncertainty principle, time independent Schrodinger equation, Born interpretation of wave function, particle in an infinite potential well (one dimension).

UNIT-III:

Band Theory of Solids and Semiconductors:

Kronig-Penny model (Qualitative), E-k diagram, Energy bands in solids, classification of materials into metals, semiconductors, and insulators, Effective mass, Density of States, Fermi distribution function, Fermi level and its importance. Intrinsic semiconductors, carrier concentration in intrinsic semiconductors, energy band diagram and position of Fermi level in intrinsic semiconductors, equation for electrical conductivity of semiconductors, extrinsic semiconductors.

UNIT-IV:

Semiconductor Devices:

Direct and indirect band-gap semiconductors, Formation of p-n junction, energy diagram of PN junction, I-V characteristics of PN junction diode, Photo diode, solar cell-efficiency, light emitting diode and their characteristics, semiconductor laser: device structure and characteristics, Hall effect and its applications.

UNIT-V:

Fiber Optics and Lasers:

Introduction, total internal reflection, acceptance angle and numerical aperture, losses associated with optical fibers, step and graded index fibers, applications of optical fibers. Introduction to interaction of radiation with matter: stimulated absorption, spontaneous emission and stimulated emission, Einstein's coefficients and their relations, characteristics of a laser, important components of a laser: active medium, pumping source, optical resonator. Population inversion, Ruby laser, He-Ne laser, applications of lasers.

Textbooks:

1. Engineering Physics, P K Palanisamy, Scietech publication.
2. Engineering Physics, V Rajendran, McGraw Hill Education.

Reference Books:

1. Engineering Physics, S O Pillai, Sivakami, New Age International (P) Limited.
2. Physics Volume I & II, Resnick and Halliday, John Wiley and sons, Inc.

APPLIED PHYSICS LAB

B. Tech. I Year II Semester

L	T	P	C
0	0	3	1.5

Course Outcomes:

1. Apply optical phenomena to characterize optical sources and components.
2. Determine the energy gap of a semiconductor diode and time constant of RC circuit
3. Describe the electrical characteristics of PN junction diode, photodiode, LED and solar cell.
4. Demonstrate the resonance in mechanical and electrical waves.
5. Identify the magnetic Induction along the axis of current carrying coil.

List of Experiments

1. Newton's rings: Determination of the radius of curvature of the lens by forming Newton's rings.
2. Diffraction grating: To determine the number of lines per inch of the grating.
3. Dispersive power: To determine the dispersive power of prism by using spectrometer.
4. Single Slit Diffraction using Lasers- Determination of wavelength of a Monochromatic Source (LASER).
5. Energy gap of P-N junction diode: Determination of the energy gap of a semiconductor diode.
6. Photo diode: Study the V-I Characteristics of Photo diode.
7. Light emitting diode: Plot V-I and P-I characteristics of light emitting diode.
8. Solar cell: Study the V-I Characteristics of Solar cell.
9. Stewart & Gee's experiment - Determination of magnetic Induction along the axis of current carrying coil.
10. LCR Circuit- Determination of the Resonance frequency of forced electrical oscillator.
11. RC- Circuit – Determination of the time constant of RC-circuit.
12. Optical fiber: Determination of the Numerical aperture of Optical fiber.

Note: Any 10 experiments are to be performed.

BASIC ELECTRICAL ENGINEERING

L	T	P	C
3	0	0	3

B. Tech. I Year II Semester

Course Outcomes:

1. Understand the fundamentals of basic circuit components and their characteristics.
2. Analyze basic electrical circuits with A.C excitation.
3. Understand the concepts of magnetic circuits and transformers.
4. Acquire the basic concepts of electrical motors.
5. Understand the concept of A.C generator and low voltage electrical installations.

UNIT I:

Introduction to Electrical Engineering and DC Circuits:

Basic definitions, types of elements, types of sources, Kirchhoff's Laws, resistive networks, inductive networks, series, parallel circuits, Star- Delta and Delta- Star transformation, Network theorems- Superposition, Thevenin's - simple problems.

UNIT II:

AC Circuits:

Representation of sinusoidal waveforms, peak, RMS and average values **-** Elementary treatment of single-phase AC circuits consisting of R, R-L, R-C, R-L-C combinations (series and parallel) Phase representation, real power, reactive power, apparent power, resonance concept. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III:

Magnetic Circuits &Transformers:

Magnetic circuits: Magnetic materials, Faraday's laws of Electromagnetic Induction, BH characteristics, Magnetic Circuits - concept of Self & Mutual Inductance.

Transformers: Ideal and practical single phase transformer, OC-SC tests, equivalent circuit, losses in transformer, regulation and efficiency - simple problems.

UNTI IV:

DC Machines and Induction Motors:

DC Machines: Construction, Principle and Operation of DC Motor, Voltage- torque equations - simple problems.

Three Phase Induction Motor: Construction, Principle and working of three phase Induction Motor, torque slip characteristics, - simple problems.

Single Phase Induction Motor: Single phase Induction Motor construction and working principle, capacitor start – applications

UNIT V:

AC Generator & Electrical Installation:

AC Generator: Construction, Principle of operation of Synchronous Generator, Pitch Factor- Distribution Factor (or winding factor) - EMF equation – simple problems.

Electrical Installation: Fuse, Circuit breakers, difference between fuse and circuit breaker, Types of Batteries, battery backup.

Textbooks:

1. Basic Electrical Engineering, D.P Kothari & I.J Nagrath, Tata McGraw Hill Publishing Company Limited-2nd Edition.
2. Basic Electrical Engineering, T.K. Nagsarkar and M.S. Sukhija, Oxford University Press-3rd Edition.

Reference Books:

1. Circuits and Networks, A.Sudhakar & Shyam Mohan.S, Tata McGraw Hill Publishing Company limited, 5th Edition.
2. Basic Electrical Engineering, K.Uma Rao and A.Jayalakshmi, Pearson Publications.
3. Basic Electrical Engineering, D C Kulshreshtha, McGraw Hill Education Private limited, 1st Edition.

BASIC ELECTRICAL ENGINEERING LAB

B. Tech. I Year II Semester

L	T	P	C
0	0	2	1

Course Outcomes:

1. Get an exposure to basic electrical laws.
2. Understand the response of different types of electrical circuits to different excitations.
3. Understand the measurement, calculation and relation between the basic electrical parameters.
4. Understand the performance characteristics of D.C electrical machines.
5. Understand the performance characteristics of A.C electrical machines.

List of experiments/ demonstrations:
Any 5 experiments from Part-A and Part-B should be conducted (Total 10 Experiments)

Part A

1. Verification of Ohms law.
2. Verification of KVL and KCL.
3. Verification of Thevenin's Theorem
4. Verification of Superposition Theorem.
5. Transient Response of Series R- L and R - C circuits using DC excitation.
6. Determination and Verification of Impedance and Current of RL and RC series circuits.

Part B

1. Transient Response of R-L-C Series circuit using DC excitation.
2. Load Test on Single Phase Transformer. (Calculate Efficiency and Regulation)
3. OC & SC Test on Single phase transformer
4. Brake test on DC shunt motor
5. Brake test on Three Phase Squirrel cage induction motor.
6. OCC of Three phase alternator.

Reference Books:

1. Circuits and Networks, A.Sudhakar & Shyam Mohan.S, Tata McGraw Hill Publishing Company Limited, 5th Edition.
2. Basic Electrical Engineering, T.K. Nagsarkar and M.S. Sukhija, Oxford University Press, 3rd Edition
3. Basic Electrical Engineering, D.P Kothari & I.J Nagrath, Tata McGraw Hill Publishing Company Limited, 2nd Edition

ENGINEERING WORKSHOP

B. Tech. I Year II Semester

L	T	P	C
0	1	3	2.5

Course Outcomes:

1. Understanding the tools and methods of using to fabricate engineering components
2. Applying the measuring techniques to verify the dimensional accuracy
3. Evaluating various methods and trades of workshop in the component building

(i) Lectures & videos:
Detailed contents:

1. Manufacturing Methods- Metal Forming, Machining, Advanced manufacturing methods (2 lectures)
2. CNC machining, Additive manufacturing (2 lectures)
3. Fitting operations & power tools (1 lecture)
4. House wiring (1 lecture)
5. Carpentry (1 lecture)
6. Plastic moulding (1 lecture)
7. Metal casting (1 lecture)
8. Welding (1 Lecture)

(ii) Workshop Practice:
Detailed contents:

1. Machine shop (Lathe machine)
2. Fitting shop
3. Carpentry
4. House Wiring
5. Welding shop (Arc welding)
6. Tin Smithy

Reference Books:

1. Elements of Workshop Technology, Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Manufacturing Engineering and Technology, Kalpakjian S. And Steven S. Schmid, 4th edition, Pearson Education India Edition, 2002.

ENGLISH COMMUNICATION SKILLS LAB

B. Tech. I Year II Semester

L	T	P	C
0	0	2	1

Course Outcomes:

1. Understand the variants in pronunciation.
2. Identify the diverse purposes of listening and speaking.
3. Discuss ideas in diverse communicative settings.
4. Exhibit increased confidence in public speaking.
5. Display critical thinking, problem solving and decision making skills through GD's.

Exercise-I:
CALL Lab:
Common Indian Variants in Pronunciation – Differences between British and American Pronunciation.
ICS Lab:
Spoken vs. Written language-Formal and Informal English- Introducing Oneself and Others.

Exercise-II:
CALL Lab:
Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening.
ICS Lab:
Features of Good Conversation – Strategies for Effective Communication Role-Play- Making Requests and Seeking Permissions - Telephone Etiquette.

Exercise-III:
CALL Lab:
Information Transfer
ICS Lab:
Descriptions-Narrations-Giving Directions and Guidelines-Giving Instructions-Seeking Clarifications-Asking for and Giving Directions-Thanking and Responding-Agreeing and Disagreeing-Seeking and Giving Advice-Making Suggestions.

Exercise-IV:
CALL Lab:
Past Tense Marker and Plural Marker
ICS Lab:
Public Speaking- Exposure to Structured Talks - Non-verbal Communication- Making a Short Speech - Extempore

Exercise-V:
CALL Lab:
Intonation- Sentence Stress -Weak Forms and Strong Forms.
ICS Lab:
Group Discussion, Mock Group Discussion sessions

Reference Books:

1. A Textbook of English Phonetics for Indian Students, T. Balasubramanian, Macmillan Publishers, 2010.
2. Speaking English Effectively, Mohan, Macmillan Publishers, 2010.

PROGRAMMING FOR PROBLEM SOLVING - II

L	T	P	C
2	0	0	2

B. Tech. I Year II Semester

Course Outcomes:

1. Identify various string handling functions in 'C'.
2. Develop programs with user defined data types.
3. Use Dynamic memory allocation functions with pointers.
4. Distinguish between Stacks and Queues.
5. Analyze various Dynamic Data Structures.

UNIT – I:
Overview of Arrays and Functions.
Strings: Introduction to Strings, String I/O, String Operations with and without built-in functions (strlen( ), strcmp( ), strcat( ),strcpy( ) and strrev( )).

UNIT -II:
Structures: Definition and Initialization of Structures, Accessing structure members, Nested Structures, Array of Structures, Structures and Functions, Unions, typedef, Enumerated Data types.

UNIT-III:
Pointers: Introduction to Pointers, Pointer Arithmetic, Pointers and Arrays, Pointer to Structure, Pointers and Strings, Parameter passing mechanism: Call by Reference, Pointer to Pointer, Dynamic Memory Allocation.

UNIT-IV:
Introduction to Data Structures: Lists and Operations, Linear and Nonlinear Data structures.
Stacks- Introduction to Stacks, Operations, Implementation of Stack using Arrays.
Queues- Introduction to Queues, Operations, Implementation of Queue using Arrays.

UNIT-V:
Linked Lists: Introduction to Linked List, Operations on Single Linked List (search, Insertion & Deletion).
Files: Introduction to Files, File Operations (Open, Close, read & Write).

Textbooks:

1. COMPUTER SCIENCE: A Structured Programming Approach Using C, B.A.Forouzon and R.F. Gilberg, Third edition, CENGAGE Learning, 2016.
2. C and Data Structures, Ashok N. Kamthane, Pearson Education. 2010.

Reference Books:

1. Problem Solving Using C, M.T.Somashekara, PHI, 2nd Edition 2009.
2. Computer Fundamentals and Programming in C, A.K.Sharma, 2nd Edition, University Press.
3. Programming in C 2/e, Pradip Dey and Manas Ghosh, Oxford University Press, 2nd Edition 2011.
4. The Fundamentals of Computers, Rajaraman V. 4th Edition, Prentice Hall of India, 2006.
5. Programming in C, R S Bichker, University Press, 2012.

PROGRAMMING FOR PROBLEM SOLVING LAB – II

L	T	P	C
0	0	2	1

B. Tech. I Year II Semester

Course Outcomes:

1. Build programs on various string handling functions.
2. Develop applications on user defined data types.
3. Apply dynamic memory allocation through pointers.
4. Implement linear data structures through stacks and queues.
5. Create linked list dynamically through stacks and queues.

Week 1:
Programs on Arrays and Functions. (Minimum 3 Programs)

Week 2 & 3:
Programs on Strings with and without string built-in Functions. (Minimum 6 Programs)

Week 4:
Programs on Accessing Structures and Nested Structures. (Minimum 3 Programs)

Week 5 & 6:
Programs on Array of Structures, Structures and Functions. (Minimum 5 Programs)

Week 7:
Programs on Unions, typedef and enum. (Minimum 4 Programs)

Week 8:
Programs on Pointers, pointer arithmetic, pointer expression, One Dimensional and Two dimensional arrays. (Minimum 4 Programs)

Week 9:
Programs on Pointer to structure, Call by Reference, Pointer to Pointer. (Minimum 3 Programs)

Week 10:
Programs on Dynamic Memory Allocation Functions. (Minimum 3 Programs)

Week 11:
Programs on Stacks and Queues using Arrays.

Week 12 & 13:
Programs on Single Linked List.

Week 14 & 15:
Programs on File Operations. (Minimum 6 Programs)

Week 16:
Review

COURSE STRUCTURE FOR B.TECH II YEAR

B. Tech. II Year I Semester

S. No.	Course Category	Course Title	L	T	P	Credits
1	BS – 1	Complex Analysis & Fourier Transforms	3	0	0	3
2	H&S – 1	Electronic Devices and Circuits	3	0	0	3
3	PC – 1	Power Systems –I	3	0	0	3
4	PC – 2	Network Analysis	3	0	0	3
5	PC – 3	Electro Magnetic Fields	3	0	0	3
6	PC – 4	Electrical Machines-I	3	0	0	3
7	PC Lab – 1	Basic Simulation Tools Lab	0	0	2	1
8	PC Lab – 2	Electrical Circuits Lab	0	0	2	1
9	MC – 1	Gender Sensitization	2	0	0	0
Total			**20**	**0**	**4**	**20**

B. Tech. II Year II Semester

S. No.	Course Category	Course Title	L	T	P	Credits
1	BS – 2	Numerical Methods and Partial Differential Equations	3	0	0	3
2	ES – 2	Fluid Mechanics and Hydraulic Machinery	3	0	0	3
3	ES – 1	Professional Communication	2	0	0	2
4.	PC – 5	Electrical Machines-II	4	0	0	4
5	PC – 6	Power Systems - II	3	0	0	3
6	PC – 7	Control Systems	3	0	0	3
7	PC Lab-3	Electrical Machines-I Lab	0	0	2	1
8	PC Lab-4	Electronic Devices and Circuits Lab	0	0	2	1
9	MC – 2	Environmental Science	2	0	0	0
Total			**20**	**0**	**4**	**20**

COMPLEX ANALYSIS AND FOURIER TRANSFORMS
(Common to EEE & ECE)

L	T	P	C
3	0	0	3

B. Tech. II Year I Semester

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

1. Work with the functions of complex variables and evaluation of complex differentiation.
2. Acquire the knowledge of complex power series and integration.
3. Apply the knowledge of contour integration to evaluate real integrals in engineering problems and acquire the knowledge of evaluating of conformal mapping and bilinear transformations.
4. Study Fourier series and define it for various types of functions.
5. Apply Fourier sine and cosine integral theorems for a given function f(x), evaluate Fourier transforms, sine and cosine transforms.

UNIT I
FUNCTIONS OF COMPLEX VARIABLES:
Introduction, Complex functions - limits and Continuity-Differentiability, Analytic functions and Properties, Cauchy-Riemann Equations (Cartesian and Polar), Harmonic functions, Construction of analytic functions.

UNIT II
COMPLEX INTEGRATION:
Introduction, Complex integration-Line integral, Cauchy's integral theorem, Cauchy's integral formula, Generalized Cauchy's integral formula, Power series: Taylor's series, Laurent series, Singular points, Types of Singularities, Residue, Cauchy's Residue theorem.

UNIT III
EVALUATION OF INTEGRALS & CONFORMAL MAPPING:

Introduction, Evaluation of improper real integrals of the type (a) $\int_{-\infty}^{\infty} f(x)dx$ (b) $\int_{c}^{c+2\pi} f(\cos\theta,\sin\theta)d\theta$ -

Conformal Mapping,-Critical Points-Bilinear transformation – fixed point – cross ratio - properties - invariance of circles.

UNIT IV
FOURIER SERIES:
Introduction- Periodic functions- Fourier series of periodic function- Dirichlet's conditions- Even and odd functions- Change of interval- Half-range sine and cosine series.

UNIT V
FOURIER TRANSFORMS:
Introduction- Fourier integral theorem (without proof)- Fourier integrals in complex form- Standard results- Fourier sine and cosine integrals- Fourier Transforms- Infinite and finite Fourier Transforms- Properties- Fourier sine and cosine transforms- inverse transforms, Finite Fourier transforms.

TEXT BOOKS:

1. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publisher-44th edition.
2. A Text book of Engineering Mathematics, N.P.Bali, Manesh Goyal- 9th edition.

REFERENCE BOOKS:

1. Advanced Engineering Mathematics, Kreyszig, John Wiley & Sons-10th edition.
2. Fundamentals of Complex Analysis, Saff, E. B. and A. D. Snider, Pearson-3rd edition.
3. Functions of Complex Variables, J.N.Sharma, Publisher Krishna prakashan-49th edition.

ELECTRONIC DEVICES AND CIRCUITS

B. Tech. II Year I Semester

L	T	P	C
3	0	0	3

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

1. Demonstrate the concepts of semiconductor theory.
2. Interpret the characteristics of different semiconductor devices with its applications.
3. Apply different biasing techniques of transistors for amplification.
4. Analyze transistor amplifiers using small signal model.
5. Analyze FET amplifiers using small signal model.

UNIT – I DIODE:

PN junction Diode Characteristics, Current equation, Temperature dependence, Static and Dynamic resistances, Equivalent circuit, Diffusion and Transition Capacitances.

Diode Applications: Rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Rectifiers with Capacitive Filter, Clippers, Clampers.

UNIT II

BIPOLAR JUNCTION TRANSISTOR (BJT):

Principle of Operation and characteristics Common Emitter, Common Base, Common Collector Configurations, Operating point, DC & AC load lines, Transistor Hybrid parameter model, Determination of h-parameters from transistor characteristics, Conversion of h-parameters.

UNIT III

TRANSISTOR BIASING AND STABILIZATION:

Bias Stability, Fixed Bias, Collector to Base bias, Self-Bias, Bias compensation using Diodes and Transistors. Analysis and Design of Small Signal Low Frequency BJT Amplifiers: Analysis of CE, CC, CB Amplifiers and CE Amplifier with emitter resistance, low frequency response of BJT Amplifiers, effect of coupling and bypass capacitors on CE Amplifier.

UNIT IV

JUNCTION FIELD EFFECT TRANSISTOR:

Construction, Principle of Operation, Pinch-Off voltage, Volt-Ampere characteristic, comparison of BJT and FET, Biasing of FET, FET as voltage variable resistor, MOSFET construction and its characteristics in enhancement and depletion modes.

UNIT V

FET AMPLIFIERS:

Small Signal Model, Analysis of CS, CD, CG JFET Amplifiers. Basic Concepts of MOSFET Amplifiers.

Special Purpose Devices: Zener Diode Characteristics, Voltage Regulator; Principle of Operation SCR, Tunnel diode, UJT, Varactor Diode.

TEXT BOOKS:

1. Electronic devices and circuits, Millman and Halkias, McGraw Hill Publication-2nd Edition.
2. Electronic devices and circuits, R.L. Boylestad and Louis Nashelsky, PEI/PHI-9th Edition.

REFERENCES:

1. Electronic devices and circuits, S. Salivahanan, N. Suresh Kumar, A. Vallavaraj, TMH - 2nd Edition.
2. Integrated electronics, J. Millman and Christos C. Halkias, TMH-Edition 2008.
3. Electronic devices and circuits, J.B Gupta, katson series-6th Edition.

POWER SYSTEMS – I

B. Tech. II Year I Semester

L	T	P	C
3	0	0	3

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

1. Understand the principle of generation of electric power in thermal, hydro, nuclear and gas power stations.
2. Apply concepts in distribution systems to solve problems.
3. Interpret the arrangement and operation of AIS and GIS substations.
4. Analyze methods to improve the power factor and voltage control.
5. Evaluate various power tariff methods.

UNIT I

POWER STATIONS:

Thermal Power Stations: Line diagram of Thermal PowerStation (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.

Hydel Power Stations: Schematic Arrangement, Brief description of Hydraulic Structures, Water turbines.

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).

UNIT II

D.C & A.C DISTRIBUTION SYSTEMS:

D.C Distribution Systems: Classification of Distribution Systems - Comparison of DC vs. AC and Under-Ground vs. Over -Head Distribution Systems- Requirements and Design features of Distribution Systems Voltage, Drop Calculations (Numerical Problems in D.C Distributors for the following cases: Radial D.C Distributor fed one end and at the both the ends (equal/unequal voltages) and Ring Main Distributor.

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

UNIT III

AIR INSULATED & GAS INSULATED (GIS) SUBSTATIONS:

Classification of substations: - Indoor & Outdoor substations: Substations layout showing the location of all the substation equipment. Bus bar arrangements in the Sub-Stations: Simple arrangements like single busbar, sectionalized single busbar, main and transfer busbar 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, busbar, construction aspects of

GIS, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations.

UNIT IV

POWER FACTOR & VOLTAGE CONTROL:

Causes of low power factor – Methods of Improving power factor – Phase advancing and generation of reactive KVAR using static Capacitors – Most economical power factor 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.

UNIT V

ECONOMIC ASPECTS OF POWER GENERATION & TARIFF:

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

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

TEXT BOOKS:

1. A text book on power system engineering, A.Chakrabarthi, M.L.Soni, P.V.Gupta and M.L Soni, Dhanpath Rai and Sons-2016 Edition
2. Principles of power systems, V.K.Mehtha and Rohit Mehtha, S.Chand Company Pvt. Ltd, 2005, Revised Edition

REFERENCE BOOKS:

1. Generation, distribution and utilization of electrical energy, C.L.Wadhwa, New Age International-3rd Edition.
2. A course in power systems, J.B.Gupta, S.K. Kataria &Sons-11th Edition.
3. A text book of power system engineering, R.K. Rajput, Laxmi Publications (P) Limited-1st Edition.

NETWORK ANALYSIS

B. Tech. II Year I Semester

L	T	P	C
3	0	0	3

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

1. Apply network theorems for the analysis of electrical networks.
2. Obtain the transient and steady-state response of electrical circuits.
3. Apply graph theory to formulate network equations.
4. Analyze two port networks.
5. Evaluate circuits in the sinusoidal steady-state (Three-phase).

UNIT I

NETWORK THEOREMS (DC & AC), MESH AND NODAL ANALYSIS:

Analysis of Circuits using Mesh and Nodal methods, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem and Compensation theorem

UNIT II

D.C AND A.C TRANSIENT ANALYSIS:

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

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

UNIT III

NETWORK TOPOLOGY:

Network Topology - Definitions, Graph, Tree, Incidence Matrix, Basic Cut Set and Basic Tie Set Matrices for Planar Networks, Loop and Nodal methods for analysis of Networks with Voltage and Current Sources, Duality & Dual Networks.

UNIT IV

TWO PORT NETWORKS:

Two port network parameters - Z, Y, ABCD and Hybrid parameters and their inter relations. Series, parallel and cascaded connection of two port networks, Concept of transformed network- Two port network parameters using transformed variables.

UNIT V

ANALYSIS OF THREE PHASE CIRCUITS:

Three phase Circuits – Generation of Three Phase Voltage - Review of Voltage and Current relations in Star and Delta systems. Analysis of balanced and unbalanced three phase circuits - Measurement of active and reactive power.

TEXT BOOKS

1. Circuit theory-analysis & synthesis, A.Chakrabarthy, Dhanpat Rai & Sons-7th revised Edition.
2. Circuits & networks-analysis and synthesis, A.Sudhakar and Shyammohan S.Palli, Tata McGraw Hill-5th Edition.

REFERENCE BOOKS

1. Network analysis, Van Valkenburg, Prentice Hall-3rd Edition.
2. Network analysis, Mahmood Nahvi, Joseph Edminister, Schaum's Outline series, McGraw Hill Companies 4th Edition.
3. Electric circuit analysis, C.L.Wadhwa, New Age International-2nd Edition.

ELECTRO MAGNETIC FIELDS

B. Tech. II Year I Semester

L	T	P	C
3	0	0	3

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

1. Understand the basic laws of electromagnetism.
2. Obtain the electric and magnetic fields' concepts for simple configurations under static conditions.
3. Analyze time varying electric and magnetic fields.
4. Examine Maxwell's equations in different forms and different media.
5. Apply electromagnetic concepts to electrical machines.

UNIT I

ELECTROSTATICS:

Vector Algebra Divergence theorem. 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's law Application of Gauss's Law Maxwell's first law. Laplace's and Poison's equations.

UNIT II

DIPOLE& CAPACITANCE:

Electric Dipole Dipole moment Polarization Potential due to an Electric Dipole and Torque. Capacitance Capacitance of parallel plate and spherical and co-axial capacitors with composite dielectrics Energy stored and energy density in a static electric field Current density conduction and Convection current densities Ohm's law in point form Equation of continuity.

UNIT III

MAGNETO STATICS, AMPERE'S CIRCUITAL LAW:

Biot-Savart's law Magnetic field intensity (MFI) MFI due to a straight current carrying filament MFI due to circular, and solenoid current Carrying wire Relation between magnetic flux, magnetic flux density Maxwell's second Equation.

Ampere's circuital Law & 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-Curl-Stroke's Theorem Maxwell's third equation.

UNIT IV

FORCE IN MAGNETIC FIELDS, MAGNETIC POTENTIAL:

Magnetic force - Lorentz force equation – force on a current element in a magnetic field - Force on a straight and a long current carrying conductor in a magnetic field – Force between two straight long and parallel current carrying conductors – Magnetic dipole and dipole moment –Torque in a magnetic field. Scalar Magnetic potential and its limitations vector magnetic potential and its properties.

UNIT V

INDUCTANCE, TIME VARYING FIELDS:

Self and Mutual inductance Determination of self-inductance of a solenoid and toroid and mutual inductance between a straight long wire Energy stored and Density in a Magnetic field. Time varying fields Faraday's laws of electromagnetic induction Maxwell's fourth equation Simple problems Modification of Maxwell's equations for time varying fields Displacement current.

TEXT BOOKS

1. Engineering electromagnetics by William H. Hayt & John. A. Buck, McGraw Hill Companies-7th Edition, 2012.
2. Electromagnetic fields, Sadiku, Oxford Publications-7th Edition.

REFERENCE BOOKS

1. Engineering electromagnetics, J P Tewari, Khanna Publishers-2nd Edition, 2005.
2. Elements of electromagnetic fields, S. P. Seth, Dhanpat Rai & Co. (Pvt.) Ltd-2nd Edition.
3. Electromagnetic field theory, K. A. Gangadhar, P. M. Ramanathan, Khanna Publishers- 16th Edition.

ELECTRICAL MACHINES - I

B. Tech. II Year I Semester

L	T	P	C
3	0	0	3

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

1. Understand different types of DC Machines.
2. Identify different parts of a DC machine & understand its operation.
3. Carry out different testing methods to predetermine the efficiency of DC machines.
4. Analyze speed control of DC machines.
5. Carry out different testing methods to pre-determine the efficiency DC machines.

UNIT I

D.C. GENERATORS – CONSTRUCTION & OPERATION:

Electromechanical Energy conversion force and torque in magnetic field systems energy balance D.C. Generators Principle of operation Action of commutator classification of DC generators separately excited and self-excited generators armature windings lap and wave windings use of laminated armature E.M.F Equation Armature reaction and commutation cross magnetizing and demagnetizing AT/pole compensating winding.

UNIT II

D.C. GENERATORS – OPERATING CHARACTERISTICS:

Commutation reactance voltage methods of improving commutation Buildup of EMF magnetization curve/OCC characteristics critical field resistance and critical speed causes for failure of self-excitation remedial measures internal and external characteristics of DC shunt, series and compound generators, Parallel operation of DCgenerators use of equalizer bar and cross connection of field windings load sharing- Different applications of DC Generators.

UNIT III

D.C. MOTORS:

Principle of operation Back EMF Torque equation, Types of DC Motors (shunt, series and compound) characteristics of DC Motors- applications.

UNIT IV

SPEED CONTROL OF DC MOTORS:

Principle of operation of 3 point and 4 point starters with protective devices – Speed control of DC Motors: armature voltage and field flux control methods – Ward-Leonard system - Different applications of DC Motors.

UNIT V

TESTING OF D.C. MACHINES:

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

TEXT BOOKS:

1. Theory and performance of Electrical machines, J.B Gupta, S.K Kataria & Sons publishers- Reprint 2013 Edition.
2. Electrical Machines, R.K.Rajput, Lakshmi Publication-4th Edition.

REFERENCE BOOKS:

1. Electrical machinery, P.S. Bimbra, Khanna Publishers-7th Edition
2. Electrical machines, S.K. Bhatta Charya, McGraw Hill Companies 4th Edition.
3. Electric machines, I.J. Nagrath& Kothari, McGraw Hill Companies 3rd Edition.

BASIC SIMULATION TOOLS LAB

B. Tech. II Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes: Upon the completion of laboratory course, the student should be able to

1. Correlate the data using plots.
2. Verify network theorems.
3. Observe transient response of series circuits.
4. Simulate rectifier circuits.
5. Analyze networks using network theorems.

Any Ten of the following experiments should be conducted

1. Basic operation on matrices.
2. Basic 2D plots of simple equations.
3. Find loop currents using mesh analysis.
4. Find node voltage using nodal analysis.
5. Transient analysis of RL series circuit.
6. Transient analysis of RC series circuit.
7. Transient analysis of RLC series circuit.
8. Analysis of half wave rectifier with and without filter.
9. Analysis of full wave rectifier with and without filter.
10. Verification of Thevenin's theorem.
11. Verification of Maximum power transfer theorem.
12. Verification of super position theorem.

ELECTRICAL CIRCUITS LAB

B. Tech. II Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes: Upon the completion of Laboratory course, the student should be able to

1. Evaluate response in a given network by using network theorems.
2. Analyze complex DC and AC linear circuits.
3. Apply concepts of electrical circuits.
4. Evaluate active power and reactive power of electric circuits.
5. Determine two port network parameters.

Any Ten of the following experiments should be conducted;

1. Measurement of voltage, current and equivalent resistance of various circuits.
2. Verification of Norton's theorem.
3. Verification of maximum power transfer theorem on DC excitation.
4. Verification of compensation theorem.
5. Verification of reciprocity theorem & Millman's theorem.
6. Resonance in series and parallel R, L, C circuits.
7. Determination of self-inductance, mutual inductance and coefficient of coupling.
8. Locus diagrams of series RL and RC circuits.
9. Calculation of RMS, average values, form factor and peak factor of complex wave form.
10. Determination of Z & Y parameters.
11. Determination of transmission & hybrid parameters.
12. Measurement of active power for three phase balanced loads.
13. Measurement of reactive power for three phase balanced loads.

GENDER SENSITIZATION

B. Tech. II Year I Semester

L	T	P	C
2	0	0	0

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

1. To develop awareness about gender discrimination and take measurable steps to counter it.
2. To identify the basic dimensions of biological, sociological, psychological and legal aspects of gender.
3. To acquire knowledge about gendered division of labour in relation to politics and economics.
4. To prepare the students against gender violence.
5. To prepare the students to work and live together as equals.

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.

UNIT II
GENDER AND BIOLOGY:
Missing Women: Sex Selection and Its Consequences (Towards a World of Equals: Unit -4) Declining Sex Ratio. Demographic Consequences.
Gender Spectrum: Beyond the Binary (Towards a World of Equals:
Unit -10) Two or Many? Struggles with Discrimination.

UNIT III
GENDER AND LABOUR:
Housework: the Invisible Labour (Towards a World of Equals:
Unit -3) "My Mother doesn't Work." "Share the Load".
Women's Work: Its Politics and Economics (Towards a World of Equals: Unit -7)
Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions 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. Additional Reading: New Forums for Justice.
Thinking about Sexual Violence (Towards a World of Equals: Unit -11)
Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT V
GENDER: CO – EXISTENCE:
Just Relationships: Being Together as Equals (Towards a World of Equals: Unit -12)
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks-The Brave Heart.

TEXT BOOK:

1. Towards a World of Equals: A Bilingual Textbook on Gender ,A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu ,Telugu Akademi, Hyderabad,Telangana State in the year 2015.

REFERENCE BOOKS:

1. Seeing like a feminist, Menon, Nivedita, New Delhi, Zubaan-Penguin Books-2012
2. I fought for my life and won, Abdulali Sohaila, Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

NUMERICAL METHODS AND PARTIAL DIFFERENTIAL EQUATIONS

B. Tech. II Year II Semester

L	T	P	C
3	0	0	3

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

1. Develop skills in solving engineering problems involving algebraic and transcendental equations.
2. Acquires the knowledge of interpolation in predicting future out comes based on the present knowledge and also to fit different types of curves.
3. To know various types of numerical methods in solving engineering problems.
4. Classify the nature of second and higher order partial differential equations and find the solutions of linear and nonlinear PDE.
5. To apply partial differential equations in different engineering problems.

UNIT I

NUMERICAL TECHNIQUES: SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS:

Introduction - The Bisection Method- The Method of False Position- The Iteration Method- Newton- Raphson Method. Solving system of linear Non- Homogeneous equations by Jacobi's and Gauss- Seidel Iteration methods.

UNIT II

CURVE FITTING AND NUMERICAL INTEGRATION:

Curve fitting: Fitting a straight line -second degree curve-exponential curve, power curve by method of least squares.

Numerical integration – General Quadrature (Newton's Cote's formula), Trapezoidal rule, Simpson's rule. $\left(\frac{1}{3}^{rd} \ \& \frac{3}{8}^{th}\right)$

UNIT III

NUMERICAL SOLUTIONS OF IVP'S:

Numerical solution of Ordinary Differential equations: Introduction- Solution by Taylor's series method- Picard's Method of successive approximations- Single step methods-Euler's Method - Runge- Kutta (second and classical fourth order) Methods- Predictor Corrector method- Adam's - Bashforth method.

UNIT IV

PARTIAL DIFFERENTIAL EQUATIONS:

Introduction- Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions- Solutions of first order Linear (Lagrange) Equation, Nonlinear Equations- Charpits Method.

UNIT V

APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS:

Introduction- Classification of general second order partial differential equations- Method of separation of variables for second order equations- Applications of Partial Differential Equations- One dimensional wave equation – One dimensional heat equation- Steady State two dimensional Heat equation (or Laplace equation).

TEXT BOOKS:

1. Higher engineering mathematics, B.S. Grewal, Khanna Publishers - 43rd Edition.
2. Numerical methods, S. S. Sastry PHI Publications.

REFERENCE BOOKS:

1. Introductions of numerical methods, Jain & Iyengar
2. Numerical methods, E. Balaguruswamy, Tata McGraw Hill Publication.
3. Ordinary and partial differential equations, theory and applications, Shah and, Nita H, PHI Publications.

FLUID MECHANICS AND HYDRAULIC MACHINERY

B. Tech. II Year II Semester

L	T	P	C
3	0	0	3

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

1. Explain fluid properties, types of fluid flows and formulate one and three dimensional compressible fluid flow problems and solve the same.
2. Apply conservation of mass, energy and momentum laws to fluid flow problems in engineering applications and study the losses in pipes.
3. Compute drag and lift forces using theory of boundary layer and understand the basics of turbo machinery.
4. Analyze practical problems of various turbines used in Industry and hydro power plants.
5. Solve various engineering problems related to centrifugal and reciprocating pumps used in agriculture, domestic and industrial applications.

UNIT I

FLUID PROPERTIES AND FLUID STATICS:

Density, Specific weight, Specific gravity, viscosity, Vapour pressure, compressibility, Surface tension Pressure at a point, Pascal's law, pressure variation with temperature, density and altitude. Hydro static law, Piezometer, Simple and differential manometers.

UNIT II

FLUID KINEMATICS:

Stream line, path line, streak line, stream tube, classification of flows, steady,unsteady, uniform, non- uniform, laminar, turbulent, rotational, irrigational flows, one, two and three dimensional flows.

Fluid Dynamics: Surface and Body forces, Euler's and Bernoulli's equation derivation, Application of Bernoulis Equation: Venturimeter, Orifice meter, Pitot tube, Navier stokes equation (explanation only), Momentum equation – applications.

UNIT III

CLOSE CONDUIT FLOW:

Reynolds Experiment, Darcy's equation, Minor losses pipes in series, pipes in parallel, total energy line and hydraulic gradient line. Impact Of Water Jets: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and a tip-velocity triangles at inlet and outlet expressions for work done and efficiency, Series vanes, Radial flow turbines.

UNIT IV

HYDRAULIC TURBINES:

Overshot and undershot water wheels, classification of Water turbines, Pelton Wheel, work done and working proportions, Francis, Kaplan turbines, draft tubes, types & its efficiency.

Performance Of Turbines: Performance under unit head, unit quantities, performance under specific conditions, specific speed, performance characteristic curves, governing of turbines, surge tanks. Water hammer.

UNIT V

CENTRIFUGAL PUMPS:

Types Component parts and working, work done by the impeller, Manometric head losses and efficiencies, minimum starting speed, loss, Specific speed, Multistage Pumps, Pumps in parallel, performance of pump, NPSH, Cavitation, priming devices, pump troubles and remedies. Reciprocating Pumps: Main components and working of a reciprocating pump, types of reciprocating pumps, power required driving the pump, coefficient of discharge and slipping indicator diagram.

TEXT BOOKS:

1. Hydraulics, fluid mechanics and hyraulic machinery, Modi and Seth, Standard Book House-14th edition.
2. Fluid mechanics and hydraulic machines, Rajput, S. Chand- 6th Edition.

REFERENCES:

1. Fluid mechanics and fluid power engineering, D.S Kumar, Kotaria & sons.
2. Fluid mechanics and machinery by D. Rama Durgaiah, New Age international, Reprint 2004.
3. Hydraulic machines by Banga & Sharma, Khanna Publishers.

PROFESSIONAL COMMUNICATION
(Common to all branches)

L	T	P	C
2	0	0	2

B. Tech. II Year II Semester

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

1. Acquire enhanced personality
2. Exhibit appropriate professional etiquette
3. Practice team building with strong communication skills
4. Develop problem solving skills and decision-making
5. Demonstrate effective presentation skills

UNIT I
SELF APPRAISAL:

Self-Introspection/ Self Retrospection introducing self & others
Goal setting SWOT Analysis,

UNIT II
PROFESSIONAL ETIQUETTE:

Etiquette-Telephone Etiquette- Netiquette Email, Social Network
Behavioral Traits Case study

UNIT III
TEAM BUILDING:

Leadership skills-Case Studies Team Essentials
Negotiation Skills
Group Discussion-Functional Aspects

UNIT IV
LOGICAL THINKING AND ANALYTICAL REASONING:

Decision Making Problem Solving Conflict management Case Study

UNIT V
PRESENTATION SKILLS:

Poster Presentation
Oral Presentation-Individual Presentation, Team Presentation, Thematic Presentation

TEXT BOOKS:

1. Effective technical communication, Ashrif Rizvi, Tata McGraw Hill-2011

REFERENCE BOOKS:

1. Speaking and writing for effective business, Soundaraja, MACMILLAN, 2010.
2. English for professional success, Hector Sanchez, Thomson, 2010.

ELECTRICAL MACHINES – II

B. Tech. II Year II Semester

L	T	P	C
4	0	0	4

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

1. Understand the concepts of rotating magnetic fields and the working principle of single phase transformer.
2. Analyze the operation & connection of three phase transformer.
3. Understand the construction & operation of three phase induction motor.
4. Analyze the performance of three phase induction motor.
5. Understand the construction & operation of single phase induction motor.

UNIT I

SINGLE PHASE TRANSFORMERS:

Principle of operation **-**Types - constructional details- Losses, Minimization of hysteresis and eddy current losses- E.M.F equation - operation on no load and on load - phasor diagrams- Problems. Equivalent circuit – efficiency at different loads - Condition for maximum efficiency- All day efficiency -voltage regulation for different loads & different power factors - effect of variations of frequency & supply voltage on iron losses - Sumpner's test-separation of losses.

UNIT II

THREE PHASE TRANSFORMERS:

Three phase poly-phase connections - Y/Y, Y/Δ, Δ/Y, Δ/ $\Delta$and open Δ, Third harmonics in phase voltages-three winding transformers-tertiary windings - Determination of Zp, Zs and Zt - off load and on load tap changing, Scott connection.

PARALLEL OPERATION AND AUTOTRANSFORMERS

Parallel operation of Single Phase Transformers with equal and unequal voltage ratios - Auto transformers - equivalent circuit - comparison with two winding transformers.

UNIT III

THREE PHASE INDUCTION MOTORS:

Construction details of cage and wound rotor machines-production of a rotating magnetic field - principle of operation - rotor emf and rotor frequency - rotor reactance, rotor current and pf. at standstill and during operation. Rotor power input, rotor copper loss and mechanical power developed. Torque equation- expressions for maximum torque and starting torque - torque slip characteristics - double cage and deep bar rotors.

UNIT IV

PERFORMANCE OF THREE PHASE INDUCTION MOTORS:

Equivalent circuit - phasor diagram - crawling and cogging. Circle diagram-no load and blocked rotor tests-predetermination of performance. Methods of starting. Calculations of torque, efficiency at different loads from circle diagram.

Speed control - voltage control – variable voltage and variable frequency method- change of poles and methods of consequent poles; cascade connection, injection of an emf into rotor circuit (qualitative treatment only) -induction generator-principle of operation.

UNIT V

SINGLE PHASE INDUCTION MOTORS:

Single phase Induction motor – Constructional features- Double revolving field theory Equivalent circuit- spilt –Phase motors- Capacitor start Capacitor run motors, applications.

TEXT BOOKS:

1. Electrical machinery, P.S. Bimbra, Khanna Publishers-7th edition.
2. Theory and performance of electrical machine, JB Gupta, SK Kataria&Sons-14th edition.

REFERENCE BOOKS:

1. Performance and design of AC machines, MG.Say, BPB Publishers-1968.
2. Electrical machines, R.K Rajput, LP publications-5th edition
3. Electric machines, I. J. Nagrath & D.P. Kothari, Tata McGraw Hill-7th Edition.

POWER SYSTEMS – II

L	T	P	C
3	0	0	3

B. Tech. II Year II Semester

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

1. Understand transmission line parameters.
2. Observe the performance of transmission lines.
3. Analyze transient behavior of transmission lines.
4. Evaluate mechanical design of transmission lines.
5. Understand the construction, grading and capacitance of underground cables.

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, MEDIUM AND LONG LENGTH TRANSMISSION LINES:

Classification of Transmission Lines Short, medium and long line and their model representations Nominal-T, Nominal-Pie A, B, C, D Constants for symmetrical & Asymmetrical Networks, Numerical Problems. Mathematical Solutions to estimate regulation and efficiency of all types of lines Numerical Problems. **Long Transmission Line**: Rigorous Solution, evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations, 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, Incident, Reflected and Refracted Waves- Reflection and Refraction Coefficients - Termination of lines with different types of conditions - Open Circuited Line, Short Circuited Line, T-Junction, Lumped Reactive Junctions (Numerical Problems). Bewley's Lattice Diagrams (for all the cases mentioned with numerical examples).

UNIT IV

FACTORS GOVERNING THE PERFORMANCE OF TRANSMISSION LINES, TRANSMISSION LINE INSULATORS, SAG AND TENSION CALCULATIONS:

Skin and Proximity effects - Description and effect on Resistance of Solid Conductors - Ferranti effect - Charging Current - Effect on Regulation of the Transmission Line. Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference. Types of Insulators, String efficiency and Methods for improvement, Numerical Problems voltage distribution, calculation of string efficiency, Capacitance grading and Static Shielding. 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.

TEXT BOOKS:

1. Electrical power systems, C.L.Wadhwa, New Age International (P) Limited, Publishers.
2. Principles of Power Systems, V.K.Mehta and Rohit Mehta, S.Chand Company Pvt. Ltd, 2005.

REFERENCE BOOKS:

1. A Text Book on Power System Engineering, M.L.Soni, P.V. Gupta, U.S. Bhatnagar, A. Chakrabarthy, Dhanpat Rai & Co Pvt. Ltd.
2. Power System Engineering, I.J. Nagarath and D.P. Kothari, TMG.
3. Power System Analysis and Design, Dr. B. R. Gupta, S. Chand & Company Limited.

CONTROL SYSTEMS

B. Tech. II Year II Semester

L	T	P	C
3	0	0	3

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

1. Understand the fundamentals of classical and modern control systems.
2. Model various electrical and mechanical systems.
3. Analyze time and frequency responses of first and second-order systems.
4. Analyze stability of control systems.
5. Represent linear discrete time systems in State space

UNIT I

INTRODUCTION TO CONTROL PROBLEM:

Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.

UNIT II

TIME RESPONSE ANALYSIS OF STANDARD TEST SIGNALS:

Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

UNIT III

FREQUENCY-RESPONSE ANALYSIS:

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion gain and phase margin. Closed-loop frequency response.

UNIT IV

INTRODUCTION TO CONTROLLER DESIGN:

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers.

UNIT V

STATE VARIABLE ANALYSIS AND CONCEPTS OF STATE VARIABLES:

State space model. Diagonalization of State Matrix. Solution of state equations. Eigen values and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

TEXT BOOKS:

1. Control Systems Engineering, I.J.Nagrath and M.Gopal, New Age International (P) Limited, Publishers-2nd Edition.
2. Automatic Control Systems, B. C. Kuo, John wiley and sons-8th Edition.

REFERENCE BOOKS:

1. Control Systems, Nagoorkani-2nd Edition.
2. Control Systems, N.C.Jagan, BS Publications-2nd Edition.
3. Modern Control Engineering, Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd.-3rd Edition.

ELECTRICAL MACHINES - I LAB

B. Tech. II Year II Semester

L	T	P	C
0	0	2	1

Course Outcomes: Upon the completion of Laboratory course, the student should be able to

1. Start and control the Different types of DC motors.
2. Assess the performance of different types of DC machines using different testing methods.
3. Identify different conditions required to be satisfied for self - excitation of DC Generators.
4. Separation losses of DC motor into different components.
5. Analyze the performance of coupled machines.

Any 10 out of the following 12 experiments should be conducted:

1. Magnetization characteristics of a DC shunt generator.
2. Load test on DC shunt generator.
3. Load test on DC compound generator.
4. Load test on DC series generator.
5. Brake test on DC compound motor.
6. Hopkinson's test on DC Shunt machines.
7. Field's test on DC Series machines.
8. Separation of losses in DC shunts motor.

In addition to the above eight experiments at least any two of the following experiments are required to be conducted from the following list.

1. Retardation test on DC shunt motor.
2. Speed control of DC shunt motor.
3. Swinburne's test on DC shunt machine.
4. Brake Test on DC shunt Motor.

ELECTRONIC DEVICES AND CIRCUITS LAB

B. Tech. II Year II Semester

L	T	P	C
0	0	2	1

Course Outcomes: Upon the completion of Laboratory course, the student should be able to

1. Understand basic concepts of electronic devices and circuits.
2. Analyze the characteristics of electronic devices and circuits.
3. Apply the concepts of electronics devices and circuits to find various parameters.
4. Evaluate the behavior of basic electronic devices.
5. Analyze the characteristics of FET and UJT.

PART-A: (Only for Viva-voce Examination) Electronic Workshop Practice (In 3 Lab Sessions):

1. Identification, Specifications, Testing of R, L, C Components (Color Codes), Potentiometers, Switches (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays, Bread Boards, PCB's.
2. Identification, Specifications and Testing of Active Devices, Diodes, BJT's, Low power JFET's, MOSFET's, Power Transistors, LED's, LCD's, SCR, UJT.
3. Study and operation of
   a. Multimeters (Analog and Digital).
   b. Function Generator.
   c. Regulated Power Supplies.
   d. CRO.

PART B: Minimum of 10 experiments of the following should be conducted

1. Forward & Reverse Bias Characteristics of PN Junction Diode.
2. Zener diode characteristics and Zener as voltage Regulator.
3. Half Wave Rectifier with & without filters.
4. Full Wave Rectifier with & without filters.
5. Input & Output Characteristics of Transistor in CB Configuration.
6. Input & Output Characteristics of Transistor in CE Configuration.
7. FET characteristics.
8. Lissajous patterns using CRO.
9. Frequency Response of CC Amplifier.
10. Frequency Response of CE Amplifier.
11. Frequency Response of Common Source FET amplifier.
12. SCR Characteristics.
13. UJT Characteristics.

ENVIRONMENTAL SCIENCE

(Common to all Branches)

L	T	P	C
2	0	0	0

B. Tech. II Year II Semester

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

1. Define and explain the structure and functions of ecosystem, values of biodiversity, threats to biodiversity and conservation of biodiversity.
2. Explain the limitations of the resources and impacts of over utilization of natural resources.
3. Explain the sources and effects of environmental pollution and list and identify the available techniques to control the pollution.
4. Explain the global environmental issues like climate change, ozone depletion and can explain the scope of EIA, Environmental Management Plan and environmental audit and list the EIA methods.
5. Mention the salient features of environmental acts and rules and define the sustainable goals along with measures required for the sustainability.

UNIT I

ECOSYSTEM:

Definition, Scope and Importance of ecosystem, Structure and Functions of ecosystem: Food chains, Food Web and Ecological Pyramids, Flow of energy; Bio-magnification.

BIODIVERSITY AND BIOTIC RESOURCES:

Introduction, Definition, levels of Biodiversity, Value of biodiversity, Hot spots of biodiversity, Threats to biodiversity, conservation of biodiversity: In-Situ and Ex-situ conservation.

UNIT II

NATURAL RESOURCES:

Classification of Resources,

WATER RESOURCES:

Use and over utilization of surface and ground water, Dams: benefits and problems, Rain water harvesting;

ENERGY RESOURCES:

Growing energy needs Renewable and Non Renewable Energy resources. **LAND RESOURCES**: land degradation – Landslide and Soil Erosion; **FOREST RESOURCES –** Uses and Exploitation.

UNIT III

ENVIRONMENTAL POLLUTION AND CONTROL:

Types of Pollution, Sources, Effects and Control measures of Air Pollution, Water Pollution, Soil Pollution and Noise Pollution.

UNIT IV

GLOBAL ENVIRONMENTAL PROBLEMS AND GLOBAL EFFORTS:

Greenhouse effect, Global Warming, climate change and their impacts on human environment; Ozone depletion and Ozone depleting substances (ODS); Aid Rains.

ENVIRONMENTAL IMPACT ASSESSMENT (EIA):

Scope of EIA and EIA methods, scope of Environmental audit and Environmental Management Plan.

UNIT V

ENVIRONMENTAL POLICY, LEGISLATION, RULES AND REGULATIONS:

Salient features of Environmental Protection act, Air (Prevention and Control of pollution) Act-1981, Water (Prevention and Control of pollution) Act-1974, Forest Conservation Act, Municipal solid waste, Hazardous waste, E-waste, Bio-medical waste, Radioactive waste Rules.

TOWARDS SUSTAINABLE FUTURE:

Concept of Sustainable Development, Sustainable goals defined by UN, Threats to Sustainability, Environmental Education, Role of IT in Environment, Smart Cities, Concept of Green Building, Low Carbon Lifestyle, Life cycle assessment and Ecological Foot Print.

TEXT BOOKS:

1. Text Book of Environmental Studies, Anubha Kaushik New age International Publishers-4th Edition.
2. Environmental studies, Erach Bharucha, University Grants Commission, University Press, 2005.

REFERENCE BOOKS:

1. Text book of Environmental Science and Technology, M.Anji Reddy, 2007
2. Environmental Science: Towards a Sustainable Future, Richard T. Wright. PHL Learning Private Ltd. New Delhi, 2008.

COURSE STRUCTURE FOR B.TECH III YEAR

B. Tech. III Year I Semester

S. No	Course Category	Course Title	L	T	P	Credits
1	H&S – 2	Managerial Economics and Financial Analysis	3	0	0	3
2	ES – 3	Switching Theory and Logic Design	3	0	0	3
3	PC – 8	Electrical Machines - III	3	0	0	3
4	PC – 9	Power Electronics	3	0	0	3
5	PE – 1	Electrical Energy Conservation and Auditing/ Electrical Estimation and Costing	3	0	0	3
6	OE – 1	Non-Conventional Energy Sources/ Fundamentals of Electrical Power Generation and Protection	3	0	0	3
7	PC Lab – 5	Electrical Machines-II Lab	0	0	2	1
8	PC Lab – 6	Advanced Communication Skills Lab	0	0	2	1
9	MC – 3	Quantitative Methods & Logical Reasoning	2	0	0	1
Total			**20**	**0**	**4**	**21**

B. Tech. III Year II Semester

S. No	Course Category	Course Title	L	T	P	Credits
1	PC – 10	Electrical Measurements & Instrumentation	3	0	0	3
2	PC – 11	Computer Methods in Power Systems	3	0	0	3
3	PC – 12	Power Semiconductor Drives	3	0	0	3
4	PC – 13	Switch Gear and Protection	3	0	0	3
5	PE – 2	Integrated Circuit and Applications/Artificial Intelligence Techniques in Electrical Engineering	3	0	0	3
6	OE – 2	Energy Auditing and Conservation/Principles of Electric Power Utilization	3	0	0	3
7	PC Lab – 7	Control Systems and Simulation Lab	0	0	2	1
8	PC Lab – 8	Power Electronics and Simulation Lab	0	0	2	1
9	MC – 4	Personality Development & Behavioral Skills	2	0	0	1
Total			**20**	**0**	**4**	**21**

COURSE STRUCTURE (for FAST TRACK)

B. Tech. III Year I Semester

S.No.	Course Category	Course Title	L	T	P	Credits
1	H&S – 2	Managerial Economics and Financial Analysis	3	0	0	3
2	ES – 3	Switching Theory and Logic Design	3	0	0	3
3	PC – 8	Electrical Machines III	3	0	0	3
4	PC – 9	Power Electronics	3	0	0	3
5	PE – 1	Electrical Energy Conservation and Auditing/ Electrical Estimation and Costing	3	0	0	3
6	OE – 1	Non-Conventional Energy Sources / Fundamentals of Electrical Power Generation and Protection	3	0	0	3
7	PC Lab – 5	Electrical Machines -II Lab	0	0	2	1
8	PC Lab – 6	Advanced Communication Skills Lab	0	0	2	1
9	MC – 3	Quantitative Methods & Logical Reasoning	2	0	0	1
Total			**20**	**0**	**4**	**21**

B. Tech. III Year II Semester

S. No.	Course Category	Course Title	L	T	P	Credits
1	PC – 10	Electrical Measurements & Instrumentation	3	0	0	3
2	PC – 11	Computer Methods in Power Systems	3	0	0	3
3	PC – 12	Power Semiconductor Drives	3	0	0	3
4	PC – 13	Switch Gear and Protection	3	0	0	3
5	PE – 2	Integrated Circuit and Applications/ Artificial Intelligence Techniques in Electrical Engineering	3	0	0	3
6	OE – 2	Energy Auditing and Conservation/ Principles of Electric Power Utilization	3	0	0	3
7	PC Lab – 7	Control Systems and Simulation Lab	0	0	2	1
8	PC Lab – 8	Power Electronics and Simulation Lab	0	0	2	1
9	MC – 4	Personality Development & Behavioral Skills	2	0	0	1
10	PC -16	Utilization of Electrical Energy	3	0	0	3
Total			**23**	**0**	**4**	**24**

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

B. Tech. III Year I Semester

L	T	P	C
3	0	0	3

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

1. Analyze the scope of managerial economics.
2. Apply managerial tools and techniques to attain optimal decisions.
3. Analyze how production function is carried out to achieve maximum output.
4. Analyze changing business environment in post liberalization scenario.
5. Evaluate and interpret the financial statements to make informed decisions.

UNIT I

INTRODUCTION TO BUSINESS AND ECONOMICS:

Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT II

DEMAND AND SUPPLY ANALYSIS:

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

Supply Analysis: Determinants of Supply, Supply Function & Law of Supply.

UNIT III

PRODUCTION, COST, MARKET STRUCTURES & PRICING:

Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale. Cost analysis: Types of Costs. Market **Structures**: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, and Monopolistic Competition. Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, and Cost Volume Profit Analysis.

UNIT IV

FINANCIAL ACCOUNTING:

Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, and Preparation of Final Accounts.

UNIT V

FINANCIAL ANALYSIS THROUGH RATIOS:

Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems).

TEXT BOOKS:

1. Business economics, theory and applications, D. D. Chaturvedi, S. L. Gupta, International Book House Pvt. Ltd.
2. Financial accounting, Dhanesh K Khatri, Tata McGraw Hill.

REFERENCE BOOKS:

1. Financial accounting for management, Paresh Shah, Oxford Press, 2015- 2nd edition.
2. Financial accounting, S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Vikas Publications-5th edition.

SWITCHING THEORY AND LOGIC DESIGN

B. Tech. III Year I Semester

L	T	P	C
3	0	0	3

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

1. Manipulate numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, gray and BCD.
2. Manipulate simple boolean expressions using the theorems and postulates of boolean algebra and to minimize combinational functions.
3. Design and analyze small combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits.
4. Design and analyze small sequential circuits and devices and to use standard sequential functions/building blocks to build larger more complex circuits.
5. To develop the state diagrams with the knowledge of Mealy and Moore circuits and algorithmic state machines for binary multipliers.

UNIT I

NUMBER SYSTEM AND MINIMIZATION TECHNIQUES:

Number System: Review of number system and base conversion, complements, signed binary numbers, floating point number representation, Error detection (parity detection only).

Minimization techniques: Boolean Algebra, postulates ,basic logic gates, Canonical and Standard Form, NAND and NOR implementation, Minimization of switching function using theorem, The Karnaugh Map Method-Up to Five Variable Maps, Tabular Method.

UNIT II

COMBINATIONAL CIRCUITS:

Adders & Subtractor, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparators, Multiplexers, De-multiplexers, Decoders, Encoders and Code converters, Hazards and Hazard Free Relations.

UNIT III

SEQUENTIAL CIRCUITS-I:

Basic Architectural Distinctions between Combinational and Sequential circuits, Latches, Flip Flops: SR, JK, Race Around Condition in JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Design of a Clocked Flip-Flop, Timing and Triggering Consideration, Clock Skew, Conversion from one type of Flip-Flop to another.

UNIT IV

SEQUENTIAL CIRCUITS-II:

Synchronous – Asynchronous – Comparison, Design of Single mode Counter, Ripple Counter, Ring Counter, Shift Register, Shift Register Sequences, Ring Counter Using Shift Register, MOD Counters. Finite state machine-capabilities and limitations, Mealy and Moore models.

UNIT V

LOGIC FAMILIES AND SEMICONDUCTOR MEMORIES:

Logic Families: DCTL, RTL, DTL, TTL and CML Logic –gate realization - Comparison,

Semiconductor Memories: Introduction to ROM, PAL, PLA, CPLD, FPGA.

TEXT BOOKS:

1. Switching and finite automata theory, ZviKohavi & Niraj K. Jha, Cambridge-3rd Edition.
2. Modern digital electronics – R. P. Jain, Tata McGraw-Hill-3rd Edition.

REFERENCE BOOKS:

1. Digital design, Morris Mano, PHI-4th Edition.
2. Introduction to switching theory and logic design, Fredriac J. Hill, Gerald R.Peterson, John Wiley & Sons Inc-3rd Edition.
3. Fundamentals of logic design- Charles H. Roth, Cengage Learning-5th Edition.

ELECTRICAL MACHINES - III

B. Tech. III Year I Semester

L	T	P	C
3	0	0	3

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

1. Understand the construction and principle of operation of synchronous machine. Armature reaction, load characteristics, harmonics in generating EMF etc.
2. Solve regulation of synchronous generator using various methods.
3. Understand the concept of parallel operation of alternators, load sharing, change of excitation& prime-mover input.
4. Understand the principle of operation of synchronous motor and working principle of a synchronous condenser in the system, power circle.
5. Understand the use of special machines and their performances.

UNIT I
SYNCHRONOUS MACHINE & CHARACTERISTICS:
Constructional Features of round rotor and salient pole machines Armature windings - Integral slot and fractional slot windings; Distributed and concentrated windings Harmonics in generated EMF suppression of harmonics Excitation of Synchronous generators in thermal plants and Hydro plants- armature reaction leakage reactance synchronous reactance and impedance experimental determination phasor diagram load characteristics.

UNIT II
REGULATION OF SYNCHRONOUS GENERATOR:
Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods salient pole alternators two reaction analysis experimental determination of Xd and Xq (Slip test) Phasor diagrams Regulation of salient pole alternators.

UNIT III
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 reactances.

UNIT IV
SYNCHRONOUS MOTORS:
Synchronous Motors: Theory of operation phasor diagram Variation of current and power factor with excitation synchronous condenser Mathematical analysis for power developed hunting and its suppression Methods of starting V and inverted V curves.

UNIT V
SPECIAL MACHINES:
Principles of operation of Reluctance Motors, Stepper Motors, Permanent magnet Brushless DC Motors, Principle and operation of Servomotor.

TEXT BOOKS:

1. Electrical machinery, P.S. Bimbra, Khanna Publishers.
2. Theory and performance of electrical machines, J.B.Gupta, Katson Books.

REFERENCE BOOKS:

1. Electric machines, I. J. Nagrath & D. P. Kothari, Tata McGraw Hill Publishers
2. Principles of electrical machines, V. K. Mehta, Rohit Mehta, S. Chand Publishing.
3. Electrical machines - III by M.V.Bakshi U.A.Bakshi, Technical Publications.

POWER ELECTRONICS

B. Tech. III Year I Semester

L	T	P	C
3	0	0	3

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

1. Understand about various power electronic devices and their commutation procedure.
2. Analyze the operation of various phase-controlled converters.
3. Analyze AC-AC Converters and solve the problems.
4. Analyze the operation of DC-DC converters understanding and solve the problems.
5. Analyze the operation of DC-AC converters and understanding the problems.

UNIT I

POWER SEMI CONDUCTOR DEVICES & COMMUNICATION CIRCUITS:

Thyristors Silicon Controlled Rectifiers (SCR's) 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 SCR's, BJT, IGBT - Numerical problems Line Commutation and Forced Commutation circuits.

UNIT II

AC-DC CONVERTERS (1-PHASE CONTROLLED RECTIFIERS):

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, Midpoint and Bridge connections with Resistive, RL loads and RLE load Derivation of average load voltage and current Line commutated inverters -Active and Reactive power inputs to the converters without and with Freewheeling Diode, Effect of source inductance Derivation of load voltage and current Numerical problems.

UNIT III

AC-DC CONVERTERS (3-PHASE CONTROLLED RECTIFIERS):

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.

AC-AC CONVERTERS (AC VOLTAGE CONTROLLERS) & FREQUENCY CHANGERS (CYCLO-CONVERTERS): AC voltage controllers Single phase two SCR's 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) Bridge configuration of single phase cyclo converter (Principle of operation only) Waveforms.

UNIT IV

DC-DC CONVERTERS (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, Jones chopper, AC Chopper, Problems. Switched Mode Regulator - SMPS (Basic Principle of Operation).

UNIT V

DC-AC CONVERTERS (INVERTERS):

Inverters Single phase inverter Basic series inverter, parallel inverter operation and waveforms Three phase inverters (180, 120 degrees conduction modes of operation) Voltage control techniques for inverters, Pulse width modulation techniques Numerical problems.

TEXT BOOKS:

1. Power electronics, Dr. P. S. Bimbhra, Khanna Publishers.
2. Power electronics, circuits, devices and applications, M. H. Rashid, Prentice Hall of India.

REFERENCE BOOKS:

1. Power electronics devices, circuits and industrial applications, V. R. Moorthi, Oxford University Press.
2. Power electronics, M. D. Singh & K. B. Kanchandhani, Tata Mc Graw - Hill Publishing Company.
3. Power electronics, Vedam Subramanyam, New Age International (P) Limited, Publishers.

ELECTRICAL ENERGY CONSERVATION AND AUDITING
(Professional Elective-1)

B. Tech. III Year I Semester

L	T	P	C
3	0	0	3

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

1. Understand the current energy scenario and importance of energy conservation.
2. Apply the concepts of energy management.
3. Evaluate energy efficiency in different electrical systems.
4. Analyze the energy audit of different energy systems.
5. Analyze the energy audit of different energy systems.

UNIT I
ENERGY SCENARIO:
Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features.

UNIT II
BASICS OF ENERGY AND ITS VARIOUS FORMS:
Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.

UNIT III
ENERGY MANAGEMENT & AUDIT:
Definition, energy audit, need, types of energy audit. Energy management (audit) approach understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.
Energy Efficiency in Electrical Systems
Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

UNIT IV
ENERGY EFFICIENCY IN INDUSTRIAL SYSTEMS:
Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and savings opportunities in HVAC, Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pumps and Pumping System: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities, assessment of cooling towers.

UNIT V

ENERGY EFFICIENT TECHNOLOGIES IN ELECTRICAL SYSTEMS:

Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.

TEXT BOOKS:

1. Guide books for national certification examination for energy manager/energy auditors' book-1, general aspects.
2. Guide books for national certification examination for energy manager/energy auditors' book-3, electrical utilities.

REFERENCE BOOKS:

1. Utilization of electrical energy and conservation, S. C. Tripathy, McGraw Hill.
2. Success stories of energy conservation by BEE, New Delhi.

ELECTRICAL ESTIMATION AND COSTING
(Professional Elective - I)

B. Tech. III Year I Semester

L	T	P	C
3	0	0	3

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

1. Generalize estimation and costing aspects of all electrical equipment.
2. Determine the concepts of installation and designs to analyse the cost viability.
3. Evaluate design aspects of wiring system, overhead and underground distribution lines, substations and illuminations.
4. Estimate the cost of various electrical designs and equipment.
5. Analyse overhead and underground transmission and distribution lines.

UNIT I

DESIGN OF SIMPLE ELECTRIC CIRCUITS:

Electrical diagrams- classification of diagrams according to purpose methods of representation for wiring diagram. System of connection of appliances and accessories schematic wiring and single line diagram. Design and drawing of panel boards. Design conditions standard sizes of boards materials used.

UNIT II

DESIGN CONSIDERATIONS OF ELECTRICAL INSTALLATIONS:

Electric Supply System Three phase four wire distribution system Protection of Electric Installation against over load short circuit and Earth fault Earthing General requirements of electrical installations testing of installations - Indian Electricity rules Neutral and Earth wire.

UNIT III

Types of loads Systems of wiring Service connections Service Mains Sub-Circuits Location of Outlets Location of Control Switches Location of Main Board and Distribution board Guide lines for Installation of Fittings Load Assessment Permissible voltage drops and sizes of wires Estimation and Costing of Electric installations.

UNIT IV

ELECTRICAL INSTALLATION FOR DIFFERENT TYPES OF BUILDINGS AND SMALL INDUSTRIES:

Electrical installations for residential buildings estimating and costing of material Electrical installations for commercial buildings high rise buildings. Electrical installations for small industries.

UNIT V

OVERHEAD AND UNDERGROUND TRANSMISSION AND DISTRIBUTION LINES:

Introduction Supports for transmission lines Distribution lines Materials used Underground cables Mechanical Design of overhead lines Design of underground cables.

TEXT BOOKS:

1. Electrical design estimating and costing, K. B. Raina, S. K. Bhattacharya, New Age International Publisher-5th edition
2. Electrical installation estimating and costing, J.B.Gupta, S.K. Katria and Sons, New Delhi-8th edition.

REFERENCE BOOKS:

1. Guide for electrical layout in residential buildings, Indian Standard Institution
2. Electrical installation buildings indian standard institution, IS: 2032.
3. Electrical Installation, estimating and costing, J. B. Gupta, Katson, Ludhiana.

NON CONVENTIONAL ENERGY SOURCES
(Open Elective-1)

B. Tech. III Year I Semester

L	T	P	C
3	0	0	3

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

1. Realize the importance of renewable energy sources for energy planning.
2. Understand the value of solar energy potential and exploit the solar energy for real world applications.
3. Understand the potential of wind energy, types of wind mills, performance characteristics and Betz criteria.
4. Analyze the potential of both tidal and ocean thermal energies and learn the extraction methods.
5. Know the potential of geothermal, bio-mass energies and learn relevant extraction methods.

UNIT I
PRINCIPLE OF RENEWABLE ENERGY:
Comparison of renewable and conventional energy sources-ultimate energy sources-natural energy currents on earth-primary supply to end use-spaghetti & pie diagrams-energy planning-energy efficient and management.

UNIT II
SOLAR RADIATION:
Extraterrestrial and terrestrial solar radiation solar thermal conversion- solar thermal central receiver photovoltaic energy conversion-solar cell configurations.

UNIT III
WIND ENERGY:
Planetary and local winds-vertical and horizontal axis wind mills-principles of wind power-maximum power-actual power - wind turbine operation - Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria.

UNIT IV
ENERGY FROM OCEANS:
Ocean thermal energy principles of OTEC plant operations-wave energy devices for energy extraction-tides types of tidal stations.

UNIT V
GEOTHERMAL AND BIO FUEL ENERGY:
Origin and types Bio fuels classification-direct combustion for heat and electricity generator-anaerobic digestion for biogas-biogas digester-power generation.

TEXT BOOKS:

1. Renewable energy sources, John Twidell &Timey&Weir.
2. Non-conventional energy sources, G.D. Rai, Khanna publications.

REFERENCE BOOKS:

1. Power plant technology, EL-Wakil, McGraw-Hill.
2. Renewable energy resources: basic principles and applications, G.N.Tiwari, M K. Ghosal, Narosa publishers.
3. Energy conversion systems, Rakosh das Begamudre, New age International publishers.

FUNDAMENTALS OF ELECTRICAL POWER GENERATION AND PROTECTION
(Open Elective-1)

L	T	P	C
3	0	0	3

B. Tech. III Year I Semester

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

1. Interpret the operation of thermal power station through its schematic diagram.
2. Observe the arrangement of hydroelectric power station through its components.
3. Show various components of nuclear power station.
4. Describe the operation of gas and diesel power station through its schematic diagram.
5. Differentiate various power system protection components.

UNIT I

THERMAL POWER STATIONS:

Introduction to Generating stations -Steam Power Stations-Advantages and disadvantages-Schematic arrangement of Steam power system - Choice of site of steam power station-Efficiency of steam power station-Equipment of steam power station.

UNIT II

HYDRO ELECTRIC POWER STATION:

Introduction–Advantages and Disadvantages-Schematic arrangement of Hydro Electric Power Station, Choice of site for Hydro Electric Power Station-Constituents of Hydro Electric Power Station- Pumped storage plants.

UNIT III

NUCLEAR POWER STATIONS:

Introduction-Advantages and Disadvantages-Selection of site for nuclear power station Nuclear Fission and Chain reaction. Nuclear fuels. - Principle of operation of nuclear reactor Schematic arrangement of nuclear power stations-Components of Nuclear Power plant-Radiation hazards: Shielding and Safety precautions.

UNIT IV

GAS AND DIESEL POWER STATION:

Gas Turbine Power Station: Introduction-Advantages and Disadvantages-Schematic arrangement of Gas turbine Power station. Diesel Power station: Introduction-Advantages and Disadvantages-Schematic arrangement of Diesel Power station.

UNIT V

INTRODUCTION TO POWER SYSTEM PROTECTION COMPONENTS (ELEMENTARY TREATMENT ONLY):

Fuses-Definition-Advantages and Disadvantages of fuses-Desirable characteristics of fuse fuse element materials-Important terms. Circuit Breakers-Definition-Important terms-Comparison of fuse and Circuit breaker Isolators Protective relay-Requirement of Protective relay-Electrical Hazards need of Earthing.

TEXT BOOKS:

1. Principles of power systems, V.K Mehta and Rohit Mehta S. Chand Company Pvt. Ltd, New Delhi-4th Edition.
2. A course in power systems, J.B.Gupta, S.K.Kataria & Sons.

REFERENCE BOOKS:

1. A text book of power system engineering, R.K.Rajput, Laxmi Publications (P) Limited.
2. Electrical Power Generation: Transmission and distribution, S.N.Singh, PHI.
3. Generation of electrical energy, B.R. Gupta, S.Chand.

ELECTRICAL MACHINES – II LAB

B. Tech. III Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes: Upon the completion of Laboratory course, the student should be able to

1. Understand the basic working principle of a transformer; obtain the equivalent circuit parameters, estimate efficiency & regulation at various loads of 1-Φ transformers.
2. Understand load sharing of transformers & conversion of 3- Φ to 2- Φ supply.
3. Determine the equivalent circuit parameters of a single phase induction motor, determine the performance characteristics and efficiency by direct and indirect methods of three phase induction motor.
4. Analyze the regulation of an alternator by various methods at different power factors.
5. Understand synchronous motor performance curves at various power factors and field currents.

Any Ten of the following experiments are required to be conducted.

1. Sumpner's test on a pair of single phase transformer.
2. Separation of core losses of a single phase transformer.
3. Scott connection of transformer and Parallel operation of single phase transformer.
4. No-load & Blocked rotor tests on three phase induction motor.
5. Regulation of a three – phase alternate by synchronous impedance m.m.f methods.
6. V and inverted V curves of a three – phase synchronous motor.
7. Equivalent circuit of a single phase induction motor.
8. Determination of Xd and Xq of a salient pole synchronous machine.

In addition to the above eight experiments alteast any two of the following experiments are required to be conducted from the following list.

9. Regulation of three phase alternator by Z.P.F. and A.S.A methods.
10. Determination of sequence impedances of a three-phase alternator.
11. Determination of sequence impedances of a three-phase transformer.
12. Speed control of three phase slip ring Induction Motor.

ADVANCED COMMUNICATION SKILLS (ACS) LAB
(Common to all branches)

B. Tech. III Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes: Upon the completion of Laboratory course, the student should be able to

1. Develop sound communication skills in various situations with the help of enriched vocabulary.
2. Practice reading techniques for a faster and better comprehension.
3. Exhibit strong writing skills to express ideas effectively.
4. Demonstrate effective presentation skills.
5. Use appropriate verbal and non-verbal skills for a successful career.

UNIT I
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 visuals Synonyms and antonyms, word roots, one word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.

UNIT II
ACTIVITIES ON READING COMPREHENSION:
General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective googling.

UNIT III
ACTIVITIES ON WRITING SKILLS:
Structure and presentation of different types of writing letter writing/Resume writing/ Statement of purpose E-correspondence/Technical report writing/Portfolio writing planning for writing improving one's writing.

UNIT IV
ACTIVITIES ON PRESENTATION SKILLS:
Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/e-mails/assignments etc.

UNIT V
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 and process, pre- interview planning, opening strategies, answering strategies, interview through tele-conference & video – conference and Mock Interviews.

REFERENCE BOOKS:

1. Technical communication, Meenakshi Raman & Sangeeta Sharma, Oxford University- 2nd Edition.
2. Functional English for success, Orient Longman.

QUANTITATIVE METHODS AND LOGICAL REASONING
(Common to all branches)

B. Tech. III Year I Semester

L	T	P	C
2	0	0	1

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

1. Perform well in various competitive exams and placement drives.
2. Solve basic and complex mathematical problems in short time.
3. Become strong in quantitative aptitude and reasoning this can be applied for GRE, GATE, GMAT or CAT exam also.
4. Develop problem solving skills and analytical abilities, which play a great role in corporate and industry set up.

UNIT I

NUMBER SYSTEM: Speed Maths, Numbers, Factors, Prime & Co Primes, LCM & HCF, Divisibility Rules, Finding Unit Place Digit and Last Two Digits of an Expression

RATIO, PROPORTION AND VARIATIONS: Definition of Ratio, Ratio of Proportion, Comparison of Ratios, Compound ratio, Direct and Indirect Proportion

PERCENTAGES: Converting Fractions and Decimal into Percentages, Successive Percentage, Populations, Expenditure and Savings

PROFIT AND LOSS: Relation between Cost Price and Selling Price, Discount and Marked Price, Gain or Loss Percentages on Selling Price

SIMPLE AND COMPOUND INTEREST: Problems on Interest (**I**), Amount (**A**), Principal (**P**) and Rate of Interest (**R**) difference between the Simple Interest and Compound Interest for 2 and 3 years.

UNIT II

PARTNERSHIP: Relation between Partners, Period of Investment and Shares

AVERAGES, AGES AND ALLEGATION : Average of Different Groups, Change in Averages by Adding, Deleting and Replacement of Objects, Problems on ages, Allegation Rule, Mean Value of the Mixture, Replacement of Equal Amount of Quantity.

TIME AND WORK: Men and Days, Work and Wages, Pipes and Cisterns, Hours and Work, Alternate Days Concept,

TIME AND DISTANCE: Difference between the Average and Relative Speeds, Reaching the Destination Late and Early, Stoppage Time Per Hour, Time and Distance between Two Moving Bodies : Train Crossing Man - same and opposite directions, Speed of Boat and Stream,

UNIT III

PROGRESSIONS AND QUADRATIC EQUATIONS: Arithmetic, Geometric and Harmonic Progressions, Arithmetic Mean, Geometric Mean and Harmonic Mean and their Relations. General form of Quadratic Equation, Finding the Roots of Quadratic Equation, Nature of the Roots.

PERMUTATION AND COMBINATION: Fundamental Rules, Problems on Permutations & combinations.

PROBABILITY: Definition of probability, Notations and Formulae, Problems on Probability.

DATA INTERPRETATION AND DATA SUFFICIENCY: Tabular and Pie-charts, Bar and Line Graphs, Introduction to Data Sufficiency, Problems on Data Sufficiency.

UNIT IV

DEDUCTIONS: Statements and conclusions using Venn diagram and Syllogism Method

SERIES COMPLETION: Number series, Alphabet series, Letter Series.

CODING AND DECODING: Letter coding, Number coding, Number to letter coding, Matrix Coding, Substitution, Mixed Letter Coding, Mixed Number Coding, Deciphering Individual Letter Codes by Analysis.

ANALYTICAL REASONING PUZZLES:
Problems on Linear, Double line-up and Circular Arrangements, Selections and Comparisons.
BLOOD RELATIONS:
Defining the various Relations among the Members of a Family, Solving Blood Relation Puzzles by using Symbols and Notations. Problems on Coded Relations.

UNIT V
DIRECTION SENSE TEST: Sort of directions in puzzles distance between two points, problems on shadows, Application of triangular triplets.
CLOCKS: Relation between Minute-Hour Hands, Angle vs Time, Exceptional Cases in Clocks
CALENDARS: Definition of a Leap Year, Finding the Odd days, finding the Day of any Random Calendar Date, repetition of Calendar Years.
CUBES AND DICES: Finding the Minimum and Maximum Number of Identical Pieces and Cuts, Painting of Cubes and cuts, Problems on Dice.
VENN DIAGRAMS: Circular Representation of given words, Geometrical Representation of Certain class, Set theory based Problems.

TEXT BOOKS:
1. Verbal reasoning, GL Barrons, Pinterest-Latest Edition, 2019
2. A modern approach to logical reasoning & quantitative aptitude, R S Agarwal, S. Chand, Publications, Revised edition, 2019

REFERENCE BOOKS:
1. Quantitative aptitude, G.L Barrons, Pinterest,2019
2. Quantitative aptitude, Abhijit Guha, McGraw Hills- Edition 2019
3. Quantitative aptitude, U. Mohan Rao, SCITECH

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

B. Tech. III Year II Semester

L	T	P	C
3	0	0	3

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

1. Analyze all the types of measuring instruments and error compensations.
2. Discuss the operation of DC Crompton potentiometer; compare the CT and PT with phasor diagram.
3. Discuss and learn the concepts of power and energy measurement by using wattmeter and energy meter.
4. Outline the concept of DC and AC bridges for the measurement of resistance, inductance & capacitance.
5. Analyze the concepts of transducers and cathode ray oscilloscopes.

UNIT I

INTRODUCTION TO MEASURING INSTRUMENTS:

Classification-deflection, 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.

UNIT II

POTENTIOMETERS& INSTRUMENT TRANSFORMERS:

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. CT and PT- Ratio and Phase angle errors (of CT only).

UNIT III

MEASUREMENT OF POWER & ENERGY:

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 reactive power. Single phase Induction type energy meter driving and braking torques-errors and compensations testing by phantom loading using RSS meter. Three phase energy meter- Maximum demand meters.

UNIT IV

D.C BRIDGES & A.C BRIDGES:

Method of measuring low, medium, high resistances sensitivity of wheat- stone Bridge carey foster's Bridge, Kelvin's double bridge for measuring low resistance, measurement of high resistance-loss of charge method Measurement of Inductance Q Factor Maxwell's Bridge, Hay's bridge, Anderson's bridge, Owen's bridge. Measurement of capacitance and loss angle Desauty Bridge. Wien's Bridge Schering Bridge.

UNIT V

TRANSDUCERS & OSCILLOSCOPES:

Definition of transducers, classification of transducers, Advantages of Electrical transducers, characteristics and choice of transducers; Principle operation of LVDT and capacitor transducers, LVDT Applications, Strain guage and its principle of operation, guage factor, Thermistors, Thermocouples, Piezo electric transducers, photovoltaic, photo conductive cells, photo diodes.

CRO: Cathode ray oscilloscope cathode ray tube time base generator- horizontal and vertical amplifiers- Lissajous Patterns.

TEXT BOOKS:

1. A course in electrical and electronic measurements and instrumentation by A. K. Sawhney, Puneet Sawhney, Dhanpat Rai & Co.
2. Electrical and electronic measurements and instrumentation, R.K.Rajput, S.Chand& company Ltd.

REFERENCE BOOKS:

1. Electrical measurements and measuring instruments, Golding E.W, Widdis F.C, Publisher: AH Wheeler & Company.
2. Electrical and electronic measurements, G.K. Banerjee, PHI Learning Pvt. Ltd.
3. Electrical Measurements and Measuring Instruments, N. V. Suryanarayana, Tata McGraw Hill.

COMPUTER METHODS IN POWER SYSTEMS

B. Tech. III Year II Semester

L	T	P	C
3	0	0	3

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

1. Demonstrate the knowledge and ability to develop Y-bus and Z-bus matrices.
2. Know the importance of load flow studies and its importance.
3. Understand Per unit system
4. Compare various types of short-circuit faults.
5. Understand the power system steady state stability and transient state stability.

UNIT I

POWER SYSTEM NETWORK MATRICES:

Graph Theory: Definitions, Bus Incidence Matrix, Y-bus formation by Singular Transformation Methods and Direct Inspection 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 (Numerical Problems). Modification of Z-bus 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, classification of Buses and their relevance to Power Flow. **LOAD FLOW SOLUTION USING GAUSS SEIDEL METHOD:** Acceleration Factor, Load flow solution without and with 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 without and with PV Busses- Derivation of Jacobian Elements, Algorithm and Flowchart (Max. 3-Buses).

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. Needs and assumptions for short circuit analysis.

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 without and with fault impedance, Numerical Problems.

UNIT IV

STEADY STATE STABILITY ANALYSIS:

Elementary concepts of Steady State, Dynamic and Transient Stabilities. Description of Steady State Stability Power Limit, Transfer Reactance, Synchronizing Power Coefficient, Power Angle Curve and Determination of Steady State stability and methods to improve steady state stability.

UNIT V

TRANSIENT STABILITY ANALYSIS:

Derivation of Swing Equation. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Case study sudden loss of parallel lines, 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, Dr. N. V. Ramana, Pearson Education India.
2. Computer methods in power system analysis, Stagg and EL-Abiad, McGraw Hill

REFERENCE BOOKS:

1. Modern power system analysis, I. J. Nagrath & D.P. Kothari, Tata McGraw Hill Publishing Company-4th Edition
2. Power system analysis, A. Nagoorkani, RBA Publications-3rd Edition
3. Power system analysis and stability, S. S. Vadhera, Khanna Publications

POWER SEMICONDUCTOR DRIVES

B. Tech. III Year II Semester

L	T	P	C
3	0	0	3

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

1. Understand the concepts of the dynamics of electric drives and speed control of different types of DC drives.
2. Analyze four quadrant operation to control speed of DC drives using dual converters.
3. Examine four quadrant operation to control speed of DC drives using choppers.
4. Discuss speed control of induction motor drives.
5. Study speed control of synchronous motor drives.

UNIT I

CONTROL OF DC MOTORS THROUGH PHASE CONTROLLED RECTIFIERS:

Introduction to Thyristor controlled Drives, Single Phase semi and fully controlled converters connected to DC separately excited and DC series motors -continuous current operation output voltage and current waveforms- Speed and Torque expressions Speed Torque Characteristics- Problems on Converter fed DC motors. Three phase semi and fully controlled converters Connected to DC separately excited and DC series motors output voltage and current waveforms Speed and Torque expressions Speed Torque characteristics - Problems.

UNIT II

FOUR QUADRANT OPERATIONS 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 (1, 2, 4 QUADRANT OPERATIONS):

Single quadrant, Two quadrant and four quadrant chopper fed separately excited and series exacted motors Continuous current operation Output voltage and current wave forms Speed torque expressions speed torque characteristics Problems on Chopper fed DC Motors Closed Loop operation (Block Diagram Only).

UNIT IV

CONTROL OF INDUCTION MOTORS:

Variable voltage& Frequency Characteristics:

Control of Induction Motor by AC Voltage Controllers Waveforms speed torque 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 delves (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. Principle of operation of BLDC motor drive.

TEXT BOOKS:

1. Fundamentals of electrical drives, G. K. Dubey, Alpha Science International Limited-2nd Edition.
2. Power semiconductor drives, J.Gnanavadivel, Anuradha Publications.

REFERENCE BOOKS:

1. Power semiconductor drives, PV Rao, BS Publications.
2. Thyristor control of electric drives, Vedam Subramanyam, Tata McGraw Hill Publications.
3. A first course on electrical drives, S K Pillai, New Age International (P) Ltd-2nd Edition

SWITCH GEAR AND PROTECTION

B. Tech. III Year II Semester

L	T	P	C
3	0	0	3

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

1. Know basic working of circuit breaker and classification of circuit breakers.
2. Make out the application of different types of circuits breakers in power systems.
3. Understand Principle of operation of over current, directional, differential and distance relays.
4. Device protection methods for alternators, transformers, bus-bars.
5. Gain concept of neutral grounding and protection Method list from different types of surge.

UNIT I

CIRCUIT BREAKERS:

Circuit Breaker (CB) Elementary principles of arc interruption, Recovery Restriking Voltage and Recovery voltages–Restriking phenomenon Average and Max. RRRV Numerical problems- Current chopping and Resistance switching–CB ratings and specifications: Types and Numerical problems- Auto reclosing. Description and operation of following types Circuit Breaker: Minimum Oil Circuit Breaker, Air Blast Circuit Breaker–Vacuum and SF6 circuit breakers.

UNIT II

ELECTROMAGNETIC, STATIC RELAYS & NUMERICAL RELAYS:

Principle of operation and construction of attracted armature Balanced beam induction disc and induction cup relays Relays classification Instantaneous DMT and IDMT types Applications of relays: Over current/under voltage relays Directional relays Differential relays and percentage differential relays. Distance relays: Impedance Reactance Mho and offset Mho relays Characteristics of distance relays Comparison of numerical relays & static relays with electromagnetic relays.

UNIT III

GENERATOR & TRANSFORMER PROTECTION:

Protection of generators against stator faults Rotor faults and abnormal conditions restricted earth fault and inter turn fault protection Numerical examples on percentage windings unprotected. Protection of transformers: Percentage differential protection Numerical problems on Design of CT's ratio Buchholz relay protection.

UNIT IV

FEEDER AND BUS BAR PROTECTION& GROUNDING PROTECTION OF LINES:

Over current earth fault, Carrier current and three zone distance relay using impedance relays– Translay relay Protection of bus bars Differential protection.

NEUTRAL GROUNDING

Grounded & ungrounded neutral systems.-Effects of ungrounded neutral system performance. Methods of neutral grounding: Solid resistance, reactance-Arcing grounds& grounding practice.

UNIT V

PROTECTION AGAINST OVER VOLTAGE AND GROUNDING:

Generation of over voltages in power systems Protection against lightning over voltages Valve type and zinc–Oxide lighting arresters Insulation coordination BIL– impulse ratio. Earthing Practices in Substations.

TEXT BOOKS:

1. Switchgear and protection, Sunil. S.Rao, Khanna publishers.
2. Power system protection and switchear gear, Badriram, D. N. Viswakarma Tata McGraw Hill Education-2nd Edition.

REFERENCE BOOKS:

1. Electrical power systems, C. L. Wadhwa, New age international (P) limited-4th Edition.
2. A Textbook on power system engineering, M. L. Soni, P. V. Gupta, U. S. Bhatnagar, A. Chakrabarthy, Dhanapat Rai & Co pvt.ltd.
3. Principles of power system, V.K Mehtha & Rohit Mehtha, S.Chand company Pvt. Ltd-4th Edition.

INTEGRATED CIRCUITS AND APPLICATIONS
(Professional Elective - 2)

B. Tech. III Year II Semester

L	T	P	C
3	0	0	3

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

1. Remember the characteristics of different integrated circuits families.
2. Infer the different applications of operational amplifiers under different configurations.
3. Recognize the importance of special function integrated circuits on different engineering applications.
4. Interpret the need for data converters for real time applications.
5. Design and analysis of first order active filter and waveform generators using operational amplifiers.

UNIT I

INTEGRATED CIRCUITS:

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

UNIT II

OP-AMP AND APPLICATIONS:

Basic information of OP-AMP, ideal and practical OP-AMP, internal circuits, OP-AMP characteristics, DC and AC characteristics, 741 OP-AMP and its features, modes of operation-inverting, non-inverting, differential. Basic application of OP-AMP, instrumentation amplifier, ac amplifier, V to I and I to V converters, sample & hold circuits, multipliers and dividers, Differentiators and Integrators, Comparators, introduction to voltage regulators.

UNIT III

ACTIVE FILTERS & OSCILLATORS:

Introduction, 1st order LPF, HPF filters, Band pass, Band reject and all pass filters. Oscillator types and principle of operation RC, Wien and quadrature type, waveform generators triangular, saw tooth, square wave and VCO.

UNIT IV

TIMERS & PHASE LOCKED LOOPS:

Introduction to 555 timer, functional diagram, monostable and astable operations and applications, Schmitt Trigger. PLL introduction, block schematic, principles and description of individual blocks of 565.

UNIT V

D-A AND A-D CONVERTERS:

Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, Different types of ADCs - parallel comparator type ADC, counter type ADC, successive approximation ADC and slope ADC. DAC and ADC specifications.

TEXT BOOKS:

1. Linear integrated circuit, D. Roy Chowdhary, New Age International(p) Ltd-2nd Edition
2. Op-amps and linear Integrated Circuits, Ramakanth A. Gayakwad, PHI.

REFERENCES BOOKS:

1. Operational amplifiers and linear integrated circuits, R.F. Coughlin & Fredrick F. Driscoll, PHI.
2. Operational amplifiers and linear integrated circuits: Theory & Applications, Denton J. Daibey, TMH.
3. Digital fundamentals - Floyd and Jain, Pearson Education-8th Edition

ARTIFICIAL INTELLIGENCE TECHNIQUES IN ELECTRICAL ENGINEERING
(Professional Elective-2)

B. Tech. III Year II Semester

L	T	P	C
3	0	0	3

Course Objectives:

1. To locate soft commanding methodologies, such as artificial neural networks, fuzzy logic and genetic algorithms.
2. To observe the concepts of feed forward neural networks and about feedback neural networks.
3. To practice the concept of fuzziness involved in various systems and comprehensive knowledge of fuzzy logic control and to design the fuzzy control.
4. To analyze genetic algorithm, genetic operations and genetic mutations.

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

1. Understanding artificial neural networks.
2. Generalize feed forward neural networks, feedback neural networks and learning techniques.
3. Identify fuzziness involved in various systems and fuzzy set theory.
4. Discover fuzzy logic control for applications in electrical engineering.
5. Interpret genetic algorithm for applications in electrical engineering.

UNIT I
ARTIFICIAL NEURAL NETWORKS:
Introduction, Models of Neuron Network-Architectures Knowledge representation, Artificial Intelligence and Neural networks–Learning process-Error correction learning, Hebbian learning Competitive learning-Boltzman learning, supervised learning-Unsupervised learning Reinforcement learning-Learning tasks.

UNIT II
ANN PARADIGMS:
Multi-layer perceptron using Back propagation Algorithm (BPA), Self –Organizing Map (SOM), Radial Basis Function Network-Functional Link Network (FLN), Hopfield Network.

UNIT III
FUZZYLOGI
C:
Introduction Fuzzy versus crisp, Fuzzy sets-Membership function –Basic Fuzzy set operations, Properties of Fuzzysets Fuzzy Cartesian Product, Operations on Fuzzy relations Fuzzy logicFuzzy Quantifiers, Fuzzy Inference-Fuzzy Rule based system, Defuzzification methods.

UNIT IV
GENETIC ALGORITHMS:
Introduction-Encoding Fitness Function-Reproduction operators, Genetic Modeling Genetic operators-Cross over-Single site cross over, Two point cross over Multi point cross over Uniform cross over, Matrix cross over-Crossover Rate-Inversion & Deletion, Mutation operator Mutation Mutation Rate-Bit-wise operators, Generational cycle-convergence of Genetic Algorithm.

UNIT V
APPLICATIONS OF AI TECHNIQUES:
Load forecasting, Load flow studies, Economic load dispatch, Load frequency control, Single area system and two area system, Reactive power control, Speed control of DC and AC Motors.

TEXT BOOKS:

1. Neural networks, fuzzy logic and genetic algorithms, S.Rajasekaran and G.A.V.Pai PHI, New Delhi.
2. Neural networks: A comprehensive foundation, Simon O Haykin, International Edition- 2nd Edition.

REFERENCE BOOKS:

1. Neural computing theory & practice, P.D.Wasserman & Van Nostrand Reinhold, New York.
2. Neural network & fuzzy system, Bart Kosko, Prentice Hall.
3. Genetic algorithms, D.E.Goldberg, Pearson Education.

ENERGY AUDITING & CONSERVATION
(Open Elective-2)

B. Tech. III Year II Semester

L	T	P	C
3	0	0	3

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

1. Realize the need for energy auditing and conservation. Get awareness on types of energy audit; represent energy flows and energy consumption in tabular and graphical methods.
2. Understand and exploit energy saving opportunities in energy efficient motors and power factor improvement methods.
3. Learn energy auditing and conservation opportunities in HVAC systems with respect to energy efficient buildings.
4. Analyze economic viability with respect to real world problems using depreciation methods.
5. Know the check lists for energy conservation in boilers, heat pumps, cooling systems, compressors and fans.

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, and thermal power station.

UNIT II

ENERGY EFFICIENT MOTORS, POWER FACTOR IMPROVEMENT& LIGHTING:

Energy efficient motors, factors affecting efficiency, variable speed, variable duty cycle systems, effect of Voltage variation on motors, motor energy audit. Power factor- methods of improvement, location of capacitors, Pf with nonlinear loads- Good Lighting system design and practice, lighting control, lighting energy audit.

UNIT III

ENERGY EFFICIENT BUILDINGS:

Green Buildings, Intelligent Buildings, Rating of Buildings, Efficient use of Buildings, Ventilation Solar Passive Architecture. Adoption to sustainable resources such as PV modules, solar heating, Cooling Techniques, Energy audit and conservation opportunities.

UNIT IV

ECONOMIC ASPECTS AND ANALYSIS:

Economics Analysis-Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis-calculation of simple payback method, net present worth method-Applications of cycle costing analysis, return of investment.

UNIT V

ENERGY CONSERVATION OPPORTUNITIES:

Energy conservation checklist, Energy conservation opportunities in boilers, Heat pumps and cooling systems, chilled water Plants and Central air- conditioning systems, Water Heaters and coolers, Compressors and Fans.

TEXT BOOKS:

1. Energy management, W.R. Murphy and G. McKay Butter worth, Heinemann publications.
2. Energy efficient electric motors, John .C. Andreas, Marcel Dekker Inc Ltd-3rd Edition

REFERENCE BOOKS:

1. Energy management, Paul o' Callaghan, McGraw Hill Book company-1st Edition.
2. Energy management hand book, W.C.Turner, John Wiley and sons-7th Edition.
3. Energy management and good lighting practice: fuel efficiency - booklet1&2 - Great Britain Energy Efficiency Office.

PRINCIPLES OF ELECTRIC POWER UTILIZATION
(Open Elective - 2)

L	T	P	C
3	0	0	3

B. Tech. III Year II Semester

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

1. Understand terms and concepts of illumination.
2. Apply the concepts of different electric lamps and good lighting Practices for artificial lighting systems.
3. Understands the methods of electric heating and welding
4. Understands the concepts of different electric traction systems and existing traction system in India.
5. Analyze the mechanics of train movement.

UNIT I
ILLUMINATION FUNDAMENTALS:
Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light.

UNIT II
VARIOUS ILLUMINATION METHODS:
Discharge lamps, MV and SV lamps- comparison between tungsten filament lamps and fluorescent tubes, Basic Principles of Light Control, Types and design of lighting and flood lighting. Energy efficient Lights.

UNIT III
ELECTRIC HEATING & WELDING:
Advantages and methods of electric heating, resistance heating induction heating and dielectric heating. Electric Welding, resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. welding.

UNIT IV
ELECTRIC TRACTION - I:
System of electric traction and track electrification. Review of existing electric traction systems in India. Special features of traction motor, Methods of electric braking-plugging Rheostatic braking and regenerative braking.

UNIT V
ELECTRIC TRACTION – II:
Mechanics of train movement, Speed-time curves for different services- trapezoidal and quadrilateral speed time curves.

TEXT BOOKS:

1. Utilization of electrical power, Er. R. K. Rajput, Laxmi Publications (P) Ltd-1st Edition.
2. Utilization of electric power and electric traction, J.B.Gupta, S.K.Kataria & Sons publication-10th Edition.

REFERENCE BOOKS:

1. Utilization of electric energy, E. Openshaw Taylor, Orient Longman (P) Ltd
2. Generation, distribution and utilization of electrical energy, C.L.Wadhwa, New Age International (P) Ltd-3rd Edition.
3. Utilization of electric power, N. V. Suryanarayana, New Age International (P) Ltd.

CONTROL SYSTEMS AND SIMULATION LAB

B. Tech. III Year II Semester

L	T	P	C
0	0	2	1

Course Outcomes: Upon the completion of Laboratory course, the student should be able to

1. Examine the time response of second order systems, synchros, and truth tables verification by PLC.
2. Design of AC servomotor and DC servomotor to find out their transfer function practically.
3. Design of DC motor, DC generator, and finding out their transfer function practically.
4. Analyze magnetic amplifier characteristics.
5. Explain stability analysis through bode, Nyquist and root locus plots using MATLAB.

Any Ten of the following experiments are to be conducted

1. Time response of Second order system.
2. Characteristics of Synchros.
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple. Boolean expressions and application of speed control of motor.
4. Effect of feedback on DC servo motor.
5. Transfer function of DC motor.
6. Transfer function of DC Shunt generator.
7. Characteristics of magnetic amplifiers.
8. Characteristics of AC servo motor.
9. Simulation of Op-Amp based Integrator and Differentiator circuits.
10. Linear system analysis (Time domain analysis, Error analysis).
11. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using simulation software.
12. State space model for classical transfer function– Verification using simulation software.

POWER ELECTRONICS AND SIMULATION LAB

B. Tech. III Year II Semester

L	T	P	C
0	0	2	1

Course Outcomes: Upon the completion of Laboratory course, the student should be able to

1. Examine the characteristics of SCR, MOSFET, & IGBT, and analyze triggering circuits.
2. Analyze input and output chrematistics of AC-DC converters.
3. Synthesize input and output chrematistics of cyclo converters.
4. Examine input and output chrematistics of DC-DC Converters.
5. Design of converters and inverters using P-Spice software.

Any ten of the following experiments are required to be conducted.

1. Study of the characteristics of SCR, MOSFET & IGBT.
2. Gate Firing Circuits for SCRs (R- Triggering, RC Triggering & UJT Triggering).
3. Single Phase AC voltage Controller with R & RL Loads.
4. Single Phase fully Controlled Bridge Converter with R& RL Loads.
5. DC Jones Chopper with R & RL Loads.
6. Single Phase Parallel Inverter with R& RL Loads.
7. Single Phase Cyclo-Converter with R& RL Loads.
8. Single Phase Series Inverter with R& RL Loads.
9. Single Phase Half controlled converter with R Load.
10. Simulation of single-phase full converter using RLE loads and single-phase AC voltage controller using RLE loads.
11. Simulation of resonant pulse commutation circuit and Buck Chopper.
12. Simulation of single phase Inverter with PWM control.

PERSONALITY DEVELOPMENT AND BEHAVIOURAL SKILLS
(Common to all branches)

B. Tech. III Year II Semester

L	T	P	C
2	0	0	1

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

1. Practice optimistic attitude for an efficient socially viable and multi-faceted personality.
2. Demonstrate functions of non-verbal communication in formal context.
3. Build effective individual & team dynamics for professional accomplishments.
4. Analyze appropriate strategic Interpersonal Skills for productive workplace relationships.
5. Correspond in multiple contexts, for varied audiences, across genres and modalities.

UNIT I
PERSONALITY DEVELOPMENT:
Definition - Various Aspects of Personality Development - Behavioral Traits. Importance of Soft Skills for personal and professional development - Success stories.

UNIT II
NON VERBAL COMMUNICATION:
Kinesics, Haptics, Proxemics, Vocalics, Oculesics
Body Language in formal contexts such as Group Discussions, Presentations and Interviews.

UNIT III
TEAM DYNAMICS:
Different Types of Teams – Role of an individual – Communicating as a group or team leader. Individual Presentations/Team Presentation - Project Presentations- Case Studies.

UNIT IV
INTERPERSONAL SKILLS:
Time Management - Stress Management - Emotional Intelligence - Conflict Management - Relationship Management.

UNIT V
DIGITAL CORRESPONDENCE:
Role of Multimedia in Communication - Communication in a Digital Edge (Video Conference Etc.) Social Networking: Importance and Effects.

TEXT BOOKS:

1. Personality Development and Soft Skills, Preparing for Tomorrow, Shikha Kapoor-2nd Edition, 2020.

REFERENCE BOOKS:

1. Personality Development and Soft Skills, Barun, K Mitra, Oxford University Press-2nd Edition, 2016
2. Professional Ethics. R Subramanian, Oxford University Press-2nd Edition, 2015

COURSE STRUCTURE FOR B.TECH IV YEAR

B. Tech. IV Year I Semester

S. No	Course Category	Course Title	L	T	P	Credits
1	PC -14	Microprocessors and Interfacing Devices	3	0	0	3
2	PC -15	Power Systems Operation and Control	3	0	0	3
3	PE - 3	Electric Vehicles / Smart Grids	3	0	0	3
4	PE – 4	Electrical Distribution Systems/ Industrial Electrical Systems	3	0	0	3
5	OE-3	Electric Vehicles and Hybrid Vehicles/ Energy Storage Systems	3	0	0	3
6	PC Lab - 9	Microprocessors and Interfacing Lab	0	0	2	1
7	PC Lab - 10	Electrical Measurements Lab	0	0	2	1
8	-	Mini Project	0	0	0	3
Total			**15**	**0**	**4**	**20**

B. Tech. EEE IV Year II Semester

S. No	Course Category	Course Title	L	T	P	Credits
1	PC -16	Utilization of Electrical Energy	3	0	0	3
2	PC -17	Renewable Energy and Energy Storage Technologies	3	0	0	3
3	-	Technical Seminar	2	0	0	2
4	-	Comprehensive Viva-Voce	0	0	0	2
5	-	Major Project	0	0	0	10
Total			**8**	**0**	**0**	**20**

COURSE STRUCTURE (for FAST TRACK)

IV Year I Semester

S. No.	Course Category	Course Title	L	T	P	Credits
1	PC -14	Microprocessors and Interfacing Devices	3	0	0	3
2	PC -15	Power Systems Operation and Control	3	0	0	3
3	PE - 3	Electric Vehicles/ Smart Grids	3	0	0	3
4	PE – 4	Electrical Distribution Systems/ Industrial Electrical Systems	3	0	0	3
5	OE-3	Electric Vehicles and Hybrid Vehicles/ Energy Storage Systems	3	0	0	3
6	PC Lab – 9	Microprocessors and Interfacing Lab	0	0	2	1
7	PC Lab – 10	Electrical Measurements Lab	0	0	2	1
8	-	Mini Project		0	0	3
9	PC - 17	Renewable Energy and Energy Storage Technologies	3	0	0	3
Total			**18**	**0**	**4**	**23**

IV Year II Semester

S. No.	Course Category	Course Title	L	T	P	Credits
1	-	Technical Seminar	2	0	0	2
2	-	Comprehensive Viva Voce	0	0	0	2
3	-	Major Project	0	0	0	10
Total			**2**	**0**	**0**	**14**

MICROPROCESSORS AND INTERFACING DEVICES

B. Tech. IV Year I Semester

L	T	P	C
3	0	0	3

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

1. Illustrate the internal architecture of 8086 and 8051.
2. Understand and apply the fundamentals of assembly level programming of microprocessors and microcontroller.
3. Explain the use of interrupts with suitable examples.
4. Demonstrate the interfacing of various peripheral devices with the microprocessor 8086.
5. Design electrical circuitry to the Microcontroller I/O ports in order to interface the controller to external devices.

UNIT I

8086 MICROPROCESSOR:

Introduction to 8085 microprocessor- 8086 architecture- Functional Diagram- Register Organization- Memory segmentation- Memory addresses- physical memory organization- Signal descriptions of 8086-common function signals- Minimum and Maximum mode operation- Timing diagrams- Interrupt structure.

UNIT II

ASSEMBLY LANGUAGE PROGRAMMING USING 8086:

Instruction formats- addressing modes- instruction set- assembler directives-procedures-macros- Simple programs.

UNIT III

INTERFACING WITH 8086 MICROPROCESSOR:

8255 Programmable Peripheral Interface-Various Modes of Operation-Interfacing Keyboard-Display- Stepper motor- ADC-DAC-8259 Programmable Interrupt Controller -8257 DMA controller.

UNIT IV

COMMUNICATION INTERFACE:

Serial communication standards- serial data transfer schemes- 8251 USART architecture and Interfacing- RS 232-TTL to RS 232C and RS 232C to TTL conversion. Simple programs on serial data transfer-IEEE-488.

UNIT V

INTRODUCTION TO MICROCONTROLLERS:

Overview of 8051 microcontroller- Architecture I/O ports and Memory organization-addressing modes and instruction set of 8051- Simple programs.

TEXT BOOKS:

1. Advanced Microprocessors and Peripherals,A. K. Ray and K.M. Bhurchandi, TMH-3rd Edition 2017.
2. The 8051 Micro controller, Kenneth. J. Ayala, Cengage Learning -3rd Edition.

REFERENCE BOOKS:

1. The 8051Microcontrollers- Architecture and Programming and Applications,K.Uma Rao-Andhe Pallavi- Pearson- 2009.
2. Micro Computer System 8086/8088 Family Architecture- Programming and Design, Liu and GA Gibson- PHI- 2nd Edition.
3. Microcontrollers and Application,Ajay. V. Deshmukh, TMGH- 2005.

POWER SYSTEM OPERATION AND CONTROL

B. Tech. IV Year I Semester

L	T	P	C
3	0	0	3

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

1. Understand economic operation of power systems.
2. Analyze and compute optimal loading of generators for a particular load demand.
3. Develop mathematical models of turbines and governors.
4. Address load frequency control problem.
5. Explain how series and shunt compensation helps in reactive power control.

UNIT I

ECONOMIC OPERATION OF POWER SYSTEMS:

Optimal operation of Generators in Thermal Power Stations - heat rate Curve - Cost Curve - Incremental fuel and Production costs, input-output characteristics, Optimum generation allocation with line losses neglected. Optimum generation allocation including the effect of transmission line losses - Loss Coefficients, General transmission line loss formula.

UNIT II

HYDROTHERMAL SCHEDULING:

Optimal scheduling of Hydrothermal System: Hydroelectric power plant models, scheduling problems- Short term hydrothermal scheduling problem.

UNIT III

MODELING:

Modeling of Turbine: First order Turbine model, Block Diagram representation of Steam Turbines and Approximate Linear Models.

Modeling of Governor: Mathematical Modeling of Speed Governing System - Derivation of small signal transfer function.

Modeling of Excitation System: Fundamental Characteristics of an Excitation system, Transfer function, Block Diagram Representation of IEEE Type-1 Model

UNIT IV

LOAD FREQUENCY CONTROL:

Single Area Load Frequency Control: Necessity of keeping frequency constant. Definitions of Control area – Single area control – Block diagram representation of an isolated power system – Steady state analysis – Dynamic response – Uncontrolled case.

Load frequency control of 2-area system – uncontrolled case and controlled case, tie-line bias control. **Load Frequency Controllers**: Proportional plus Integral control of single area and its block diagram representation, steady state response – Load Frequency Control and Economic dispatch control.

UNIT V

REACTIVE POWER CONTROL:

Overview of Reactive Power control – Reactive Power compensation in transmission systems– advantages and disadvantages of different types of compensating equipment for transmission systems. Load compensation–Specifications of load compensator, Uncompensated and compensated transmission lines: Shunt and Series Compensation.

TEXT BOOKS:

1. Modern power system analysis, I.J. Nagarath & D.P. Kothari, Tata McGraw Hill Publishing Company Ltd -4th Edition.
2. Power systems analysis and stability, S.S Vadhera, Khanna Publications- 4th Edition.

REFERENCE BOOKS:

1. Power generation, operation and control, Allen J. Wood, Bruce F. Wollenberg, Gerald B. Sheble, Wiley -3rd Edition.
2. Power system stability and control, Prabha Kundur, McGraw Hill companies-Indean Edition.
3. Power system operation and control, Dr.K.Uma Rao, Wiley India Pvt.Ltd.

ELECTRIC VEHICLES
(Professional Elective – 3)

B. Tech. IV Year I Semester

L	T	P	C
3	0	0	3

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

1. Understand the components of Electric Vehicles and Fundamentals of Electric Vehicles.
2. Explain the types of batteries and principles of operation of batteries.
3. Pursue the basic principles of Electric motors which can be used in Electric vehicles.
4. Apprehend the transmission of the drive system and the components of transmission.
5. Understand the concepts of hybrid vehicles and analyze the performance of hybrid vehicles.

UNIT I
ELECTRIC VEHICLES:
Introduction to Electric Vehicles History of Electric and Hybrid Vehicles Components vehicle mechanics Roadway fundamentals vehicle kinetics Dynamics of vehicle motion Propulsion System Design.

UNIT II BATTERIES:
Basics Types Parameters Capacity Discharge rate State of charge State of Discharge Depth of Discharge Technical characteristics Battery pack Design Properties of Batteries. Fuel Cells - Types - Fuel Cell Electric Vehicle.

UNIT III
DC & AC ELECTRICAL MACHINES (Speed control Techniques):
Motor and Engine rating - Requirements - Speed control techniques of DC machines in Electric Vehicles Speed control techniques of three phase A/c machines Induction machines Permanent Magnet Machines, Switched Reluctance Machines.

UNIT IV
ELECTRIC VEHICLE DRIVE TRAIN:
Transmission configuration Components gears, differential, clutch, brakes regenerative braking-motor sizing Gear Ratio Torque speed characteristics EV Motor Sizing Initial Acceleration Rated Vehicle Velocity Maximum Velocity - Maximum Gradability.

UNIT V
HYBRID ELECTRIC VEHICLES:
Types of Hybrid Vehicles series and parallel Hybrid Electric Vehicles, series parallel configuration Internal Combustion Engines Reciprocating Engines Practical and Air-Standard Cycles Air- Standard Otto Cycle Air-Standard Diesel Cycle Example IC Engines in HEVs Design Drive train sizing of components.

TEXT BOOKS:

1. Electric & hybrid vehicles Design Fundamentals, Iqbal Hussain, CRC Press 2nd Edition.
2. Electric vehicle technology explained, James Larminie, John Lowry, Wiley & Sons-2nd Edition.

REFERENCE BOOKS:

1. Modern electric, hybrid electric, and fuel cell vehicles: fundamentals, theory and design, Mehrdad Ehsani, Yimin Gao, Ali Emadi, CRC Press - 2nd Edition.
2. Electric vehicle battery systems, Sandeep Dhameja - Kindle Edition.

SMART GRIDS
(Professional Elective-3)

B. Tech. IV Year I Semester

L	T	P	C
3	0	0	3

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

1. Report the features of Smart Grid.
2. Outline the smart grid architecture.
3. Optimize Transmission and Distribution systems.
4. Represent operation and importance of PMUs, WAMS.
5. Discover control techniques for micro grid and smart grid.

UNIT I
INTRODUCTION TO SMART GRID:
Introduction to Smart Grid Working definitions of Smart Grid and Associated Concepts - Smart Grid Functions Traditional Power Grid and Smart Grid - New Technologies for Smart Grid Advantages Indian Smart Grid - Key Challenges for Smart Grid.

UNIT II
SMART GRID ARCHITECTURE:
Components and Architecture of Smart Grid Design - Review of the proposed architectures for Smart Grid, fundamental components of Smart Grid designs Transmission Automation Distribution Automation - Renewable energy Integration.

UNIT III
COMPUTATIONAL TECHNIQUES FOR SMART GRIDS:
Tools and Techniques for Smart Grid: Computational Techniques Static and Dynamic Optimization Techniques Computational Intelligence Techniques Evolutionary Algorithms Artificial Intelligence techniques.
Distribution Generation Technologies: Introduction to Renewable Energy Technologies Micro grids - Storage Technologies Electric Vehicles and plug in hybrids Environmental impact and Climate Change Economic Issues.

UNIT IV
COMMUNICATION TECHNOLOGIES AND SMART GRID:
Introduction to Communication Technology Synchro-Phasor Measurement Units (PMUs) Wide Area Measurement Systems (WAMS) - Introduction to Internet of Things (IOT) - Applications of IOT in Smart Grid.

UNIT V
CONTROL OF SMART POWER GRID SYSTEM:
Load Frequency Control (LFC) in Micro Grid System Voltage Control in Micro Grid System Reactive Power Control in Smart Grid. Case Studies and Test beds for the Smart Grids.

TEXT BOOKS:

1. Smart grids, infrastructure, technology and solutions, Stuart Borlase, CRC Press - 1st Edition.
2. Renewable and efficient electric power system, Gil Masters, WileyIEEE Press 2nd Edition.

REFERENCE BOOKS:

1. Synchronized phasor measurements and their applications, A.G.Phadke and J.SThorp, Springer 2nd Edition.
2. Wind power in power systems, T. Ackermann, Hoboken, NJ, USA, John Wiley 2nd Edition.

ELECTRICAL DISTRIBUTION SYSTEMS
(Professional Elective-4)

B. Tech. IV Year I Semester

L	T	P	C
3	0	0	3

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

1. Distinguish between transmission and distribution systems. Classification of loads and their characteristics.
2. Understand design considerations of distribution feeders and substations.
3. Compute voltage drop and power loss in feeders.
4. Understand protection and coordination of distribution systems.
5. Examine the power factor improvement and voltage control.

UNIT I
INTRODUCTION & GENERAL CONCEPTS:
Introduction to distribution systems: Load modeling and characteristics. Coincidence factor, contribution factor, loss factor - Relationship between the load factor and loss factor.
Classification of Loads:
Residential, commercial, Agricultural, Industrial loads and their characteristics.

UNIT II
DISTRIBUTION FEEDERS & SUBSTATIONS:
Design Considerations Of Distribution Feeders: Radial and loop types of primary feeders, voltage levels, feeder loading; basic design practice of the secondary distribution system.
Substations:
Rating of distribution substation, service area with in primary feeders. Benefits derived through optimal location of substations.

UNIT III
DISTRIBUTION SYSTEM ANALYSIS:
Voltage drop and Power-Loss Calculations - Derivation for voltage drop and power loss in lines, manual methods of solution for radial networks, three phase balanced primary lines.

UNIT IV
PROTECTIVE DEVICES & CO-ORDINATION:
Objectives of distribution system protection, types of common faults and procedure for fault calculations.
Protective Devices - Principle of operation of Fuses, Circuit reclosure, and line sectionalizers, and circuit breakers.
Coordination of Protective devices -General co-ordination procedure.

UNIT V
VOLTAGE CONTROL & POWER FACTOR IMPROVEMENT:
Equipment for voltage control, effect of series capacitors, line drop Compensation, effect of AVB/AVR. Power-factor control using different types of power capacitors, shunt and series capacitors, effect of shunt capacitors (Fixed and Switched), capacitor allocation - Economic justification - Procedure to determine the best capacitor location.

TEXT BOOKS:

1. Electric power distribution system engineering, Turan Gonen, CRC Press-3rd Edition.
2. Electrical distribution systems, Dr.S.Siva Naga Raju, Dr.K.Shankar, Danapathi Rai Publications-2nd Edition.

REFERENCE BOOKS:

1. Electric power distribution, A.S. Pabla, Tata McGraw Hill Publishing Company 7th Edition.
2. Electrical power distribution systems, V.Kamaraju, Tata Mc Graw Hill Publishing company - 2nd Edition.
3. Electrical power distribution hand book, G. Ram Murthy, University Press-2nd Edition.

INDUSTRIAL ELECTRICAL SYSTEMS
(Professional Elective - 4)

B. Tech. IV Year I Semester

L	T	P	C
3	0	0	3

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

1. Review electrical wiring systems for residential, commercial and industrial consumers, representing the systems with standard symbols and drawings, SLD.
2. Distinguish residential and commercial electrical systems.
3. Identify various illumination schemes.
4. Select industrial load, motor, transformer and other components.
5. Carry out selection of industrial power back scheme.

UNIT I
ELECTRICAL SYSTEM COMPONENTS:
LT system wiring components, selection of cables, wires, switches, distribution box, metering system. Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices.

UNIT II
RESIDENTIAL AND COMMERCIAL ELECTRICAL SYSTEMS:
Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

UNIT III
ILLUMINATION AND INDUSTRIAL ELECTRICAL SYSTEM AUTOMATION:
Illumination Systems:
Understanding various terms regarding light, lumen intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.
Industrial Electrical System Automation:
Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.

UNIT IV
INDUSTRIAL ELECTRICAL SYSTEMS I:
HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction - kVAR calculations, types of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

UNIT V
INDUSTRIAL ELECTRICAL SYSTEMS II:
DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

TEXT BOOKS:

1. Electrical wiring, estimating & costing, S.L.Uppal and G.C.Garg, Khanna publishers-2008.
2. Electrical design, estimating & costing, K. B. Raina, New age International -2007.

REFERENCE BOOKS:

1. Web site for IS standards.
2. Residential commercial and industrial systems, H. Joshi, McGraw Hill Education-2008.
3. Electrical estimating and costing, S. Singh and R. D. Singh, Dhanpat Rai and Co-1997

ELECTRIC VEHICLES AND HYBRID VEHICLES
(Open Elective – 3)

B. Tech. IV Year I Semester

L	T	P	C
3	0	0	3

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

1. Understand the components of electric vehicles and fundamentals of electric vehicles.
2. Explain the types of batteries and principles of operation of batteries.
3. Pursue the basic principles of electric motors which can be used in electric vehicles.
4. Apprehend the transmission of the drive system and the components of transmission.
5. Understand the concepts of hybrid vehicles and analyze the performance of hybrid vehicles.

UNIT I
ELECTRIC VEHICLES:
Introduction to Electric Vehicles - History of Electric Vehicles -Components - vehicle mechanics - Roadway fundamentals - vehicle kinetics - Dynamics of vehicle motion - Propulsion System Design.

UNIT II BATTERIES:
Basics - Types - Parameters - Capacity - Discharge rate - State of charge - state of Discharge - Depth of Discharge - Technical characteristics - Battery pack Design - Properties of Batteries. Fuel Cells - Types - Fuel Cell Electric Vehicle.

UNIT III
DC & AC ELECTRICAL MACHINES (Basics Principle of Operation Only)**:**
Motor and Engine rating - Requirements - DC machines - Three phase A/c machines -Induction machines - Permanent Magnet Machines, Switched Reluctance Machines.

UNIT IV
ELECTRIC VEHICLE DRIVE TRAIN:
Transmission configuration - Components gears, differential, clutch, brakes regenerative braking- motor sizing- Gear Ratio Torque speed characteristics - EV Motor Sizing Initial Acceleration - Rated Vehicle Velocity - Maximum Velocity - Maximum Gradability.

UNIT V
HYBRID ELECTRIC VEHICLES:
Types of Hybrid Vehicles - series and parallel Hybrid Electric Vehicles, series- parallel configuration
- Internal Combustion Engines - Reciprocating Engines - Practical and Air-Standard Cycles - Air-Standard Otto Cycle - Air-Standard Diesel Cycle - Example IC Engines in HEVs - Design - Drive train - sizing of components.

TEXT BOOKS:

1. Electric & hybrid vehicles - design fundamentals, Iqbal Hussain, CRC Press 2nd Edition.
2. Electric vehicle technology explained, James Larminie and John Lowry, Wiley & Sons-2nd Edition.

REFERENCE BOOKS:

1. Modern electric, hybrid electric, and fuel cell vehicles: fundamentals,theory and design, Mehrdad Ehsani, Yimin Gao, Ali Emadi,", CRC Press - 2nd Edition.
2. Electric vehicle battery systems, Sandeep Dhameja - Kindle Edition.

ENERGY STORAGE SYSTEMS
(Open Elective – 3)

B. Tech. IV Year I Semester

L	T	P	C
3	0	0	3

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

1. Understand electrical energy storage technologies.
2. Explain the needs for electric energy storage.
3. Analyze the characteristics and features of energy from various sources.
4. Classify various types of energy storage and various devices used for the purpose.
5. Apply the same concepts to real time solutions like electric vehicles, smart grid and SCADA.

UNIT I
ELECTRICAL ENERGY STORAGE TECHNOLOGIES:
Characteristics of electricity - The roles of Electric Energy Storage - High generation cost during peak demand periods - Need for continuous and flexible supply - Long distance between generation and consumption- Congestion in power grids - Transmission by cables.

UNIT II
NEEDS FOR ELECTRICAL ENERGY STORAGE:
Emerging needs for Electric Energy Storage –Utilization of more renewable energy - less fossil fuel - Smart Grid uses - The roles of electrical energy storage technologies - The roles from the view point of a utility, from the view point of consumers, from the view point of generators of renewable energy.

UNIT III
FEATURES OF ENERGY STORAGE SYSTEMS:
Classification of Electric Energy Storage systems - Mechanical storage systems - Pumped Hydro Storage (PHS) - Compressed Air Energy Storage (CAES) - Flywheel Energy Storage (FES) - Electrochemical storage systems - Secondary batteries - Flow batteries - Chemical energy storage, - Hydrogen (H2) - Synthetic Natural Gas (SNG).

UNIT IV
TYPES OF ELECTRICAL ENERGY STORAGE SYSTEMS:
Electrical storage systems - Double-layer capacitors (DLC) - Superconducting magnetic energy storage (SMES) - Thermal storage systems - Standards for Electric Energy Storage - Technical comparison of EES technologies.

UNIT V
APPLICATIONS:
Present status of applications - Utility use (conventional power generation, grid operation & service) - Consumer use (uninterruptable power supply for large consumers) - New trends in applications - Renewable energy generation - Smart Grid - Smart Micro grid, Smart House - Electric vehicles - Management and control hierarchy of storage systems - Internal configuration of battery storage systems - External connection of EES systems - Aggregating EES systems and distributed generation (Virtual Power Plant) - Battery SCADA -Aggregation of many dispersed batteries.

TEXT BOOKS:

1. Electrical energy storage, IEC Market Strategy Board.
2. Energy storage benefits and market analysis,James M.Eyer, Joseph J.Jannucci and Garth. P.Corey, Sandia National laboratories, 2004.

REFERENCE BOOKS:

1. Energy storage for the electricity grid-benefits and market potential assessment guide, Jim Eyer, Garth Corey, Sandia National laboratories, 2010.
2. Power system energy storage technologies, Paul Breeze, Academic Press.
3. Electric energy storage systems, Przemyslaw Komarnicki,Pio Lombardi,Zbigniew Styczynski ,Springer.

MICROPROCESSORS AND INTERFACING LAB

B. Tech. IV Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes: Upon the completion of Laboratory course, the student should be able to

1. Apply the fundamentals of assembly level programming of microprocessor and microcontrollers.
2. Build a program on a microprocessor using instruction set of 8086 and 8051.
3. Evaluate assembly language program for 8086 and 8051 microcontroller to interface peripheral devices for simple applications.
4. Understand the development of prototype using combination of hardware and software.
5. Develop assembly language programs for various applications using 8051 microcontroller.

Note: Minimum of 12 experiments to be conducted.

8086 MICROPROCESSOR:

1. Arithmetic Operations (addition, subtraction, multiplication and division)
2. Addition of two BCD numbers.
3. Ascending order/Descending order of an array of numbers.
4. Finding Largest/Smallest numbers in an array of numbers.
5. Generation of Fibonacci series.
6. Hexadecimal to Decimal conversions
7. ASCII to Decimal conversion.
8. Program for sorting an array for 8086.
9. Program for searching for a number or character in a string for 8086.
10. Program for string manipulations for 8086.

MASM PROGRAMMING:

1. Arithmetic Operations (addition, subtraction, multiplication and division)
2. Addition of two BCD numbers.
3. Ascending order/Descending order of an array of numbers.
4. Finding Largest/Smallest numbers in an array of numbers.
5. Generation of Fibonacci series.
6. Hexadecimal to Decimal conversions.

ELECTRICAL MEASUREMENTS LAB

B. Tech. IV Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes: Upon the completion of Laboratory course, the student should be able to

1. Calibrate voltmeters, ammeters and single phase energy meter.
2. Design the scale of PMMC voltmeter, LPF wattmeter, LVDT and resistance strain gauge.
3. Calculate resistance, inductance and capacitance using bridges.
4. Compute 3-Φ reactive power.
5. Test single phase energy meter and dielectric strength of oil of transformers.

Any ten of the following experiments are required to be conducted

1. Calibration and Testing of single phase energy Meter.
2. Calibration of dynamometer type 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. LVDT and capacitance pickup - characteristics and Calibration.
10. Resistance strain gauge - strain measurements and Calibration.
11. Transformer turns ratio measurement using A.C. Bridge.
12. Measurement of ratio error and phase angle of given C.T. by comparison.

INDUSTRY ORIENTED MINI PROJECT

B. Tech. IV Year I Semester

L	T	P	C
0	0	0	3

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

1. Undertake problem identification, formulation and solution.
2. Know the key stages in the devolvement of the project.
3. Inculcate software / hardware implementation skills
4. Understand methodologies and professional way of documentation and communication
5. Extend / use the idea of mini project for major project.

Three or four students constituting a batch, work on an industry oriented topic approved by the head of the department and prepare a comprehensive mini project report after completing the work to the satisfaction.

The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department comprising of senior faculty covering all the domains of electrical and electronics engineering. The student is required to submit a mini project report at the end of the semester.

The project work done by the student is evaluated based on the report submitted along with an oral presentation, jointly by external and internal examiners constituted by the Head of the Department.

UTILIZATION OF ELECTRICAL ENERGY
(Professional Core – 16)

B. Tech. IV Year II Semester

L	T	P	C
0	0	0	3

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

1. Study illumination methods &solutions for illumination.
2. Acquire knowledge of methods of electrical heating & welding and related problems.
3. Understand various electrical drives, their characteristics & applications.
4. Analyze electric traction movement.
5. Observe the effect of varying acceleration and braking retardation.

UNIT I

ILLUMINATION:

Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light.

Various Illumination Methods:

Discharge lamps, MV and SV lamps comparison between tungsten filament lamps and fluorescent tubes, Energy Efficient Lamps -principle of operation, Basic principles of light control, Types and design of lighting and flood lighting.

UNIT II

ELECTRIC HEATING &WELDING:

Electric Heating:

Advantages and methods of electric heating, resistance heating induction heating and dielectric heating.

Electric Welding:

Resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding

UNIT III

ELECTRIC DRIVES:

Type of electric drives, choice of motor, starting and running characteristics, speed control, temperature rise, particular applications of electric drives, types of industrial loads, continuous, intermittent and variable loads, load equalization.

UNIT IV

ELECTRIC TRACTION-I:

System of electric traction and track electrification. Review of existing electric traction systems in India, Magnetic Levitation - Bullet Trains. Special features of traction motor, advantages of electric braking. Mechanics of train movement, Speed-time curves for different services – trapezoidal and quadrilateral speed time curves.

UNIT V

ELECTRIC TRACTION-II:

Calculations of tractive effort, power, specific energy consumption for given run, effect of varying acceleration and braking retardation, adhesive weight and braking retardation, adhesive weight and coefficient of adhesion.

TEXT BOOKS:

1. Utilisation of electric power, Er. R.K. Rajput, Laxmi Publications-2nd Edition
2. Utilisation of electric energy , E.Openshaw Taylor, Orient Longman-1st Edition

REFERENCE BOOKS:

1. Utilization of electrical power including electric drives and electric traction, N.V.Suryanarayana, New Age International (P) Limited Publishers, 1996.
2. Generation, distribution and utilization of electrical energy ,C.L. Wadhwa, New Age International (P) Limited-Revised 1st edition
3. Utilization of electric power & electric traction, J. B. Gupta, Katson Series, 2013

RENEWABLE ENERGY AND ENERGY STORAGE TECHNOLOGIES
(Professional Core- 17)

B. Tech. IV Year II Semester

L	T	P	C
3	0	0	3

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

1. Discuss the energy scenario and the consequent growth of the power generation from renewable energy sources.
2. Explain the basic physics of wind and wind generation topologies
3. Describe the basics of solar power generation
4. Express the power electronic interfaces for solar PV generation.
5. Generalize the issues related to the grid-integration of solar and wind energy systems.

UNIT I
PHYSICS OF WIND POWER:
History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions.

UNIT II
WIND GENERATOR TOPOLOGIES:
Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent- Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control.

UNIT III
THE SOLAR RESOURCE:
Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.
Solar thermal power generation:
Technologies - Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis

UNIT IV
SOLAR PHOTOVOLTAIC:
Technologies - Amorphous, mono crystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control.

UNIT V
ENERGY STORAGE TECHNOLOGIES:
Role of Electrical Energy storage system -Electro chemical storage systems, secondary batteries, Management and control hierarchy of storage systems - Internal configuration of battery storage systems, design of electric energy storage system for solar and wind plants (block diagram).

TEXT BOOKS:

1. Renewable energy technologies:A practical guide for beginners, Chetan Singh Solanki, PHI,2008
2. Wind power in power systems, T. Ackermann, John Wiley and Sons Ltd., 2005.

REFERENCE BOOKS:

1. Solar energy: Principles of thermal collection and storage, S.P.Sukhatme, McGraw Hill, 1984.
2. Grid integration of wind energy conversion systems, H. Siegfried and R. Waddington, John Wiley and Sons Ltd., 2006.
3. Renewable energy applications, G. N.Tiwari and M. K. Ghosal Narosa Publications, 2004.

TECHNICAL SEMINAR

B. Tech. IV Year II Semester

L	T	P	C
2	0	0	2

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

1. Identify promising new direction of various cutting edge technologies in electrical and electronics domain.
2. Do literature survey using library resources, internet, technical journals for a thrust area.
3. Prepare a technical report and present with the latest tools of presentations.
4. Enhance the skills of self-study and lifelong learning.

METHOD OF EVALUATION:

During the seminar session each student is expected to prepare and present a topic on engineering / technology, for duration of about 8 to 10 minutes. In a session of two periods per week, 15 students are expected to present on the topic chosen and approved. Each student is expected to present before the end of the semester and his/her performance is evaluated based on the choice of the topic, content of the presentation, preparation of the presentation and quires answered. At the end of the semester, he / she have to submit a report on his / her topic of seminar for evaluation. A Faculty guide is to be allotted for guidance and monitoring the progress of the work done by the student. Evaluation is 100% internal.

COMPREHENSIVE VIVA VOCE

B. Tech. IV Year II Semester

L	T	P	C
0	0	0	2

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

1. Acknowledge the understanding level in various areas of electrical and electronics engineering.
2. Prepare comprehensively to answer question from all the courses studied.
3. Attain oral presentation skills by answering question in precise and concise manner.
4. Preparedness to face interviews both in the academic and industrial sector.
5. Gain self-confidence and inter personal skills.

Comprehensive Viva-Voce will be conducted by a committee consisting of head of the department and two senior faculty members of the department. The comprehensive Viva-Voce is intended to assess the student's understanding of the subjects he/ she studied during the course of study.

MAJOR PROJECT

B. Tech. IV Year II Semester

L	T	P	C
0	0	0	10

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

1. Develop comprehensive solution to issues identified in previous semester project work.
2. Formulate and develop a design proposal on a problem in area of interest.
3. Apply technical / managerial skills for analysis, design, simulation and modeling of various real time problems in the domain of electrical and electronic engineering.
4. Synthesize the results of detailed analytical studies conducted.
5. Present he or her work in a conference or publish work in a peer reviewed journal

Three or four students constituting a batch, work on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor.

The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is submitted by the student before the end of the semester. The project work is evaluated based on the project report submitted along with an oral presentation on the work done jointly by external and internal examiners constituted by the Head of the Department.