CURRICULUM - 2023

C -23

DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

STATE BOARD OF TECHNICAL EDUCATION & TRAINING

ANDHRA PRADESH

DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING
CURRICULUM- 2023 (C-23)

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PREAMBLE

Technical Education is a key driver of economic development and plays a crucial role in providing individuals with the skills and knowledge necessary to thrive in the workplace. As technological advancements continue to reshape industries and create new opportunities, it is critical that technical education curricula remain relevant and up-to-date.

The curriculum has been designed with this in mind, with a focus on practical skills, critical thinking, and problem-solving. We believe that these skills are essential for success in both academic and professional spheres. The revamping of the technical education curriculum is made with collaborative effort from educators, industry experts, policymakers, and students.

At the heart of the curriculum, is the belief that the technical education should be **student-centered**, empowering learners to take ownership of their learning and pursue their passions. We aim to create a learning environment that is safe, supportive, and nurturing, where every student has the opportunity to reach their fullest potential. We acknowledge that learning is a lifelong journey, and our curriculum is designed to provide a solid foundation for continued growth and development. We hope that our students will not only leave with a diploma but with employability and passion for learning.

The State Board of Technical Education and Training, (SBTET) AP, has been offering Diploma programmes to meet the above said aspirations of the stake holders: industries, students, academia, parents and the society at large. **The Curriculum should be flexible, adaptable, and responsive to the changing needs of the industry and society.** As such, it has been the practice of SBTET, A.P., to keep the curriculum abreast with the advances in technology through systematic and scientific analysis of current curriculum and bring out an updated revised version at regular intervals.

The design of Curriculum C-23 was started in the month of January - 2023. Feedback was collected from all stake holders: Students, Lecturers, Senior Lecturers, Head of Sections and Principals for all programmes for this purpose. Accordingly, a workshop was convened on 15th February 2023 by Smt. C. Naga Rani, I.A.S, Director of Technical Education & Chairperson, SBTET, AP to discuss on revamping of C-20 curriculum to meet the needs of industries and for improvement of placements.

The meeting was attended by Sri. Saurab Gaur, I.A.S, Principal Secretary, Skill Development & Training, Smt. Lavanya Veni, I.A.S, Director, Employment & Training. Thirteen Representatives from Industries and Fourteen Academicians from Higher Level Institutions and officials of ITI, Skill Development, CTE & SBTET attended the workshop.

Smt. C Naga Rani, I.A.S., Commissioner of Technical Education while addressing in the workshop, emphasized the necessity of industrial training and on-hand experience, that the students need to undergo to support the industries and the Gaps in the Curriculum need

to be fixed to make the students passionate to work in the industry in order to support economy of the country.

The committees of each branch consisting of experts from Industries, Higher Level Institutions and Faculty of Polytechnics are informed to study the possibility of incorporating the following aspects while preparation of the curriculum so as to improve employability.

- **To bring out industry-oriented Diploma Engineers.**
- **Internet of Things (IoT) for all branches**
- **Theoretical & Practical subjects 50: 50 Ratio**
- **Industry 4.0 concepts.**
- **5G Technology.**
- **Critical Thinking (Quantitative Aptitude, Data Interpretation, Quantitative reasoning etc) to face the written tests conducted by the industries during placements.**

In continuation, series of workshops with subject experts followed in the subsequent weeks for thorough perusal for preparation of draft curriculum. Also, the suggestions received from representatives from various industries, academic experts from higher level institutions, subject experts from Polytechnics, have been recorded, validated for incorporation into the **Curriculum C-23.** Finally, the draft curriculum was sent to academicians of higher-level institutions, industrial experts for Vetting.

The design of new Curricula C-23 for different diploma programmes has thus been finalised with the active participation of the members of the faculty teaching in the Polytechnics of Andhra Pradesh, and duly reviewed by Expert Committee constituted of academicians and representatives from industries. Thus, the primary objective of the curriculum change is to produce employable diploma holders in the country by correlating the growing needs of the industries with relevant academic input.

The outcome-based approach as given by NBA guidelines has been followed throughout the design of this curriculum and designed to meet the requirements of NBA Accreditation, too.

The Revised Curriculum i.e., Curriculum–2023 (C-23) is approved by 45th Academic Committee of SBTET, A.P for its implementation with effect from Academic Year 2023-24. Also, the SBTET, A.P under the aegis of the Department of Technical Education, Andhra Pradesh in it's 62nd Board Meeting held on 13-07-2023 (vide item no: 17) Approved to update the Polytechnic Curriculum C-23 with effect from the academic year 2023-2024 onwards after revamping the present C-20 curriculum, to meet the latest industrial technological developments including Industry 4.0 concepts.

2. HIGHLIGHTS OF CURRICULUM C-23

The following Courses/ Topics are incorporated in this curriculum C-23 as per the suggestions received from Industrial Experts, Faculty of Higher Level Institutions and Polytechnics to improve the Employability Skills of the Polytechnic Students.

1. Duration of course for regular Diploma is 3 years.
2. The Curriculum is prepared in Semester Pattern. However, First Year is maintained as Year-wise pattern.
3. 6 Months Industrial training has been introduced for 3 years Diploma Courses in VI semester.
4. Updated subjects/topics relevant to the industry are introduced in all courses at appropriate places.
5. The policy decisions taken at the State and Central level with regard to environmental science are implemented by including relevant topics in Chemistry. This is also in accordance with the Supreme Court guidelines issued in Sri Mehta's case.
6. Keeping in view the increased need of communication skills which is playing a major role in the success of Diploma Level students in the industries, emphasis is given for learning and acquiring listening, speaking, reading and writing skills in English. Further as emphasized in the meetings, Communication Skills lab and Life Skills lab are continuing for all the branches.
7. CAD specific to the branch has been given emphasis in the curriculum. Preparing drawings using CAD software has been given more importance.
8. Upon reviewing the existing C-20 curriculum, it is found that the theory content is found to have more weightage than the Practical content. In C-23 curriculum, more emphasis is given to the practical content in Laboratories and Workshops, thus strengthening the practical skills. The ratio of Theory & Practicals is 50:50.
9. With increased emphasis for the student to acquire Practical skills, the course content in all the subjects is thoroughly reviewed and structured as outcome based than the conventional procedure based.
10. Curriculum of Laboratory and Workshops have been thoroughly revised based on the suggestions received from the industry and faculty, for better utilization of the equipment available in the Polytechnics. The experiments /exercises that are chosen for the practical sessions are identified to confirm to the field requirements of industry.
11. The theory and practical subjects are restructured to find room for new theory and practical subjects to meet the present the industrial needs.
12. As electric vehicles are the key technology to decarbonise road transport, it is important to learn about EV Technology. Hence, to meet the need of present technology a new subject titled "ELECTRIC VEHICLE TECHNOLOGY" is introduced in V semester.

13. A new laboratory titled "HYBRID POWER SYSTEMS LABORATORY" is introduced in IV semester in which industrial visits are made compulsory to bridge the gap between classroom learning and real-world circumstances and to aware the latest trends in industries which facilitates the students for better understanding of power system concepts.
14. To make the students effective and efficient in all aspects, three periods per week are allotted in every year/semester for STUDENT CENTRIC ACTIVITY in which student will be trained for placements or make use of library or participate in sports & games/clean & green etc.

SPECIFIC CHANGES INCORPORATED IN PRESENT CURRICULUM C-23

a) The number of theory subjects in each semester is limited to 05 only by restructuring the related subjects/topics and deleting repeated/higher order topics. Similarly, the relevant laboratories are restructured to find room for new laboratories.
b) The duration of engineering drawing is made 03 periods by reducing the syllabus which is not necessary for Electrical & Electronics Engineering students.
c) To boost the technical knowledge for better understanding of theory concepts the ratio of Theory & Practical is made 50:50 in this C-23 curriculum.
d) The Electrical Engineering Drawing I & II are restructured and made into one single electrical drawing subject by deleting the topics which cover in theory subjects to find space for introducing new laboratories.
e) A new laboratory EE-410 is introduced in IV semester titled with HYBRID POWER SYSTEM LABORATORY in which power systems practicals are introduced.
f) Industrial visits play a key role for technical students which help to bridge the gap between classroom learning and real-world job circumstances. Keeping this in view, the industrial visits are made compulsory in EE-410, HYBRID POWER SYSTEM LABORATORY and proper weightage is given for industrial visits.
g) A new theory subject titled ELECTRIC VEHICLE TECHNOLOGY, EE-502 is introduced in V semester in which EV technology and battery technology topics are introduced to meet the present industrial needs.
h) MATLAB practicals are introduced in MATLAB PRACTICE LABORATORY, EE-506 in V semester in which simulation practicals are incorporated.
i) SCADA practicals have been incorporated in PLC & SCADA laboratory, EE-507 in V semester to throw light on importance of SCADA in power system.

3. ACKNOWLEDGEMENTS

The Members of the working group are grateful to Smt C. Naga Rani I.A.S., Commissioner of Technical Education & Chairman of SBTET, for continuous guidance and valuable inputs during process of revising, modifying and updating the Curriculum C-20 to Curriculum C-23.

We are grateful to Sri. S. Suresh Kumar, I.A.S, Principal Secretary, Skills Development & Training for his valuable suggestions to bring the revamped curriculum C-23 in to a final form to meet latest Industry 4.0 concepts.

We are grateful to Sri. Saurab Gaur, I.A.S, former Principal Secretary, Skills Development & Training who actively participated in the Industry-Academia workshop conducted on 15th February, 2023 and offered valuable suggestions and insights into the learning needs and preferences so that the curriculum is engaging, inclusive, and effective.

It is pertinent to acknowledge the support of the following in the making of Curriculum C-23. A series of workshops in different phases were conducted by SBTET, AP, Guntur involving faculty from Polytechnics, Premier Engineering Colleges & representatives from various Industries and Dr. C. R. Nagendra Rao, Professor & Head, NITTTR-ECV to analyse the Previous C-20 Curriculum and in designing of C-23 Curriculum, is highly appreciated and gratefully acknowledged.

We also extend our sincere thanks to Sri. V. Padma Rao, Joint Director of Technical Education, Sri K.V. Ramana Babu, Secretary, SBTE&T, Andhra Pradesh, Sri K. Vijaya Bhaskar, Deputy Director (Academic) , Andhra Pradesh, officials of Directorate of Technical Education and the State Board of Technical Education, Andhra Pradesh and all teaching fraternity from the Polytechnics who are directly or indirectly involved in preparation of the curricula.

4. RULES AND REGULATIONS OF C-23 CURRICULUM

Duration and pattern of the courses

All the Diploma programs run at various institutions are of AICTE approved 3 years or 3½ years duration of academic instruction. All the Diploma courses are run on year wise pattern in the first year, and the remaining two or two & half years are run in the semester pattern. In respect of few courses like Diploma in Bio-Medical course, the training will be in the seventh semester. **Run-through system is adopted for all the Diploma Courses, subject to eligibility conditions.**

Procedure for Admission into the Diploma Courses:

Selection of candidates is governed by the Rules and Regulations laid down in this regard from time to time.

a) Candidates who wish to seek admission in any of the Diploma courses will have to appear for the Common Entrance Test for admissions into Polytechnics (POLYCET) conducted by the State Board of Technical Education and Training, Andhra Pradesh, Vijayawada. Only the candidates satisfying the following requirements will be eligible to appear for the Common Entrance Test for admissions into Polytechnics (POLYCET).
    a. The candidates seeking admission should have appeared for S.S.C examination, conducted by the Board of Secondary Education, Andhra Pradesh or equivalent examination thereto, at the time of applying for the Common Entrance Test for admissions into Polytechnics (POLYCET). In case of candidates whose results of their Qualifying Examinations is pending, their selection shall be subject to production of proof of their passing the qualifying examination in one attempt or compartmentally at the time of admission.
    b. Admissions are made based on the merit obtained in the Common Entrance Test (POLYCET) and the reservation rules stipulated by the Government of Andhra Pradesh from time to time.
    c. For admission into the following Diploma Courses for which entry qualification is 10+2, candidates need not appear for POLYCET. A separate notification will be issued for admission into these courses.
        i). D.HMCT ii). D. Pharmacy

Medium of Instruction

The medium of instruction and examination shall be English.

Permanent Identification Number (PIN)

A cumulative / academic record is to be maintained of the Marks secured in sessional work and end examination of each year for determining the eligibility for promotion etc., A Permanent Identification Number (PIN) will be allotted to each admitted candidate to maintain academic records.

Number of Working Days Per Semester / Year:

- **a)** The Academic year for all the Courses shall be in accordance with the Academic Calendar.
- **b)** The Working days in a week shall be from Monday to Saturday
- **c)** There shall be 7 periods of 50 minutes duration each on all working days.
- **d)** The minimum number of working days for each semester / year shall be 90 / 180 days excluding examination days. If this prescribed minimum is not achieved due to any reason, special arrangements shall be made to conduct classes to complete the syllabus.

Eligibility (Attendance to Appear for the End Examination)

a) A candidate shall be permitted to appear for the end examination in all subjects, if he or she has attended a minimum of 75% of working days during the year/Semester.

b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester or 1st year may be granted on medical grounds.

c) A stipulated fee shall be payable towards condonation for shortage of attendance.

d) Candidates having less than 65% attendance shall be detained.

e) Students whose shortage of attendance is not condoned in any semester / 1st year and not paid the condonation fee in time are not eligible to take their end examination of that class and their admissions shall stand cancelled. They may seek re-admission for that semester / 1st year when offered in the next subsequent academic semester/year.

For INDUSTRIAL TRAINING:

i) During Industrial Training the candidate shall put in a minimum of 90% attendance.

ii) If the student fails to secure 90% attendance during industrial training, the student shall reappear for 6 months industrial training at his own expenses.

Readmission

Readmission shall be granted to eligible candidates by the respective Principal/ Regional Joint Director.

- **a)** (i) Within 15 days after commencement of class work in any semester (Except Industrial Training).
  (ii) For Industrial Training: before commencement of the Industrial training.
- **b)** Within 30 days after commencement of class work in any year (including D. Pharmacy course or first year course in Engineering and Non-Engineering Diploma streams). Otherwise, such cases shall not be considered for readmission for that semester / year and are advised to seek readmission in the next subsequent eligible academic year.
- **c)** The percentage of attendance of the readmitted candidates shall be calculated from the first day of beginning of the regular class work for that year / Semester,

as officially announced by CTE/SBTET but not from the day on which he/she has actually reported to the class work.

Scheme of Evaluation

a) First Year

Theory Courses: Each Course carries Maximum marks of 80 with an end examination of 3 hours duration, along with internal assessment for Maximum of 20 marks. (Sessional marks). However, there are no minimum marks prescribed for sessionals.

Laboratory Courses: There shall be 40/20 Marks for internal assessment i.e. sessional marks for each practical Course with an end examination of 3 hours duration carrying 60/30 marks. However, there are no minimum marks prescribed for sessional.

b) III, IV, V, VI and VII Semesters:

Theory Courses: End semester evaluation shall be of 3 hours duration and for a maximum of 80 marks.

Laboratory Courses: Each Course carry 60/30 marks of 3 hours duration 40/20 sessional marks.

Internal Assessment Scheme

a) Theory Courses: Internal assessment shall be conducted for awarding Sessional marks on the dates specified. **Three-unit tests shall be conducted for I year students and two Unit Tests for semesters. The details are presented below.**

S. No.	Type of Assessment	Weightage Assigned
(i)	Testing of knowledge through mid-examination for year/sem as (Mid-1+Mid-2+Mid3) or (Mid-1 + Mid-2)	40
(ii)	Assignments	5
(iii)	*Dynamic Learning activities: Project Work/ Seminar/Tech-fest/Group Discussion, Quizzes etc./Extra-curricular activities/NSS/NCC/ IPSGM/Cleaning & Greening of Campus etc.*	*5*
	T O T A L	50

Internal Assessment shall be of 90 minutes duration and for a maximum of 40 marks for each test.

At least one assignment should be completed for each unit which carries 10 marks. The total assignment marks should be reduced to 5.

The dynamic learning activity is to be conducted which carries 10 marks. The total marks should be reduced to 5.

The total 50 marks assigned to internal assignment is to be scaled down to 20 marks.

b) Practical Courses:

(i) Drawing Courses:

The award of Sessional marks for internal Assessment shall be as given in the following table

Distribution of Marks for the Internal Assessment Marks			
First Year (Total:40 Marks)		**Semesters (Total:40 Marks)**	
Max:20 Marks	Max:20 Marks	Max:20 Marks	Max:20 Marks
From the Average of THREE Unit Tests.	From the Average of Assessment of Regular Class work Exercises.	From the Average of TWO Unit Tests.	From the Average of Assessment of Regular Class work Exercises.

- For first year engineering drawing each unit test will be conducted for a duration of 2 hours with maximum marks of 40.
- (Part - A: 4 questions x 5 marks = 20 Marks; Part –B: 2 questions x 10 marks = 20 marks).
- For the semester drawing examinations, Two Unit tests shall be conducted as per the Board End Examination Question Paper Pattern.
- All Drawing exercises are to be filed in serial order and secured for further scrutiny by a competent authority

(ii) Laboratory Courses:

(a) Student's performance in Laboratories / Workshop shall be assessed during the year/ semester of study for 40 marks in each practical Course.

(b) Evaluation for Laboratory Courses, other than Drawing courses:

i. Instruction (teaching) in laboratory courses (except for the course on Drawing) here after shall be task/competency based as delineated in the Laboratory sheets, prepared by SBTET, AP & NITTTR- ECV and posted in SBTET website.
ii. Internal assessment for Laboratory shall be done on the basis of task/s performed by the student as delineated in the laboratory sheets, prepared by SBTET, AP & NITTTR- ECV and posted in AP, SBTET website.
iii. Question paper for End semester Evaluation shall also be task/s based and shall be prepared and distributed by SBTET as done in case of theory courses be prepared as per SBTET rules in vogue.

c) Internal assessment in Labs / workshops / Survey field work etc., during the course of study shall be done and sessional marks shall be awarded by the concerned Teacher.

d) For practical examinations, except in drawing, there shall be two examiners. External examiner shall be appointed by the Principal in consultation with

respective Head of Section preferably choosing a qualified person from in the order of preference.

i) Nearby Industry

ii) Govt / Semi Govt organization like R & B, PWD, PR, Railways, BSNL, APSRTC, APSEB etc.

iii) Govt / University Engg College.

iv) HoD/Senior Lecture (Selection Grade-II) from the Govt. Polytechnic

Internal examiner shall be the person concerned with internal assessment as in **(a)** above. The end examination shall be held along with all theory papers in respect of drawing.

e) Question Paper for Practicals: Question paper should cover (the experiments / exercise prescribed to test various) skills like handling, manipulating, testing, trouble shooting, repair, assembling and dismantling etc., from more than one experiment / exercise

f) Records pertaining to internal assessment marks of both theory and practical Courses are to be maintained for official inspection.

g) In case of Diploma programs having Industrial Training, Internal Assessment and Summative Evaluation, shall be done as illustrated in the following table:

Assessment no	**Upon completion of**	**By**	**Based on**	**Max Marks**
1	12 weeks	1. The faculty concerned (Guide) and 2. Training in charge (Mentor) of the industry	Learning outcomes as given in the scheme of assessment, for Industrial Training	120
2	22 weeks			120
3. Final summative Evaluation	24 weeks	1. The faculty member concerned, 2. HoD concerned and 3. An external examiner	1.Demonstration of any one of the skills listed in learning outcomes	30
			2.Training Report	20
			3.Viva Voce	10
			TOTAL	**300**

h) Each staff member including Head of Section shall be assigned a batch of students 10 to 15 for making assessment during industrial training.

Minimum Pass Marks

a) Theory Examination:

For passing a theory Course, a candidate has to secure a minimum of 35% in end examination and a combined minimum of 35% of both Sessional and end examination marks put together.

b) Practical Examination:

For passing a practical Course, a candidate has to secure a minimum of 50% in end examination and a combined minimum of 50% of both sessional and practical end examination marks put together. In case of D.C.C.P., the pass mark for typewriting and short hand is 45% in the end examination. There are no sessional marks for typewriting and Shorthand Courses of D.C.C.P course.

C) Industrial Training:

I. Monitoring: Similar to project work each teacher may be assigned a batch of 10-15 students irrespective of the placement of the students to facilitate effective monitoring of students learning during industrial training.

II. Assessment: The Industrial training shall carry 300 marks and pass marks is 50% in assessments at industry (first and second assessment) and final summative assessment at institution level put together i.e. 150 marks out of 300 marks. And also student has to secure 50% marks in final summative assessment at institution level.

III. In-Plant Industrial Training for 3-Year Diploma (C-23) Courses is scheduled as per the Academic Calendar of the SBTET every year.

Provision for Improvement

Improvement is allowed only after he / she has completed all the Courses from First Year to Final semester of the Diploma.

a) Improvement is allowed in any 4 (Four) Courses of the Diploma.
b) The student can avail of this improvement chance **ONLY ONCE**, that too within the succeeding two examinations after the completion of Diploma. However, the duration including Improvement examination shall not exceed **FIVE** years from the year of first admission.
c) No improvement is allowed in Practical / Lab Courses or Project work or Industrial Training assessment. However, improvement in drawing Course(s) is allowed.
d) If improvement is not achieved, the marks obtained in previous Examinations hold good.
e) Improvement is not allowed in respect of the candidates who are punished under Mal-practice in any Examination.
f) Examination fee for improvement shall be paid as per the notification issued by State Board of Technical Education and Training from time to time.
g) All the candidates who wish to appear for improvement of performance shall deposit the original Marks Memos of all the years / Semesters and also original Diploma Certificate to the Board. If there is improvement in performance of the current examination, the revised Memorandum of marks and Original Diploma Certificate will be issued, else the submitted originals will be returned.

Rules of Promotion From 1ST YEAR TO 3rd, 4th, 5th, 6th and 7th Semesters:

A) For Diploma Courses of 3 Years duration

i). A candidate shall be permitted to appear for first year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds up to 10%) and pay the examination fee.

ii) A candidate shall be promoted to 3rd semester if he/she puts the required percentage of attendance in the first year and pays the examination fee. A candidate who could not pay the first-year examination fee has to pay the promotion fee as prescribed by State Board of Technical Education and Training, AP from time to time before commencement of 3rd semester.

A candidate is eligible to appear for the 3rd semester examination if he/she puts the required percentage of attendance in the 3rd semester and pays the examination fee.

iii) A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and pay the examination fee. A candidate, who could not pay the 3rd semester exam fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training AP from time to time before commencement of 4th semester. A candidate is eligible to appear for the 4th semester examination if he/she puts the required percentage of attendance in the 4th semester and pays the examination fee.

iv) A candidate shall be promoted to 5th semester provided he / she puts the required percentage of attendance in the 4th semester and pays the examination fee. A candidate, who could not pay the 4th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5th semester.

A candidate is eligible to appear for the 5th semester examination if he/she puts the required percentage of attendance in the 5th semester and pays the examination fee.

v) A candidate shall be sent to Industrial training / VI semester provided he/she puts in the required percentage of attendance in the 5th semester and pay the examination fee/ promotion fee as prescribed by SBTET.
A candidate is eligible to appear for Industrial Training assessment (Seminar/Viva-voce) puts the required percentage of attendance, i.e., 90% in 6th semester Industrial Training.

For IVC & ITI Lateral Entry students:

i.) A candidate shall be permitted to appear for Third Semester examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds up to 10%) and pay the examination fee for Third semester.

ii) A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and pay the examination fee. A candidate, who could not pay the 3rd semester exam fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training AP from time to time before commencement of 4th semester.

A candidate is eligible to appear for the 4th semester examination if he/she puts the required percentage of attendance in the 4th semester and pays the examination fee.

ii) A candidate shall be promoted to 5th semester provided he / she puts the required percentage of attendance in the 4th semester and pays the examination fee. A candidate, who could not pay the 4th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5th semester.

A candidate is eligible to appear for the 5th semester examination if he/she puts the required percentage of attendance in the 5th semester and pays the examination fee.

iii) A candidate shall be sent to Industrial training / VI semester provided he/she puts in the required percentage of attendance in the 5th semester and pay the examination fee/ promotion fee as prescribed by SBTET.
A candidate is eligible to appear for Industrial Training assessment (Seminar/Viva-voce) puts the required percentage of attendance, i.e., 90% in 6th semester Industrial Training and pays the examination fee.

B) For Diploma Courses of 3 ½ Years duration (MET/ CH/ CHPP/ CHPC/ CHOT/ TT):

i. A candidate shall be permitted to appear for 1st year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds upto 10%) i.e. attendance after condonation on Medical grounds should not be less than 65% and pay the examination fee.

ii. A candidate shall be promoted to 3rd semester if he/she puts the required percentage of attendance in the 1st year and pays the examination fee. A candidate who could not pay the 1st year examination fee has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 3rd semester.

iii. A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and pay the examination fee. A candidate, who could not pay the 3rd semester exam fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 4th semester.
A candidate is eligible to appear for the 4th semester exam if he/she puts the required percentage of attendance in the 4th semester

<u>For IVC & ITI Lateral Entry students</u>:

a) Puts the required percentage of attendance in the 4th semester

iv. A candidate shall be promoted to 5th semester industrial training provided he / she puts the required percentage of attendance in the 4th semester and pays the examination fee. A candidate, who could not pay the 4th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5th semester.

v. Promotion from 5th to 6th semester is automatic (i.e., from 1st spell of Industrial Training to 2nd spell) provided he/she puts the required percentage of

attendance, which in this case ie.,90 % of attendance and attends for the VIVA-VOCE examination at the end of training.

vi. A candidate shall be promoted to 7th semester provided he / she puts the required percentage of attendance in the 6th semester and pays the examination fee. A candidate, who could not pay the 6th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 7th semester.

vii. A candidate shall be promoted to 7th semester of the course provided he/she has successfully completed both the spells of Industrial Training.

A candidate is eligible to appear for 7th semester examination if he/she

a) Puts in the required percentage of attendance in the 7th semester

For IVC & ITI Lateral Entry students:

a) Puts in the required percentage of attendance in the 7 th semester.

C) For Diploma Courses of 3 ½ Years duration (BM):

The same rules which are applicable for conventional courses also apply for this course. The industrial training in respect of this course is restricted to one semester (6 months) after the 6th semester (3 years) of the course.

i. A candidate shall be permitted to appear for first year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds upto 10%) i.e. attendance after condonation on Medical grounds should not be less than 65% and pay the examination fee.

ii. A candidate shall be promoted to 3rd semester if he/she puts the required percentage of attendance in the first year and pays the examination fee. A candidate who could not pay the first-year examination fee has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 3rd semester.

iii. A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and pay the examination fee. A candidate who could not pay the 3rd semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 4th semester.

A candidate is eligible to appear for the 4th semester examination if he/she

a) Puts in the required percentage of attendance in the 4th semester

For IVC & ITI Lateral Entry Students:

A candidate is eligible to appear for the 4th semester examination if he/she puts the required percentage of attendance in the 4th semester

iv. A candidate shall be promoted to 5th semester provided he / she puts the required percentage of attendance in the 4th semester and pays the examination fee. A candidate, who could not pay the 4th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5th semester.

A candidate is eligible to appear for the 5th semester exam if he/she

a) Puts in the required percentage of attendance in the 5th semester.

For IVC & ITI Lateral Entry students:

a) Puts in the required percentage of attendance in the 5th semester.

v. A candidate shall be promoted to 6th semester provided he/she puts in the required percentage of attendance in the 5th semester and pays the examination fee.

A candidate who could not pay the 5th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 6th semester.

A candidate is eligible to appear for 6th semester examination

a) Puts in the required percentage of attendance in 6th semester

IVC & ITI Lateral Entry students:

a) Puts in the required percentage of attendance in 6th semester.

vi. A candidate shall be promoted to 7th semester provided he/she puts in the required percentage of attendance in 6th semester and pay the examination fee. A candidate, who could not pay the 6th semester examination fee, has to pay the promotion fee prescribed by SBTET from time to time before commencement of the 7th semester (Industrial Training).

A candidate is eligible to appear for 7th semester Industrial Training assessment (Seminar/Viva-voce) if he/she

a) Puts in the required percentage of attendance, ie., 90% in 7th semester Industrial Training.

For IVC & ITI Lateral Entry students:

a) Puts in the required percentage of attendance, i.e., 90% in 7th semester Industrial Training.

Students Performance Evaluation

Successful candidates shall be awarded the Diploma under the following divisions of pass.

a) First Class with Distinction shall be awarded to the candidates who secure an overall aggregate of 75% marks and above.
b) First Class shall be awarded to candidates who secure overall aggregate of 60% marks and above and below 75% marks.
c) Second Class shall be awarded to candidates who secure a pass with an overall aggregate of below 60%.

i. The Weightage of marks for various year/Semesters which are taken for computing overall aggregate shall be 25% of I year marks + 100% of 3rd and subsequent Semesters.

ii. In respect IVC & ITI Lateral Entry candidates who are admitted directly into diploma course at the 3rd semester (i.e., second year) level the aggregate of (100%) marks secured at the 3rd and subsequent semesters of study shall be

taken into consideration for determining the overall percentage of marks secured by the candidates for award of class/division.

d) Second Class shall be awarded to all students, who fail to complete the Diploma in the regular 3 years/ 3 ½ years and four subsequent examinations from the year of first admission.

EXAMINATION FEE SCHEDULE:

The examination fee should be as per the notification issued by State Board of Technical Education and Training, AP from time to time.

Structure of Examination Question Paper:

I. Formative assessment (Internal examination)

a) For theory Courses:

Three-unit tests for first year and two-unit tests for semesters shall be conducted with a duration of 90 minutes for each test for maximum marks of 40. It consists of part A and Part B.

Part A contains five questions and carries 16 marks. Among these five questions first question consists of four objective items like one word or phrase answer/filling-in the blanks/true or false etc with one mark for each question. The other four questions are short answer questions and carry three marks each.

Part B carries 24 marks and consists of three questions with internal choice ie., Either/Or type, and each question carries 8 marks.

The sum of marks of 3 tests for I year and 2 tests for semesters including assignments and Dynamic learning activities (50 marks) shall be reduced to 20 marks in each Course for arriving at final sessional marks.

b) For drawing Courses:

For I year:

Three-unit tests with duration of 90 minutes and for maximum marks of 40 marks shall be conducted for first year. It consists of part A and Part B.

Part A consists four questions for maximum marks of 16 and each question carries four marks (4×4 marks=16 marks).

Part B carries maximum marks of 24 and consists of five questions while the student shall answer any three questions out of these five questions. Each question in this part carries a maximum mark of 8, (3×8 marks=24 marks).

The sum of marks obtained in 3-unit test marks shall be reduced to 20 marks for arriving at final sessional marks. Remaining 20 marks are awarded by the Course teacher based on the student's performance during regular class exercise.

For semester: Two-unit tests with duration of 90 minutes and for maximum marks of 40 marks shall be conducted. The sum of marks obtained in 2-unit test marks shall be reduced to 20 marks for arriving at final sessional marks. Remaining 20

marks are awarded by the Course teacher based on the student's performance during regular class exercise.

c) For Laboratory /workshop: 50% of total marks for the Course shall be awarded based on continuous assessment of the student in laboratory/workshop classes and the remaining 50% shall be based on the sum of the marks obtained by the students in two tests.

II. Summative assessment (End examination)

The question paper for theory examination is patterned in such a manner that the Weightage of periods/marks allotted for each of the topics for a particular Course be considered. End Examination paper is of 3 hours duration.

a) Each theory paper consists of Section 'A' and 'B'

Section 'A' with Max marks of 30, contains 10 short answer questions. All questions are to be answered and each carry 3 marks, i.e., 10 x 3 = 30.

Section 'B' with Max marks of 50 contains 8 essay type questions. Only 5 questions are to be answered and each carry 10 marks, i.e., Max. Marks: 5 x 10 = 50.

Thus, the total marks for theory examination shall be: 80.

b) **For Engineering Drawing Course (107) consist of section 'A' and section 'B'**.

Section 'A' with max marks of 20, contains four (4) questions. All questions in section 'A' are to be answered to the scale and each carries 5 marks, ie. 4 x 5=20.

Section 'B' with max marks of 40, contains six (6) questions. The student shall answer any four (4) questions out of the above six questions and each question carries 10 Marks, i.e., 4 x 10 = 40.

c) Practical Examinations

For Workshop practice and Laboratory Examinations, each student has to pick up a question paper distributed by Lottery System.

Max. Marks for an experiment / exercise	:	50
Max. Marks for VIVA-VOCE	:	10
Total Max. Marks	:	60

In case of practical examinations with 50 marks, the marks shall be distributed as

Max. Marks for an experiment / exercise	:	25
Max. Marks for VIVA-VOCE	:	05
Total Max. Marks	:	30

In case of any change in the pattern of question paper, the same shall be informed sufficiently in advance to the candidates.

d) **Note: Evaluation for Laboratory Courses, other than Drawing courses**:

I. Instruction (teaching) in laboratory courses (except for the course on Drawing) hereafter shall be task/competency based as delineated in the Laboratory sheets, prepared by SBTET, AP and posted in its website.

II. Internal assessment for Laboratory shall be done on basis of task/s performed by the student as delineated in the laboratory sheets, prepared by SBTET, AP and posted in its website.

III. Question paper for End semester Evaluation shall be prepared as per SBTET rules in vogue.

ISSUE OF MEMORONDUM OF MARKS

All candidates who appear for the end examination will be issued memorandum of marks without any payment of fee. However, candidates who lose the original memorandum of marks have to pay the prescribed fee to the Secretary, State Board of Technical Education and Training, A.P. for each duplicate memo from time to time.

MAXIMUM PERIOD FOR COMPLETION OF DIPLOMA PROGRAMMES: Maximum period for completion of the diploma courses is twice the duration of thecourse from the date of First admission (includes the period of detention and discontinuation of studies by student etc) failing which they will have to forfeit the claim for qualifying for the award of Diploma (They will not be permitted to appear for examinations after that date). This rule applies for all Diploma courses of 3 years and 3 ½ years of engineering and non-engineering courses.

ELIGIBILITY FOR AWARD OF DIPLOMA

A candidate is eligible for award of Diploma Certificate if he / she fulfil the following academic regulations.

i. He / She pursued a course of study for not less than 3 / 3 ½ academic years & not more than 6 / 7 academic years.

ii. He / she have completed all the Courses.
Students who fail to fulfil all the academic requirements for the award of the Diploma within 6 / 7 academic years from the year of admission shall forfeit their seat in the course & their seat shall stand cancelled.

For IVC & ITI Lateral Entry students:

i. He / She pursued a course of study for not less than 2 / 2 ½ academic years & not more than 4 / 5 academic years.

ii. He / she has completed all the Courses.
Students who fail to fulfil all the academic requirements for the award of the Diploma within 4 / 5 academic years from the year of admission shall forfeit their seat in the course & their seat shall stand cancelled.

ISSUE OF PHOTO COPY OF VALUED ANSWER SCRIPT, RECOUNTING& REVERIFICATION:

A) FOR ISSUE OF PHOTO COPIES OF VALUED ANSWER SCRIPTS

I. A candidate desirous of applying for Photo copy of valued answer script/s should apply within prescribed date from the date of the declaration of the result.

II. Photo copies of valued answer scripts will be issued to all theory Courses and Drawing Course (s).

III. The Photo copy of valued answer script will be dispatched to the concerned candidate's address as mentioned in the application form by post.

IV. No application can be entertained from third parties.

B) FOR RE-COUNTING (RC) and RE-VERIFICATION(RV) OF THE VALUED ANSWER SCRIPT

i. A candidate desirous of applying for Re-verification of valued answer script should apply within prescribed date from the date of the declaration of the result.

ii. Re-verification of valued answer script shall be done for all theory Courses' and Drawing Course(s).

iii. The Re-verification committee constituted by the Secretary, SBTETAP with Course experts shall re-verify the answer scripts.

I. RE-COUNTING

The Officer of SBTET will verify the marks posted and recount them in the already valued answer script. The variations if any will be recorded separately, without making any changes on the already valued answer script. The marks awarded in the original answer script are maintained (hidden).

II. RE-VERIFICATION

(i) The Committee has to verify the intactness and genuineness of the answer script(s) placed for Re-verification.

(ii) Initially single member shall carry out the re-verification.

(iii) On re-verification by single member, if the variation is less than 12% of maximum marks, and if there is no change in the STATUS in the result of the candidate, such cases will not be referred to the next level ie., for 2-Tier evaluation.

(iv) On re-verification by a single member, if the variation is more than 12% of maximum marks, it will be referred to 2-Tier evaluation.

(v) If the 2-Tier evaluation confirms variation in marks as more than 12% of maximum marks, the variation is considered as follows:

a) If the candidate has already passed and obtains more than 12% of the maximum marks on Re-verification, then the variation is considered.

b) If the candidate is failed and obtains more than 12% of the maximum marks on Re-verification and secured pass marks on re-verification, then the status of the candidate changes to PASS.

c) If a candidate is failed and obtains more than 12% of the maximum marks on Re-verification and if the marks secured on re-verification are still less than the minimum pass marks, the status of the candidate remain FAIL only.

(vii) After Re-verification of valued answer script, the same or change if any therein on Re-verification, will be communicated to the candidate.

(viii) On Re-verification of Valued Answer Script if the candidate's marks are revised, the fee paid by the candidate will be refunded or else the candidate has to forfeit the fee amount.

Note: No request for Photo copies/ Recounting /Re-verification of valued answer script would be entertained from a candidate who is reported to have resorted to Malpractice in that examination.

Mal Practice Cases:

If any candidate resorts to Mal Practice during examinations, he / she shall be booked and the Punishment shall be awarded as per SBTETAP rules and regulations in vogue.

Discrepancies/ Pleas:

Any Discrepancy /Pleas regarding results etc., shall be represented to the SBTETAP within one month from the date of issue of results. Thereafter, no such cases shall be entertained in any manner.

Issue of Duplicate Diploma

If a candidate loses his/her original Diploma Certificate and desires a duplicate to be issued he/she should produce written evidence to this effect. He / she may obtain a duplicate from the Secretary, State Board of Technical Education and Training, A.P., on payment of prescribed fee and on production of an affidavit signed before a First-Class Magistrate (Judicial) and non-traceable certificate from the Department of Police. In case of damage of original Diploma Certificate, he / she may obtain a duplicate certificate by surrendering the original damaged certificate on payment of prescribed fee to the State Board of Technical Education and Training, A.P.

In case the candidate cannot collect the original Diploma within 1 year from the date of issue of the certificate, the candidate has to pay the penalty prescribed by the SBTET AP from time to time.

Issue of Migration Certificate and Transcripts:

The Board on payment of prescribed fee will issue these certificates for the candidates who intend to prosecute Higher Studies in India or Abroad.

General

i. The Board may change or amend the academic rules and regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students, for whom it is intended, with effect from the dates notified by the competent authority.
ii. All legal matters pertaining to the State Board of Technical Education and Training, AP are within the jurisdiction of Mangalagiri.
iii. In case of any ambiguity in the interpretation of the above rules, the decision of the Secretary, SBTET, A.P is final.

VISION

To develop Electrical &Electronics Engineering professionals competent to face the global challenges in a Edifying environment conducive to learn technical knowledge, skills blended with ethics and values, to Coordinate and serve to the society for betterment and comfortable living.

MISSION

M1	To provide a competitive learning environment, through a need-based curriculum designed in collaboration with industry, conducive for high quality education emphasizing on transfer of knowledge and skill development essential for the profession and the society as well.
M2	To nurture higher order leadership qualities and ethics and values in students to enable them to be leaders in their chosen professions while maintaining the highest level of ethics.
M3	To encourage the spirit of inquisition to promote innovation and entrepreneurship strengthened with life skills to sustain the stress.
M4	To foster effective interactions and networking with all the stake holders so as to work towards the growth and sustainability of the society and environment.

Programme Educational Objectives (PEOs)

On completion of the Diploma Electrical & Electronics Engineering programme, the students should have acquired the following characteristics

PEO1	An ability to apply knowledge of mathematics, Science , engineering and management principles in solving problems in the field of Electrical and Electronics Engineering.
PEO2	To be life-long learners with sprit of enquiry and zeal to acquire new knowledge and skills so as to remain contemporary and posses required professional skills.
PEO3	To enhance entrepreneurial, communication and other soft skills, which will enable them to work globally as leaders, team members and contribute to nation building for the betterment of the society.
PEO4	To make them strongly committed to the highest levels of professional ethics and focus on ensuring quality, adherence to public policy and law, safety, reliability and environmental sustainability in all their professional activities

PROGRAMME OUTCOMES(POs)

1. **Basic and discipline specific knowledge**: Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
2. **Problem analysis**: Identify and analyses well-defined engineering problems using standard methods
3. **Design/Development of solutions**: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs
4. **Engineering tools, Experimentation and Testing**: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.
5. **Engineering practices for society, sustainability and environment**: Apply appropriate technology in context of society, sustainability, environment and ethical practices.
6. **Project Management**: Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
7. **Life-Long learning**: Ability to analyses individual needs and engaging updating in the context of technological changes.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. An ability to understand the basic concepts of Electrical & Electronics Engineering and to apply them to various areas like Wiring Installations, Lighting Schemes , Static & Rotating machinery, drawing layouts , Power System (Generation, Transmission, Distribution & utilisation), Digital electronics, power control devices, Computer programming ,managerial skills and the use SMART technologies .

2. An ability to Repair, develop and troubleshooting of Various Electrical & Electronics equipment's by using suitable tools and techniques, to design Customized applications in Electrical & Electronics Engineering at economic and efficient considerations, to develop software & hardware solutions.

3. Wisdom of social and environmental awareness along with ethical responsibility to have a successful career and to sustain passion and zeal in the field of Electrical & Electronics Engineering for real-world applications in the field of Electronics using optimal resources as an Entrepreneur.

DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
(FIRST YEAR)

Subject Code	Name of the Subject	Instruction periods/week		Total Periods /year	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
EE-101	English	3	-	90	3	20	80	100
EE-102	Engineering Mathematics - I	5	-	150	3	20	80	100
EE-103	EngineeringPhysics	3	-	90	3	20	80	100
EE-104	Engineering chemistry & Environmental studies	3	-	90	3	20	80	100
EE-105	Electrical Engineering Material Science	4	-	120	3	20	80	100
EE-106	Basic Electrical Technology	6	-	180	3	20	80	100
PRACTICAL								
EE-107	EngineeringDrawing	-.	3	90	3	40	60	100
EE-108	ElectricalWiring Laboratory	-	6	180	3	40	60	100
EE-109	Physics Lab	-	1.5	45	1½	20	30	50
EE-110	Chemistry Lab	-	1.5	45	1½	20	30	50
EE-111	Computer Fundamentals Laboratory	-	3	90	3	40	60	100
	TOTAL	**24**	**15**	**1170**	**30**	**280**	**720**	**1000**

NOTE:03 periods per week are allotted to Student Centric Activity (Library, Sports& Games, Clean & Green, Preparation for placements etc)

NOTE:1) EE-101, 102, 103, 104, 109, 110, 111 are common with all branches.
2) EE-107 is common with EC/AEI/BME-107.

DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
(III SEMESTER)

Subject Code	Name of the Subject	Instruction periods/week		Total Periods /year	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
EE-301	Engineering Mathematics - II	4	-	60	3	20	80	100
EE-302	Electrical Machines- I	5	-	75	3	20	80	100
EE-303	A.C. Circuits & Transformers	6	-	90	3	20	80	100
EE-304	Electronics Engineering	4	-	60	3	20	80	100
EE-305	Programming in ''C''	5	_	75	3	20	80	100
PRACTICAL								
EE-306	Electrical CAD Laboratory	-	3	45	3	40	60	100
EE-307	Electrical Machines – I Laboratory	-	3	45	3	40	60	100
EE-308	Circuits & Transformers Laboratory	-	3	45	3	40	60	100
EE-309	Electronics Engineering Laboratory	-	3	45	3	40	60	100
EE-310	Programming in ''C'' Laboratory	-	3	45	3	40	60	100
	TOTAL	**24**	**15**	**585**	**30**	**300**	**700**	**1000**
NOTE:03 periods per week are allotted to Student Centric Activity (Library, Sports& Games, Clean & Green, Preparation for placements etc)								
NOTE:EE-301 is common with A/AA/CER/C/M/MET/MNG/TT-301.								

DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
(IV SEMESTER)

Subject Code	Name of the Subject	Instruction periods/week		Total Periods /year	Scheme of Examination			
		Theory	Practical / Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
EE-401	Electrical Installation & Estimation	4	-	60	3	20	80	100
EE-402	Electrical Machines-II	5	-	75	3	20	80	100
EE-403	Power Systems – I	4	-	60	3	20	80	100
EE-404	Power Electronics & PLC	4	-	60	3	20	80	100
EE-405	General Mechanical Engineering	4	-	60	3	20	80	100
PRACTICAL								
EE-406	Electrical Engineering Drawing	-	6	90	3	40	60	100
EE-407	Electrical Machines-II Laboratory	-	3	45	3	40	60	100
EE-408	Communications Skills Laboratory	-	3	45	3	40	60	100
EE-409	Power Electronics Laboratory	-	3	45	3	40	60	100
EE-410	Hybrid Power Systems Laboratory	-	3	45	3	40	60	100
	TOTAL	**21**	**18**	**585**	**30**	**300**	**700**	**1000**
NOTE:03 periods per week are allotted to Student Centric Activity (Library, Sports& Games, Clean & Green, Preparation for placements etc)								
NOTE:EE-408 is common with all branches.								

III SEMESTER

DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
(III SEMESTER)

Subject Code	Name of the Subject	Instruction periods/week		Total Periods /year	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
EE-301	Engineering Mathematics - II	4	-	60	3	20	80	100
EE-302	Electrical Machines- I	5	-	75	3	20	80	100
EE-303	A.C. Circuits & Transformers	6	-	90	3	20	80	100
EE-304	Electronics Engineering	4	-	60	3	20	80	100
EE-305	Programming in ''C''	5	_	75	3	20	80	100
PRACTICAL								
EE-306	Electrical CAD Laboratory	-	3	45	3	40	60	100
EE-307	Electrical Machines – I Laboratory	-	3	45	3	40	60	100
EE-308	Circuits & Transformers Laboratory	-	3	45	3	40	60	100
EE-309	Electronics Engineering Laboratory	-	3	45	3	40	60	100
EE-310	Programming in ''C'' Laboratory	-	3	45	3	40	60	100
	TOTAL	**24**	**15**	**585**	**30**	**300**	**700**	**1000**
NOTE:03 periods per week are allotted to Student Centric Activity (Library, Sports& Games, Clean & Green, Preparation for placements etc)								
NOTE:EE-301 is common with A/AA/CER/C/M/MET/MNG/TT-301.								

ENGINEERING MATHEMATICS-II
(Common to A/AA/CER/C/EE/M/MET/MNG/TT)

Course Code	Course Title	No. of Periods/week	Total No. of periods	Marks for FA	Marks for SA
EE-301	Engineering Mathematics-II	4	60	20	80

Chapter No.	Title	No. of Periods	Weightage	No. of short question (3 marks)	No. of Essay questions (10 marks)	CO'S Mapped
1	Indefinite Integration	20	34	3	2.5	CO1
2	Definite Integration	10	16	2	1	CO2
3	Applications of Definite Integrals	10	21	2	1.5	CO3
4	Differential Equations	20	39	3	3	CO4
TOTAL		**60**	**110**	**10**	**8**	

Chapter No.	Title	No. of Periods	Marks Allotted	Short Type	Essay Type	COs mapped
Unit – I: Indefinite integration						
1	Indefinite integration	20	34	3	2 1/2	CO1
Unit – II: Definite Integration						
2	Definite Integrals	10	16	2	1	CO2
Unit-III: **Applications of Definite Integrals**						
3	Area of curves	3	3	1	0	CO3
4	Mean and RMS values	3	8	1	1/2	CO3
5	Numerical Integration	4	10	0	1	CO3
Unit – IV: Differential Equations						
6	Introduction to Differential Equations	5	6	2	0	CO4
7	Solutions of first order differential equations	4	13	1	1	CO4

8	Solutions of second order homogeneous differential equations	4	10	0	1	CO4
9	Solutions of second order non-homogeneous differential equations	7	10	0	1	CO4
	Total	60	110	10	8	
			Marks	**30**	**80**	

COURSE OBJECTIVES	(i) To understand the concepts of indefinite integrals and definite integrals with applications to engineering problems. (ii) To understand the formation of differential equations and learn various methods of solving first order differential equations. (iii) To learn the principles of solving homogeneous and non-homogeneous differential equations of second order.

COURSE OUTCOMES	CO1	Integrate various functions using different methods.
	CO2	Evaluate definite integrals.
	CO3	Solve engineering problems by applying definite integrals.
	CO4	Obtain differential equations and solve differential equations of first order and first degree, and solve homogeneous and non-homogeneous differential equations of second order.

LEARNING OUTCOMES

Unit-I

C.O. 1 Integrate various functions using different methods.

L.O.1.1. Explain the concept of Indefinite integral as an anti-derivative.

State the indefinite integral of standard functions and properties of $\int (u+v)\,dx$ and $\int ku\,dx$ where *u, v* are functions of *x* and *k* is constant.

Solve problems involving standard functions using these properties.

Evaluate integrals involving simple functions of the following type by the method of substitution.

i) $\int f(ax+b)dx$, *where f(x)* is in standard form.

ii) $\int (f(x))^n f'(x)\,dx,\ n \neq -1$

iii) $\int \frac{f'(x)}{f(x)}dx$

iv) $\int [f(g(x))]g'(x)dx$

Find the integrals of *tan x, cot x, sec x* and *cosec x* w.r.t x

Evaluate the Standard integrals of the functions of the type

i) $\frac{1}{a^2+x^2}, \frac{1}{a^2-x^2}, \frac{1}{x^2-a^2}$

ii) $\frac{1}{\sqrt{a^2+x^2}}, \frac{1}{\sqrt{a^2-x^2}}, \frac{1}{\sqrt{x^2-a^2}}$

iii) $\sqrt{a^2+x^2}, \sqrt{a^2-x^2}, \sqrt{x^2-a^2}$

Evaluate integrals using decomposition method.

Solve problems using integration by parts.

1.9 Use Bernoulli's rule for evaluating the integrals of the form $\int u.vdx$.

1.10. Evaluate the integrals of the form $\int e^x[f(x)+f'(x)]dx$

Unit-II

C.O.2 Evaluate definite integrals.

L.O.2.1. State the fundamental theorem of integral calculus

Explain the concept of definite integral.

Solve simple problems on definite integrals.

State various properties of definite integrals.

Evaluate simple problems on definite integrals using these properties.

Syllabus for Unit test-I completed

Unit -III

C.O.3Solve engineering problems by applying definite integrals.

L.O. 3.1. Find the area bounded by a curve and axes.

Obtain the mean and R.M.S values of the simple functions in given intervals.

Solve simple problems using Trapezoidal rule and Simpson's 1/3 rule for the approximation of definite integrals.

Unit -IV

C.O. 4 Form differential equations and solve differential equations of first order and first degree and Solvehomogeneous and non-homogeneous differential equations of second order

L.O.4.1. Define a Differential equation, its order and degree

Find order and degree of a given differential equation.

Form a differential equation by eliminating arbitrary constants.

Solve the first order and first degree differential equations by variables separable method.

Solve linear differential equation of first order of the form $\frac{dy}{dx}+Py=Q$, where P and Q are functions of x only or constants.

Solve homogeneous second order linear differential equations of the type $(aD^2+bD+c)y=0$ where $a(\neq 0)$, b, c are real numbers.

Define complementary function, particular integral and general solution of a non-homogeneous linear differential equation of second order with constant coefficients.
Describe the methods of solving f(D) = X, where f(D) is a polynomial of second order and X is a function of the forms k, e^{ax}, $\sin ax$, $\cos ax$ and x and their linear combinations.

Syllabus for Unit test-II completed

CO/PO – Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1				3	2	2
CO2	3	2	2	2				3	2	2
CO3	3	3	3	3				3	3	3
CO4	3	3	3	3				3	3	3
Avg.	3	2.5	2.5	2.25				3	2.5	2.5

3 =Strongly mapped (High), **2 =** Moderately mapped (Medium), **1 =** Slightly mapped (Low)

Note: The gaps in CO/PO mapping can be met with appropriate activities as follows:

For PO5: Appropriate quiz programmes may be conducted at intervals and duration as decided by concerned faculty.
For PO6: Seminars on applications of mathematics in various engineering disciplines are to be planned and conducted.
For PO7: Plan activities in such a way that students can visit the Library to refer standard books on Mathematics and access the latest updates in reputed national and international journals. Additionally, encourage them to attend seminars and learn mathematical software tools.

PO- CO – Mapping strength

PO no	**Mapped with CO no**	**CO periods addressing PO in column I**		**Level (1,2 or 3)**	**Remarks**
		Number	**%**		
1	CO1, CO2, CO3,CO4	60 (20+10+10+20)	100%	3	>40% Level 3 Highly addressed 25% to 40% Level 2 Moderately addressed
2	CO1, CO2, CO3,CO4	37 (6+6+10+15)	61.6%	3	
3	CO1, CO2, CO3,CO4	37 (6+6+10+15)	61.6%	3	
4	CO1, CO2, CO3,CO4	35 (4+6+10+15)	58.3%	3	
5					

6					
7					5% to 25% Level 1 Low addressed
PSO 1	CO1, CO2, CO3,CO4	60 (20+10+10+20)	100%	3	
PSO 2	CO1, CO2, CO3,CO4	37 (6+6+10+15)	61.6%	3	<5% Not addressed
PSO 3	CO1, CO2, CO3,CO4	37 (6+6+10+15)	61.6%	3	

COURSE CONTENTS

Unit-I

Indefinite Integration

1. Integration regarded as anti-derivative, indefinite integrals of standard functions - Properties of indefinite integrals - Integration by substitution or change of variable - Integrals of tan x, cot x, sec x, cosec x.

Evaluation of integrals which are of the following forms:

$i) \frac{1}{a^2+x^2}, \frac{1}{a^2-x^2}, \frac{1}{x^2-a^2}$

$ii) \frac{1}{\sqrt{a^2+x^2}}, \frac{1}{\sqrt{a^2-x^2}}, \frac{1}{\sqrt{x^2-a^2}}$

$iii) \sqrt{a^2+x^2}, \sqrt{a^2-x^2}, \sqrt{x^2-a^2}$

Integration by decomposition of the integrand into simple rational algebraic functions. Integration by parts, Bernoulli's rule and integrals of the form $\int e^x [f(x) + f'(x)]\, dx$.

Unit-II

Definite Integration

2. Definite integral, fundamental theorem of integral calculus, properties of definite integrals, evaluation of simple definite integrals.

Unit-III Applications of Definite Integrals

3. Area bounded by a curve and axes - Mean and RMS values of a function in given intervals - Trapezoidal rule, Simpson's 1/3 rule to evaluate an approximate value of a define integral.

Unit -IV

Differential Equations

4. Definition of a differential equation - Order and degree of a differential equation- Formation of differential equations - Solutions of differential equations of first order and first degree using variables separable method and linear differential equation of the type $\frac{dy}{dx} + Py = Q$ - Solutions of homogenous and non-homogeneous linear differential equations of second order with constant coefficients.

Textbook:

Engineering Mathematics-II, a textbook for second year third semester diploma courses, prepared & prescribed by SBTET, AP.

Reference Books:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Schaum's Outlines Differential Equations, Richard Bronson & Gabriel B. Costa
3. M.Vygodsky, Mathematical Handbook: Higher Mathematics, Mir Publishers, Moscow.

Unit Test Syllabus

Unit Test	Syllabus
Unit Test-I	From 1.1 to 2.5
Unit Test-II	From 3.1 to 4.8

ELECTRICAL MACHINES-I

Course code	Course title	No. of periods/week	Total no. of periods	Marks for FA	Marks for SA
EE-302	ELECTRICAL MACHINES-I	5	75	20	80

Chapter No.	Title	No.of Periods	Weightage	No. of short question (3 marks)	No. of Essay questions (10 marks)	CO'S Mapped
1	Fundamentals of D.C Generators, Armature reaction and Characteristics	18	26	2	2	CO1
2	Fundamentals of DC motors	12	19	3	1	CO2
3	Speed Control and Testing of D.C Motors	12	13	1	1	CO3
4	Basics of Electrical Measuring Instruments	18	26	2	2	CO4
5	Transducers, Sensors and Electronic & Digital Instruments	15	26	2	2	CO5
TOTAL		**75**	**110**	**10**	**8**	

COURSE OBJECTIVES	i. To Familiarise knowledge on construction, working principle and characteristics of DC machines and Armature reaction. ii. To know different methods of speed control and testing of motors. Iii. To use different generators and motors for specific applications. iv.To know the performance of different electrical and electronic measuring instruments. v. To know the working principle of Transducers and sensors.

COURSE OUTCOMES	**CO1**	**EE-302.1**	Describe the parts of a DC machine, its usages and analyse armature reaction and commutation for its effects.
	CO2	**EE-302.2**	Describe the working of a D.C motor and analyse the characteristics for its performance
	CO3	**EE-302.3**	Familiarise the usage of starter for different DC motors and selecting specific methods of speed control for D.C motor and to analyse various tests on D.C motors.
	CO4	**EE-302.4**	Describe the construction and working of different electrical and electronic measuring instruments and to explain the measurement of resistance.
	CO5	**EE-302.5**	Choosing appropriate Transducer for a specific application and to describe the basic principle of electronic digital measuring instruments.

LEARNING OUTCOMES:

1. Fundamentals of D.C Generators, Armature Reaction and Characteristics

Explain electromechanical energy conversion.
Describe the constructional features of a D.C generator with a legible sketch and list the various materials used for each part.
Explain the working principle of D.C generator.
State the types of armature windings.
Derive the E.M.F equation of D.C generator in terms of Φ,Z, N, P &A and solve problems.
Classify D.C Generators based on excitation and draw its equivalent circuit by giving their voltage and current equations and solve problems.
State the various losses incurred in a D.C Generator and draw power flow diagram.
Define the mechanical, electrical and overall efficiencies of DC Generator.
Define Armature reaction and state its effects.
State Commutation and list the different methods of improving commutation.
Plot Open Circuit Characteristics, Internal characteristics and external characteristics ofthe following types of D.C. Generators:
(i) Separately excited(ii) Shunt(iii)Series
List the applications of above D.C generators.

2. Fundamentals of D.C Motors

Define DC motor
Explain the working of D.C motor.
Explain the significance of back E.M.F.
Classify DC motors.
Write the formula for Back E. M. F for different D.C Motors with equivalent circuits.
Solve Problems on Back E.M.F.
Define Torque and derive Torque equation of a D.C motor.
Plot the i) Electrical characteristics and ii) Mechanical characteristics of (a) Shunt

b) Series D. C. Motors

List the applications of the various D.C motors.

3. Speed Control and Testing of D.C Motors

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Explain the three different methods of speed Control (Flux, Armature and voltage) for D.C shunt motors.

Explain the different methods of speed control of series motor.

State the necessity of a starter and List different types of Starters for DC motors.

Explain the working of 3-point starter with legible sketch.

List different tests of D.C Motors.

Describe the direct and indirect methods of testing of the DC motors.

Explain the method of conducting brake test on D.C Series and Shunt motors.

4. Basics of Electrical measuring instruments.

Classify the instruments on the basis of(i) construction and output(ii) principle of working

(iii) method of measuring the value

State the purpose of obtaining deflecting, controlling and damping torques in Indicating

instruments.

Explain the working of Permanent Magnet Moving Coil instrument.

State the advantages, disadvantages and applications of M.C Instruments.

Describe working of Moving Iron (M.I) Instrument i) Attraction type Instrument ii) Repulsion type

State the advantages and disadvantages of M.I. Instruments.

Explain the working of a Dynamometer type instrument

State the need for instrument transformers (CT and PT).

Classify the measurement of resistance into Low, Medium and High Values giving examples foreach.

Describe the construction and working of Megger

5. Transducers, Sensors and Electronic & Digital Instruments

Define Transducer

Classify Transducers(i)based on the principle of transduction form used

(ii) as Primary and Secondary(iii) as Passive and Active (iv) as Analog and Digital

(v) as Transducers and Inverse Transducers

State the applications of Transducers.

Describe the construction of Linear Variable Differential transformer (LVDT).

Explain the working of LVDT.

Define Sensor and list its types.

List the applications of sensors.

List the basic components of analogue electronic instruments.

List the basic components of Digital instruments.

List the advantages of Digital Instruments over Analog Instruments.

Explain the Working of Digital Multi meter with block diagram.

Explain the Working of Single-Phase Digital Energy meter with block diagram.

HYPONATED COURSE CONTENT

1. **Fundamentals of D.C Generators, Armature Reaction and Characteristics**
   Electromechanical energy conversion – constructional features of D.C generator with legible sketches- principle of D.C generator - windings (i) Lap (ii) Wave- E.M.F equation -Classification of DC generators based on excitation-Voltage and Current equations for different types of D.C Generators-simple problems -losses incurred in the D.C Generators-mechanical, electrical and overall efficiencies of DC Generators-Armature reaction —Commutation and list of methods for improving commutation –Open circuit, internal and external characteristics of Separately excited, Shunt and Series DC Generators- Applications of D.C generators.
2. **Fundamentals of D.C Motors**
   Definition of DC motor-Working of D.C motors-classification - significance of back E.M.F- Formula for back E.M.F for different D.C motors- Problems on E.M.F equation -Torque equation of DC motor - electrical and mechanical characteristics of D.C Shunt and Series motors-Applications of D.C motors.

3. **Speed Control and testing of D.C Motors**
   Methods of speed control (Flux, Armature and Voltage) for D.C shunt motors-different methods of speed control for series motors -necessity of starter-Types of starters- 3-point starter-direct and indirect methods of testing of DC motors-list of different tests-Brake test on DC series and shunt motors.

4. **Basics of electrical measuring instruments:**
   Classification of instruments - Deflection, Controlling and Damping torques in the indicating
   Instruments-working of Permanent magnet moving coil-advantages, disadvantages andapplications-working moving iron instruments –advantages and disadvantages – Dynamometertypeinstrument–working - instrument transformers- Classification of resistance measurement - Construction and working of megger.

5. **Transducers, Sensors and Electronic & Digital Instruments**
   Definition of transducer - Classification of Transducers - Applications of Transducers - construction and working of LVDT- Basic Concept of Sensors,types and its applications- Basic components of analog electronic Instruments - basic components of Digital instruments- advantages of Digital Instruments over Analog Instruments- working of digital multi meter with block diagram- working of single phase digital energy meter with block diagram.

REFERENCE BOOKS

1. B.L. Theraja -Electrical Technology - Vol - I –S.Chand&co.
2. B.L. Theraja -Electrical Technology - Vol –II -S.Chand&co.
3. P.S. Bhimbhra –Electrical machines
4. E.W. Golding and F.C. Widdis,Electrical Measurements and measuring instruments– Wheele publishers.
5. A. K.SAWHNEY - Electrical and Electronic measuring instruments –- Dhanpat Rai &Sons.

Syllabus to be Covered for Unit Tests

Unit Test	Learning Outcomes to be Covered
Unit Test – I	From 1.1 to 3.5
Unit Test – II	From 3.6 to 5.12

A.C. CIRCUITS AND TRANSFORMERS

Course code	Course title	No. of periods/ week	Total no. of periods	Marks for FA	Marks for SA
EE-303	A.C. CIRCUITS AND TRANSFORMERS	6	90	20	80

Chapter No.	Title	No.of Periods	Weightage	No. of short question (3 marks)	No. of Essay questions (10 marks)	CO'S Mapped
1	Fundamental of A.C.	13	9	3	0	CO1
2	Single phase A.C Circuits	23	26	2	2	CO2
3	Poly phase circuits	13	26	2	2	CO3
4	Single phase transformers	28	26	2	2	CO4
5	Three phase transformers and Auto Transformers	13	23	1	2	CO5
TOTAL		**90**	**110**	**10**	**8**	

COURSE OBJECTIVES	i. To understand basics of alternating quantities ii. To acquire knowledge on A.C circuits and its components and to solve them. iii. To understand poly phase circuits and solve problems iv. To familiarise with the knowledge of single phase and three phase transformers

COURSE OUTCOMES	**CO1**	EE-303.1	Understand the fundamental concepts of AC quantities and solving problems in j-notation
	CO2	EE-303.2	Comprehending the knowledge of resonance in series and parallel R, L, C circuits
	CO3	EE-303.3	Describe poly phase circuits and solving problems
	CO4	EE-303.4	Explain the working of single transformers and understand equivalent circuit parameters, efficiency and regulation.
	CO5	EE-303.5	Analyse the three phase transformers, types and cooling methods.

LEARNING OUTCOMES:

Fundamentals of A.C

State the relation between poles, speed and frequency

Define the instantaneous value, maximum value, frequency, time period, Average value, R.M.S value, Form factor and Peak factor of an A.C quantity.

Derive the expression for the above for different alternating waveforms viz. halfwave and full wave rectified sine wave.

Explain the terms phase and phase difference of an A.C quantity.

Understand j operator

Convert polar quantities into rectangular quantities and Vice-versa.

1. Single-phase A.C circuits

Derive relationship between voltage and current in a

(i) Pure resistive circuit ii) Pure inductive circuit iii) Pure capacitive circuit.

Calculate the impedance, current, phase angle, power and power factor in R-Lseries circuits, R-C series circuits, L-C series circuits, R-L-C seriescircuits.

Solve Problems on Series Circuits

Define Resonance and Derive a formula for resonant frequency of a R-L-C series circuit.

Define Q-factor and state its importance,

Solve problems on Series Resonance.

State the concept of conductance, susceptance and admittance.

Explain the method of solving two branch parallel A.C circuits by using J-notation method

Solve Problems on j-notation method for two branch parallel A.C circuits.

2. Poly Phase Circuits

Definetheterm`PolyPhase'.

List advantages of 3 phase system over single-phase system.

Write the expressions for three-phase emfs and represent them by phasor diagram.

State the concept of phase sequence.

Derive the relation between line and phase values of current and voltage in 3phase

(i) Star circuits and(ii)delta circuits.

Derive the equation for power in 3 phase circuit.

Solve numerical examples in balanced loads.

Derive the formulae for measurement of 3 phase power and power factor byusing two watt meters.

Solve simple problems on two wattmeter method.

3. Single phase transformer

Define Transformer and Explain its working principle.

Classify the transformers basedon

(i) numberofphases (ii)construction (iii)function.
Explain the constructional details oftransformers with legible Sketch.
Distinguish between shell type and core typetransformers.
Derive the E.M.F equation of a single phasetransformer and solve problems.
Define 'transformation'ratio.
Explain ideal transformer and Draw Vector diagram for a transformer workingon noload.
Develop the vector diagram of a transformer on loadfor
(i) Unity powerfactor (ii) Lagging powerfactor (iii) Leading powerfactor
Draw the equivalent circuit of a transformer byapproximation.
Determine the equivalent circuit constants from no-load test and short circuit test data and solve problems.
Derive the approximate equation for regulation fortransformer.
List the losses taking place in attransformer and derive the condition for maximum
efficiency of attransformer.
Solve simple problems on regulation and efficiency.
State the reason for transformer rating inKVA.
Define all-day efficiency.
Differentiate between distribution transformer and powertransformer.

4. Three Phase Transformers and Autotransformers

State the advantages of 3 phase transformer over single phasetransformer.
List the different types of three phase transformers by giving theirsymbolic representation
and voltagerelationships.
State theapplicationsof (i)star-star (ii)delta-star (iii)star-delta (iv)delta- delta connected transformers.
State the need for parallel operation of three phase transformers.
State the conditions for parallel operation of 3 phasetransformers.
List the specialtransformers.
State the advantages and disadvantages ofautotransformers
State the necessity of cooling of powertransformers.
List different methods of cooling of powertransformer.
Draw a legible sketch of a powertransformer and explain the function of eachpart.
State the need for Tap changing in power transformer and
explainthe`onload'and`off
load' tapchanging.

HYPONATED COURSE CONTENT

Fundamentals ofA.C.

Relation between poles, speed and frequency- Definition of Alternating quantity, cycle, period, frequency, amplitude, instantaneous value and angular velocity - Average value

- effective value/R.M.S value definitions and derivations - calculations of these values for half wave rectified sine wave, full wave rectified Sine wave forms-form factor- peak factor **-** Representation of alternating quantities by equation, graphs and phasor diagrams **-** Phase and phase difference **–** Understanding of `J' notation for alternating quantities ,transformation from polar to rectangular notations andVice-versa

Single phase A.C. Circuits

Concept of reactance, purely inductive and purely capacitive circuits - Derivation of voltage, current, power relations including phase relationships, wave forms and phasor diagrams **-** R-L, R-C , L-C & R-L-C series circuits - Derivation of relation between voltage, current, impedance, power including wave forms and phasor diagrams. Impedance triangle, phase angle, power factor, active and reactive components of current and power in above circuits – Definition of Resonance in series circuits and expression for resonant frequency- Q-factor-Importance of Q- factor- Problems on series circuits and seriesresonance-Concept of conductance, susceptance and admittance - Simple Parallel circuits - solution by `J' notation – problems.

Poly phasecircuits

Definition of Poly phase - Advantages of poly-phase systems over single-phasesystems - Location of coils for obtaining required phase difference - Representation of 2 phase,3 phase EMF by equations, graphs and phasors - phase sequence **-** Current in neutral in 2 phase and 3 phase system - Method ofconnection of star and delta - phasor diagram showing relation between phase and line quantities, Relation between phase and Line values of voltages and currents -power equation - Problems on 3 phase balanced circuits – Measurement of 3 phase power by two wattmeter and power factor in balanced circuits - Effect of Load power factor on wattmeter readings – Problems.

Single PhaseTransformers

Introduction to Transformer, Classification of transformers, Construction of transformers, Theory of an ideal transformer - emf equation derivation – Transformation ratio and turns ratio and relation between them - Voltage ratio and current ratio – Transformer on no load - No load current components and no load power factor - Transformer on load – Equivalent circuit of transformer - Equivalent circuit constants by transformation, Short circuit test - Regulation of transformer - definition and derivation of approximate equation for regulation - determination of regulation from S.C. Test data , determination of losses in transformer from O.C. and S.C. tests data- efficiency, condition for maximum efficiency-simple problems on efficiency and regulation – rating of transformer- all-day efficiency definition- Differentiation between distribution transformer and powertransformer.

Three- phase transformer & Autotransformer

Advantages of 3 phase transformer over single phase transformer. Descriptive treatment of star-star, delta-delta, star-delta and delta-star, voltage current and phase relation for the above groups- Need and conditions to be fulfilled for paralleling 3 phase transformer

- Auto-transformers – applications, Necessity of cooling - Methods of cooling - Sketch of power transformer indicating parts and explain their functions - Tap changing gear - on load and off load tap changing in power transformer.

REFERENCE BOOKS

1. B.L. Theraja-Electrical Technology - Vol - I S. Chand&co.
2. V. K .Mehta-Introduction to Electrical Engg.
3. A.Chakrabarthy -Electrical Circuits - Dhanapat Rai andSons
4. B.L. Theraja –A.K.Theraja-Electrical Technology - Vol - II S. Chand & co.
5. J.B.Gupta-Theory and performance of electrical machines-KATSON BOOKS

Syllabus to be Covered for Unit Tests

Unit Test	Learning Outcomes to be Covered
Unit Test-I	From 1.1 to 3.9
Unit Test-II	From 4.1 to 5.11

ELECTRONICS ENGINEERING

Course Code	Course Title	No. of periods/ Week	Total No. of Periods	Mark s for FA	Marks for SA
EE-304	ELECTRONICS ENGINEERING	4	60	20	80

Chapter No.	Title	No. of Periods	Weightage	No. of short question (3 marks)	No. of Essay questions (10 marks)	CO'S Mapped
1	Semi-conductor devices	16	26	2	2	CO1
2	Power Supplies	08	16	2	1	CO2
3	Amplifiers	16	21	2	1.5	CO3
4	Oscillators	08	21	2	1.5	CO4
5	Linear Integrated Circuits	12	26	2	2	CO5
TOTAL		**60**	**110**	**10**	**8**	

COURSE OBJECTIVES	i). To introduce students to the basic theory of semiconductor devices and their practical applications in electronics.
	ii). To familiarize students to the principle of operation, design and synthesis of different electronic circuit and integrated circuits, and their applications.
	iii).To provide strong foundation for further study of electronic circuits and integrated circuits.

COURSE OUTCOMES	CO1	EE304.1	Analyze the formation and working of various semiconductor devices.
	CO2	EE304.2	Explain the rectifiers and voltage regulators.
	CO3	EE304.3	Analyze the concept of amplifier, small signal amplifier, large signal amplifier and feedback amplifier.
	CO4	EE304.4	Analyze various oscillators.
	CO5	EE304.5	Analyze the op-amp application circuits.

LEARNINGOUTCOMES

1. Semi-conductorDevices

DefinePNJunctionDiodeandexplainits formation.
ExplaintheworkingofPNJunctiondiodewithnobias,forward bias and reverse bias.
DrawtheVIcharacteristicsofPNJunctionDiode.
ExplaintheworkingofZenerdiode.
Drawthe VIcharacteristicsof Zener diode.
ExplainformationofPNPandNPNtransistors
Statethedifferentconfigurationsoftransistors.
PlottheInput/OutputcharacteristicsofatTransistorinCEconfiguration.
ExplaintheworkingandVIcharacteristicsof (a) FET (b) MOSFET (c) IGBT . Mention
their applications.

2. Power Supplies

Define Rectifier.
Explaintheworkingand,drawthecircuitdiagramsandwaveforms of:
(a) HalfWaveRectifier (b)FullWave Rectifier (c) BridgeRectifier
Statetheneedoffilterinpowersupplies.
Listthe differenttypesof filtersusedinpowersupplies.
ExplaintheworkingofZenerdiodeasaVoltage regulatorina powersupply.
Explaintheworkingofvoltageregulatedpowersupply.

3. Amplifiers

DefineAmplifier
Explaintheoperationoftransistorasanamplifier.
Listtheapplicationsofamplifiers.
Listthe differenttypesofcouplingmethods inamplifiers
Explaintheworkingof RC coupled amplifier with the circuit diagram and draw the frequencyresponsecurves.
Explain the need for power amplifier.
Distinguishbetweenvoltageamplifierandpoweramplifier.
Definetheterms(a)feedback (b)feedbackfactor
Explaintheeffectoffeedbackongain, bandwidth andnoise

4. Oscillators

DefineOscillatorandclassifydifferenttypesofoscillators
Statetheconditionsrequiredforsustainedoscillations
Statetheneed of(a) AFOscillator(b)RF Oscillator(c) SquareWaveOscillator
Drawthe circuit diagram andexplaintheworkingof

(a) RCPhaseShiftOscillator(b)HartleyOscillator(c)Colpitt'sOscillator

Listtheapplicationsofoscillators.

5. **LinearIntegratedCircuits**

DefineIntegratedCircuit.

Listthe advantagesofIntegratedCircuitsoverDiscrete Circuits.

ExplaintheoperationofDifferentialAmplifier.

ListthecharacteristicsofanIdealOperationalAmplifier.

ExplaintheworkingofOperationalAmplifier.

ExplaintheworkingofOpAmp invertingAmplifier.

Statethe conceptofvirtualground.

ExplaintheOperationalAmplifieras

(a) summer (b)integrator (c)differentiator (d)inverter.

Draw the Pin Diagram of 741 IC and state its important specifications and functionof each

pin.

HYPONATEDCOURSECONTENTS

1. **Semi-conductorDevices**

PN Junction Diode,forwardandreversebias-Zenerdiode,Zenerdiodecharacteristics-formation of PNP and NPN transistors- Transistor configurations - CB, CE and CC - Input andoutput characteristics of CE - FET,MOSFET, IGBT-characteristicsandtheir applications.

2. **Power supplies**

Half wave, Full wave and Bridge rectifiers, Types of Filters, Voltage regulated power supply using Zener Diode.

3. **Amplifiers**

Principles of Operation- Classification of Amplifiers, coupling methods, Frequency Response of R.C coupled amplifier – applications - Power amplifier – feedback amplifier.

4. **Oscillators**

Oscillator- types of oscillators -AF Oscillator- RF Oscillator -Square wave Oscillator -RC phase shift Oscillator -Hartley oscillator-Colpitt's oscillator –applications of oscillators.

5. **Linear Integrated circuits.**

Differential Amplifier – advantages of ICs – OperationalAmplifier–Gain–summer–integrator–differentiator-scalechanger – inverter -741IC.

Note: 1.Thissubjectistobe taughtbyElectronics&CommunicationEngg.Faculty

2. Papersettingandpaperevaluationisalso to be done by Electronics &CommunicationEngg.Faculty.

REFERENCEBOOKS

1. NN Bhargava – Basic Electroncis and linear circuits – TTTI, chandigarh
2. V.K.Mehta,Rohitmehta-PrinciplesofElectronics,SChand& Co.
3. G.K.Mithal-AppliedElectronics-Khannapublishers
4. G.K.Mithal-Electronicdevicesandcircuits-Khannapublishers
5. J.B.Gupta-AtextbookofElectronicsEngineering-KATSONBOOKS

SyllabustobeCoveredforUnitTests

UnitTest	**LearningOutcomestobeCovered**
UnitTest-I	From1.1to3.5
UnitTest-II	From3.6to5.9

PROGRAMMINGINC

Course Code	CourseTitle	No.of periods /Week	Total No.ofPeriods	Marks forFA	Marks forSA
EE-305	PROGRAMMINGINC	5	75	20	80

Chapter No.	Title	No.of Periods	Weightage	No. of short question (3 marks)	No. of Essay questions (10 marks)	CO'S Mapped
1	Basicsof'C'Programming	10	16	2	1	CO1
2	Decision&LoopControlStatements	15	26	2	2	CO2
3	Arrays&Strings	18	26	2	2	CO3
4	UserdefinedFunctions	15	16	2	1	CO4
5	Structures,Unions&Pointers	17	26	2	2	CO5
	TOTAL	**75**	**110**	**10**	**8**	

COURSEOBJECTIVES	i.To impartadequateknowledgeontheneedof programminglanguages andproblem-solvingtechniques.
	ii.To developprogrammingskills usingthefundamentalsandbasicsofC-Language.
	iii.To enable effectiveusageofarrays,structures,functions,pointersandto implementthememorymanagementconcepts.

COURSE OUTCOMES	CO1	EE-305.1	DevelopCprogramsusingoperatorswith proper Flowchartandalgorithm.
	CO2	EE-305.2	Apply conditionalanditerativestatementsto WriteC programs.
	CO3	EE-305.3	Develop Cprogramsonarraysandstrings.
	CO4	EE-305.4	Developmodularprogrammingusingfunctions.
	CO5	EE-305.5	Write programmesusing structures, unions andpointers.

LEARNINGOUTCOMES

1. **Basicsof'C'Programming**

State the Importance of 'C'
Explain the basic structure of 'C' Programming
KnowtheProgrammingstylewithsample program
Executea'C' Program
Knowaboutthecharacter set
Knowaboutconstants,variables, keywords&identifiers
Listvariousdatatypeswith examples
Explain different arithmetic operators, relational operators and logical
operatorswith theirprecedence
Explaintheassignment statements
Explainthe increment& decrement operators
IdentifythecompoundAssignment operators
Explaintheinputfunctionsprintfand scanf
Knowvarioustypeconversion techniques

2. **Decision&LoopControl Statements**

StatetheImportanceofconditional expressions
List andexplainthevariousconditional statements
Explaintheswitch statement
Listthe different iterativeloopsandexplainthem(for,do,while statements)
Definenestingandimplementwithsimple programs
Differentiate 'break' and 'continue' statements with programs
Mentionaboutthenullstatementsandcomma operator

3. **Arrays& Strings**

Define1-D and2-D Arrays.
Knowhow to initializeabove arraysandaccessarray elements
Explainsimpleprogramsusing arrays
Define 'string'
Knowhow todeclareandinitialize string variables
Understandvariousstringhandling functions
Implementprogramsusingstring functions

4. **Userdefinedfunctions**

Define 'function'
Understandtheneedfor Userdefined functions
Knowthe returnvaluesandtheir types
Listthe fourstorageclassessupportedby C
Discusstheimportanceoffunctionprototypes in programming
Differentiatelocalandexternal variables
Identifyautomatic and static variablesanddiscussthemin detail.

5. **Structures,Unions&Pointers**

Definea structure

Describeaboutstructure variable
Explain initialization of structures

Knowtheaccessingofmembersofa structure.
Illustrate concept ofstructure assignment
Explainhowtofindsizeofa structure.
Knowpassingofindividualmembersofa structuretoa function
DefineUnionandIllustrateuseof union
Declarepointer,assignpointer,andinitialize pointer
Discusspointer arithmetic.
Illustrate with example how pointer can be used to realize the effect ofparameter
passing by reference.
Illustratewithexamplesthe relationship betweenarraysand pointers.
Listvariousconditional andunconditionalpreprocessor directives

Note: 1.ThisSubjectistobe taughtbyComputerEngg.faculty
2.Paper setting and paper evaluation is also to be done by Computer EnggFaculty.

HYPONATEDCOURSECONTENTS

1. **Basicsof'C' Programming**
   Structure of a C program, Programming rules, Character Set, Keywords, Constants, Variables,Data types, Type conversion, Arithmetic, Logical, Relational operators and precedences – Assignment,Increment,Decrementoperators,evaluationofexpressions. I/P functions
2. **DecisionandLoopcontrol Statements**
   If, If-else, Nested If else, Break, Continue and Switch statements Loops:- For, While, Do-while,NestingofLoops- Nullstatement..
3. **Arraysand Strings**
   1 D Array declaration, Initialization, 2 D Array declaration, Initialization, Accessing of Arrayelements,CharacterArraysdeclarationandInitializationofStrings, stringhandlingfunctions
4. **Userdefined Functions**
   Function-Definition,Declaration,Returnstatement,passingparameterstofunction-Functioncalls,Storageclassesofvariables, Scopeandvisibility.
5. **Structures,Unions&Pointers**
   Structurefeatures,DeclarationandInitialization,AccessingofStructurememb ers,Unions.Pointerdeclaration,Arithmeticoperationsandpointers,Pointersa ndArrays,VariousPreprocessordirectives.

REFERENCEBOOKS

1. YashwantKanetkar–"LetuslearnC"- BPBPublication,NewDelhi
2. BalaguruSwamy–"ProgramminginANSIC"-TMH,IIIEdition
3. ByronGottfried-ProgrammingInC –SchaumSeries
4. ReemaThareja-ProgramminginC –Oxforduniversitypress.
5. BrainW, KernighanandDennisM.Ritchie-CProgramming Language-pearson

SyllabustobeCoveredforUnitTests

UnitTest	**LearningOutcomestobeCovered**
UnitTest-I	From1.1to3.7
UnitTest-II	From4.1to5.13

ELECTRICAL CAD LABORATORY

Course code	Course title	No. of periods/ week	Total no. of periods	Marks for FA	Marks for SA
EE-306	ELECTRICAL CAD LABORATORY	03	45	20	30

S.No	Unit Title	No. of periods	CO's Mapped
1.	Exercise on various tool bars, menus and standard Commands, Practice on dimensioning and formatting commands, insert commands and view commands.	14	CO1
2.	Exercise on drawing isometric drawings in 2D and introduction to 3D	5	CO1
3.	Exercise on drawing Electrical symbols, electrical wiring, electrical poles, towers and earthing systems.	15	CO2
4.	Exercise on drawing of the core section of transformer, pole and plinth mounted sub stations.	7	CO4
5	Exercise drawing the end view of D.C. Machine	4	CO5
	Total	**45**	

COURSE OBJECTIVES	1) The students will learn to create control designs using standard-based commands and drafting tools.
	2) To facilitate error-checking and schematic designing.
	3) The course will provide training on cinematic-quality rendering, 3D animation, and visual presentation of panel layout model.
	4) Overall, this course is intended to help control designers to design and implement the control systems efficiently.

COURSE OUTCOMES	CO1	EE-306.1	Familiarise and Practice on design of different engineering drawing models using basic commands
	CO2	EE-306.2	Drawing electrical circuits using basic symbols
	CO3	EE-306.3	Practicing on various poles, towers and earthing systems.

	CO4	EE-306.4	Design and drawing core sections of Transformers, Pole and plinth mounted substations.
	CO5	EE-306.5	Designing and development of end view of D.C. Machine.

LEARNING OUTCOMES

1. Exercise on various tool bars, menus and standard Commands, Practice on dimensioning and formatting commands, insert commands and view commands.

1. Study components in menu bar, Customise and arrange tool bar, Display the drawing created in the working area
2. Study of user coordinate system (UCS), Increase or decrease layouts
3. Give the inputs in the command bar, Display name and purpose of the tools, Study cross hair to locate thecursor
4. Invoke the commands, Getting started with AutoCAD, Create a new file, Open a file, Save a file, Close afile
5. Delete the object or text, Copy the object or text, Paste entities, Zoom anobject.
6. Use LINE command, MLINE command, POLYLINE command
7. Draw a circle using CIRCLE command, with centre point and radius, POLYGON command, HELIX command
8. Draw a rectangular, Triangular and quadrilateral areas filled with a solid, colour with the help of planetool
9. Understand SPLINE command, ELLIPSE command, DIVcommand
10. Understand INSERT command, HATCH command, MIRROR command, ARRAYcommand
11. Understand STRETCH command, TRIM command, BREAK command, JOINTcommand,
12. Understand FILLET command, CHAMFER command, EXPLODE command, GROUP command.
13. QDIM command, Practice LINEAR, ALIGNED and COORDINATE dimensions RADIUS or DIAMETER commands, ANGULUR dimension command, ARC LENGTH command BASELINE command, CENTREMARK command, LAYER command, Control the visibility of objects and assigned properties to objects, Practice the locking, unlocking of layers.
14. Write a text to drawing, change font size and style, Create a standard naming convention to a text styles, table styles, layer styles, dimension stylesetc.
15. Insert blocks into current drawing file using INSERTcommand

16. Understand ATTACH RASTER IMAGE command, REDRAWcommand
17. Draw the orthographic views (side view, top view, front view) of anyobject
18. Draw the isometric views of any object, SHADE command, HIDEcommand.

2. Exercise on drawing isometric drawings in 2D and introduction to 3D

1. Visualise the isometric view SW, NE isometric views, Isometric SNAP and GRID
2. Use set snap spacing, Change the default axis colours, size of the crosshair display by using crosshair tab
3. Create an isometric circle on the current isometric plane using Ellipse Iso circle

3. Exercise on drawing Electrical symbols, electrical wiring, electrical poles, towers and earthing systems.

1. Draw various electrical symbols
2. Drawing of electrical wiring circuit of one lamp controlled by one switch
3. Drawing of electrical wiring circuit of stair case wiring
4. Drawing of electrical wiring circuit of godown wiring
5. Drawing of electrical wiring circuit of series parallel control circuits
6. Drawing of different electrical poles with cross-arms, insulators and stay sets
7. Drawing of transmission towers
8. Drawing of pipe earthing with dimensions
9. Drawing of plate earthing with dimensions

4. Exercise on drawing of the core section of transformer, pole and plinth mounted sub stations.

1. Drawing of plan and elevation of different stepped cores of single phase transformer.
2. Drawing of Pole mounted substation and Plinth mounted substation with dimensions

5. Exercise drawing the end view of D.C.Machineand view of a D.C. Machine

1. Drawing of end view of D.C. Machine

HYPONATED COURSE CONTENTS

1. Exercise on various tool bars, menus and standard Commands, Practice on dimensioning and formatting commands, insert commands and view commands.

Study components in menu bar-Customise and arrange tool bar-Display the drawing created in the working area-user coordinate system (UCS)-Increase or decrease layouts-Give the inputs in the command bar-Display name and purpose of the tools-Study cross hair to locate the cursor-Invoke the commands-Getting started with AutoCAD-Create a new file-Open a file-Save a file-Close a file- Delete the object or text -Copy the object or text-Paste entities-Zoom anobject.

Use LINE command-MLINE command-POLYLINE command-Draw a circle using CIRCLE command-with centre point and radius-POLYGON command-HELIX command-Draw a rectangular-Triangular and quadrilateral areas filled with a solid-colour with the help of plane tool-Understand SPLINE command-ELLIPSE command-DIV command-Understand INSERT command-HATCH command- MIRROR

command-ARRAY command-Understand STRETCH command-TRIM command-BREAK command-JOINT command-Understand FILLET command-CHAMFER command-EXPLODE command- GROUP command - QDIM command-Practice LINEAR-ALIGNED and COORDINATE dimensions-RADIUS or DIAMETER commands-ANGULUR dimension command-ARC LENGTH command-BASELINE command- CENTREMARK command-LAYER command-Control the visibility of objects and assigned properties to objects-Practice the locking, unlocking of layers-Write a text to drawing-change font size and style- Create a standard naming convention to a text styles-table styles-layer styles-dimension styles etc. - Insert blocks into current drawing file using INSERT command-Understand ATTACH RASTER IMAGE command-REDRAW command-Draw the orthographic views (side view-top view-front view) of any object-Draw the isometric views of any object-SHADE command-HIDE command.

2. Exercise on drawing isometric drawings in 2D and introduction to 3D

Visualise the isometric view SW-NE isometric views-Isometric SNAP and GRID-Use set snap spacing- Change the default axis colours-size of the crosshair display by using crosshair tab-Create an isometric circle on the current isometric plane using Ellipse Isocircle.

3. Exercise on drawing Electrical symbols, electrical wiring, electrical poles, towers and earthing systems.

Draw various electrical symbols - Drawing of electrical wiring circuit of one lamp controlled by one switch-stair case wiring- godown wiring-series parallel control circuits - Drawing of different electrical poles with cross-arms-insulators and stay sets-transmission towers - Drawing of pipe earthing and Plate earthing with dimensions.

4. Exercise on drawing of the core section of transformer, pole and plinth mounted sub stations.

Drawing of plan and elevation of different stepped cores of single phase transformer - Drawing of Pole mounted substation and Plinth mounted substation with dimensions.

5. Exercise drawing the end view of D.C.Machine and view of a D.C. Machine

Drawing of end view of D.C Machine.

Reference books

1. Get started with AutoCAD Electrical (Vol.1 and 2)– James Richardson-Musselburgh Press Publishers
2. AutoCAD Electrical 2022 Black Book 7th edition–Gaurav Verma, Matt Weber – Cadcamcae Works Publishers

ELECTRICAL MACHINES – I LABORATORY

Course code	Course title	No. of periods/ week	Total no. of periods	Marks for FA	Marks for SA
EE-307	Electrical Machines – I Laboratory	3	45	40	60

Chapter No.	Title	No. of Periods	CO'S Mapped
1	Characteristics of DC Generators	12	CO1
2	Testing and Speed control of DC motors	18	CO2
3	Measuring Instruments	6	CO3
4	Transducers and sensors	9	CO4
Total		**45**	

COURSE OBJECTIVES	i. To familiarise with the knowledge of different materials , tools used in Electrical Engineeringprocess ii. To know the etiquette of working with the fellowworkforce iii. To reinforce theoretical concepts by conducting Relevantexperiments iv.To know the procedures for measuring resistance and power. v. To know the working of transducers and sensors

COURSE OUTCOMES	**CO1**	EE-307.1	Demonstrate the skill of planning and organizing experimental setup for D.C Generators,performing operations for investigating performance and to sketch graphically.
	CO2	EE-307.2	Analyse the experimental results to draw inferences, to make recommendations for selection of D,C motor and to run at various speeds for different applications and plotting various characteristics.
	CO3	EE-307.3	Conduct a test for measurement of resistance and power.
	CO4	EE-307.4	Analyse the working of transducers and sensors

Learning outcomes:

1. Characteristics of DC Generators

1. Obtain OCC of a DC shunt Generator at below, rated and above ratedspeeds.
2. Obtain Internal and External characteristics of DC ShuntGenerator.
3. Obtain Internal and External characteristics of DC SeriesGenerator.
4. Obtain Internal and External characteristics of DC CompoundGenerator

2. Testing and Speed Control of D.CMotors

1. Identify the terminals of the following DCMachinesi) DC Shuntmotorii) DC SeriesMotor
2. Study the parts of DC 3 - point starter, 4 - point starter and Drum ControllerStarter.
3. Obtain performance characteristics by conducting Brake Test on DC ShuntMotor
4. Obtain performance characteristics by conducting Brake Test on DC SeriesMotor.
5. Speed control of DC Shunt Motorbyi) Rheostatic controlmethod ii) Field controlmethod
6. ObtaintheperformanceofaDCShuntMotorbyconductingSwinburne'stest.

3. Measuring Instruments

1. Calibration of dynamometer type ofwatt meter.
2. Measurement of earth resistance by using megger.

4. Transducers and sensors

1. Obtain the performance characteristics of LVDT by conducting an experiment.
2. Obtain the performance characteristics of thermocouple by conducting an experiment.

HYPONATED COURSE CONTENTS

1. Characteristics of DCGenerators

OCC of a DC shunt Generator at below, rated and above ratedspeeds- Internal and External characteristics of DC ShuntGenerator- Internal and External characteristics of DC SeriesGenerator - Internal and External characteristics of DC CompoundGenerator

2. Testing and Speed Control of D.CMotors

Identification of terminals of DC machines-parts of DC 3-point starter- Brake Test on DC Shunt

Motor- Brake Test on DC SeriesMotor-Methods of Speed control of DC Shunt Motor-Swinburne'stest on DCShuntMotor.

3. Measuring Instruments

Calibration of dynamometer type watt meter-Measurement of earth resistance by using megger.

4. Transducers and sensors

Performance characteristics of LVDT- performance characteristics of thermocouple.

Competencies to be achieved by the student

S.No	Experiment title	Competencies	Key Competencies
1	OCC of a DC shunt Generator at below, rated and above rated speeds.	• Draw the relevant circuit diagram for OCtest. • Select the proper DC supplyvoltage. • Choose the proper range of voltmeter, ammeter and rheostat. • Make the connections according to circuit diagram. • Ensure that all the instruments are connected in proper polarity. • Check the speed and maintain it constant by means of field regulator before taking every reading. • Observe and note the readings in a tabular form. • Draw the graphbetweenI_fVsE_g.	• Make the connections according to circuit diagram. • Observe and note the readings in a tabular form. • Draw the graphbetweenI_fVsE_g.
2, 3 ,4	Internal and External characteristics of DC shunt generator DC series generator DC compound generator	• Draw the relevant circuit diagram • Select the proper DC supply voltage. • Choose the proper range of voltmeter, ammeter and rheostat. • Make the connections according to circuit diagram. • Ensure that all the instruments are connected in proper polarity. • Check the speed and maintain it constant by means of field regulator before taking every reading. • Apply load in steps upto rated current • Observe and note the readings in a tabular form. • Draw the graph between I_aVsE_g ,I_l Vs V_l	• Make the connections according to circuit diagram • Observe and note the readings in a tabular form. • Draw the graph between I_aVsE_g ,I_l Vs V_l

5	Identify the terminals of the following DC Machines DC Shuntmotor, DC SeriesMotor	• Note down the name platedetails. • Locate the different terminals of a DC Shunt Motor / DC Series Motor • Measure the resistance across different terminals using multimeter. • Record the resistance values of theterminals. • Identify the armature and shunt field / series field resistance according to resistance valuesobserved.	• Measure the resistance across different terminals using multimeter. • Identification of armature and shunt field / series field resistance according to resistance valuesobserved.
6	Study the parts of DC 3 point starter.	• Locate the Line, Armature, Field terminals of the starter (L-A-F) • Locate NVR coil and OLRcoils. • Know the purpose of NVR and OLRcoils. • Properly connect Starter and motor terminals • Properly handle the Starter terminals. • Properly start the motor.	• Know the purpose of NVR and OLRcoils. • Properly handle the Starterterminals.
7, 8	Performance characteristics of DC (Shunt, Series) by conducting Brake Test	• Select the proper DC supply voltage • Choose the proper range of voltmeter, ammeter and rheostat. • Connect the circuit as per the circuit diagram. • Ensure that all the instruments are connected in proper polarity. • Start the Motor with the starter. • Note the readings of speed N, current I and spring balance for a particular load. • Pour water in the break drum carefully. • Check the speed and maintain it constant by means of field regulator before taking every reading.	• Connect the circuit as per the circuit diagram. • Note readings by varying loads on the motor upto rated current. • Calculate the torque, input, output and efficiency. • Draw performance curves of motor

		• Note readings by varying loads on the motor upto rated current. • Calculate the torque, input, output and efficiency. • Draw performance curves of motor	
9	Speed control of DC Shunt Motor by (a) Rheostatic control method (b) Fieldcontrol Method	• Select the proper DC supply voltage • Choose the proper range of voltmeter, ammeter and • rheostat. • Connect the circuit as per the circuit diagram. • Ensure that all the instruments are connected improper • polarity. • Handle the 3- point Starter • Set the Field Resistance of the motor by gradually • moving the knob on the rheostat coil. • Record the readings of Ammeter and Tachometer by gradually increasing the resistance in the Field rheostat. • Draw the graph speed Vs Field current. • Observe the graph and write the conclusions.	• Connect the circuit as per the circuit diagram. • Record the readings of Ammeter and Tachometer by gradually increasing the resistance in the Field rheostat. • Draw the graph speed Vs Field current. • Observe the graph and write the conclusions.
10	Performance of a DC Shunt Motor by conducting Swinburne's test.	• Select the proper DC supply voltage • Choose the proper range of voltmeter, ammeter and rheostat. • Connect the circuit as per the circuit diagram. • Ensure that all the instruments are connected in proper polarity. • keep the rheostat in maximum position in armature so that minimum voltage is applied to armature	• Connect the circuit as per the circuit diagram. • Calculate the efficiency of the DC Machine as a Generator and as a Motor at various loads. • Draw the conclusions

		• Adjusting the field rheostat to minimum position • Adjust the speed of the motor to its rated value by using itsField Rheostat. • Taking the readings of Ammeter and Voltage by opening the Field switch • Taking the readings of Voltage and current by closing the field switch and gradually decreasing the resistance in the Rheostat. • Calculate the efficiency of the DC Machine as a Generator and as a Motor at various loads. • Draw the conclusions Adjusting the field rheostat to minimum position • Adjust the speed of the motor to its rated value by using itsField Rheostat. • Taking the readings of Ammeter and Voltage by opening the Field switch • Taking the readings of Voltage and current by closing the field switch and gradually decreasing the resistance in the Rheostat. • Calculate the efficiency of the DC Machine as a Generator and as a Motor at various loads. • Draw the conclusions	

11	Calibration of dynamometer type ofwatt meter	• Select the proper supply voltage • Choose the proper range of voltmeter, ammeter and rheostat. • Connect the circuit as per the circuit diagram. • Ensure that all the instruments are connected in proper polarity. • Initially keep in no load condition. • Switch on power supply. • Load is switched on and note down the readings of ammeter,voltmeter and wattmeter. • Increase the load in steps and note down the corresponding meter readings at every step. • Remove the load gradually and switch off the supply. • Calculate the error and percentage error.	• Connect the circuit as per the circuit diagram. • Load is switched on and note down the readings of ammeter,voltmeter and wattmeter. • Calculate the error and percentage error.
12	Measurement of earth resistance by using megger.	• Connect the megger as per the connection diagram. • Switch ON the megger • Rotate the handle of the Megger at uniform speed. • The value of resistance is measured directly from the instrument.	• Rotation of the handle of the megger at uniform speed • The value of resistance is measured directly from the instrument.

13	Performance characteristics of LVDT	• Connections are given as per the circuit diagram • The screw gauge is adjusted for minimal voltage • The core is moved in clockwise direction with the help of screw gauge • The output voltage for each 1mm displacement was added and noted • The displacement core was brought to initial position and moved in anticlockwise direction. • Again for each 1mm displacement was noted • A graph is plotted between displacement and output voltage.	• Connections are given as per the circuit diagram • Performance characteristics of LVDT is studied.
14	performance characteristics of thermocouple.	• Connect the multi-meter to the Thermocouple as shown in the diagram • Heat the water up to90°C. • The emf is noted down aftera certain interval such as 5 C. • Graph is plotted between emf and Thermocouple. • Calculate time constant from the graph	• Connect the multi-meter to the Thermocouple as shown in the diagram • Graph is plotted between emf and Thermocouple. • Calculate time constant from the graph.

CIRCUITS AND TRANSFORMERS LABORATORY

Course code	Course Title	No. of periods /week	Total No. of periods	Marks for FA	Marks for SA
EE-308	CIRCUITS AND TRANSFORMERS LABORATORY	3	45	40	60

Chapter No.	Title	No. of periods	CO's Mapped
1	DC Circuits and DC Theorems	12	CO1
2	AC Circuits	12	CO2
3	Performance and testing of Transformers	21	CO3
	Total	**45**	

COURSE OBJECTIVES	i) Verification of KCL, KVL and DC Theorems
	ii) Observe the response at R, L and C in series RLC circuit, determining the power in single phase and three phase balanced circuits
	iii) To reinforce theoretical concepts of transformers by conducting relevant experiments.

COURSE OUTCOMES	**CO1**	**EE-308-1**	Understand the connection patterns in bread board, able to connect circuit in bread board, verify DC theorems.
	CO2	**EE-308-2**	Understand the operating procedure of CRO, able to connect the voltmeters and watt meters in a circuit, able to determine the power in single phase and three phase balanced circuits.
	CO3	**EE-308-3**	Able to determine the polarity of Transformer terminals and its transformation ratio, Understand the testing procedure of single phase transformers to determine its parameters, able to find dielectric strength of transformer oil.

LEARNING OUTCOMES

DC Circuits and DC Theorems

Verification of OHM's law
Verification of KCL and KVL
Verification of Super Position Theorem
Verification of Thevenin's Theorem
Verification of Maximum Power Transfer Theorem

AC Circuits

Verifying the response at R, L and C in series RLC circuit
Measurement of power in single phase circuit by 3-Voltmeter method
Measurement of power in three phase balanced circuit by 2-Wattmeter method

Performance and testing of Transformers

Determination of the polarity and voltage transformation ratio of a single phase transformer
Conduct load test on 1-phase Transformer and calculate efficiency and regulation
Conduct O.C. and S.C. tests on 1-phase transformer and from result

a) Draw the equivalent circuit
b) Calculate efficiency at various loads and power factor
c) Find the load at which maximum efficiency occurs

Conduct Oil testing using oil testing kit to know the dielectric strength of transformer oil

HYPONATED COURSE CONTENT

1.0. Verification of DC Circuits and DC Theorems

Verification of OHM's law, KCL and KVL – Verification of DC Theorems (Superposition, Thevenin's and Maximum power transfer)

2.0. AC Circuits

Verifying the response at R, L and C in series RLC circuit - Measurement of power - in single phase circuit by 3 Voltmeter method - in three phase balanced circuit by 2-Wattmeter method

3.0. Performance and testing of Transformers

Determination of - polarity of terminals - voltage transformation ratio – Direct load test on 1-phase Transformer – Calculation of efficiency and regulation - O.C. and S.C. tests on 1-phase transformer - equivalent circuit - efficiency at various loads and power factor - load at which maximum efficiency occurs - Test to know the dielectric strength of transformer oil

Competencies & Key competencies to be achieved by the student

Sl.No.	Experiment Title	Competencies	Key Competencies
1	Verification of DC Circuits and DC Theorems	• Understand the connection patterns in bread board • Identify the correct rating of resistors, voltage sources and meters • Connection of circuit diagram on bread board with proper input sources and meters • Interpreting the responses of various circuits related to verification of KCL, KVL and DC Theorems	• Connection of devices with exact ratings as per circuit diagram in bread board • Verification of laws and theorems in DC
2	AC Circuits	• Operating of CRO • Setting up the desired voltage source frequency • Connection of circuit diagram on bread board with proper input sources • Using CRO to observe output waveform patterns • Usage of 3 voltmeter and 2 wattmeter methods to measure power in single phase and three phase respectively	• Verifying the response at R, L and C in series RLC circuit • Ability to measure power in single phase and balanced three phase circuits
3	Performance and testing of Transformers	• Conduct polarity test and ascertain the relative polarities of secondary windings. • Interpret the name plate details of transformer • By selecting proper range and type of meters the circuit diagram to determine voltage transformation ratio is to be connected • Make connections as per circuit diagram with appropriate range and type of meters to conduct load test, O.C. test and S.C. test • Follow the precautions to be taken (ex: Check for loose and/or wrong connections if any and rectify) • Perform the tests as per standard procedure and make a note of test results	• Identifying the polarity of transformer terminals • Ability to find transformation ratio of transformer • Calculation of efficiency and voltage regulation by performing O.C., S.C. and load tests • Ability to determine dielectric strength of transformer oil

		• Calculate the efficiency and regulations from test data • Plot the efficiency curve and indicate the maximum efficiency point • Conduction of transformer Oil testing using oil testing kit to know the dielectric strength of transformer oil.	

ELECTRONICS ENGINEERING LABORATORY

Course Code	Course Title	No. of periods / Week	Total No. of Periods	Marks for FA	Marks for SA
EE-309	ELECTRONICS ENGINEERING	3	45	40	60

Chapter No.	Title	No. of periods	CO's Mapped
1.	Semiconductor Devices	12	CO1
2.	Power Supplies	12	CO2
3.	Amplifiers	6	CO3
4.	Oscillators	9	CO4
5.	Linear Integrated Circuits	6	C05
	Total	**45**	

COURSE OBJECTIVES	i. To impart adequate knowledge on electronic devices and circuits.
	ii. To develop skills of using amplifier and oscillators.
	iii. To enable effective usage of linear integrated circuits.

COURSE OUTCOMES	CO1	EE-309.1	Illustrate the characteristics of various electronic devices.
	CO2	EE-309.2	DevelopingPower Supply Circuits.
	CO3	EE-309.3	Designing amplifier and using them in various applications.
	CO4	EE-309.4	Practice on various oscillator circuits.
	CO5	EE-309.5	Practicing linear integrated circuits to develop various applications.

LEARNING OUTCOMES

1. Semiconductor Devices

1. Plot the VI characteristics of PN junction diode.
2. Plot the VI characteristics of Zener diode.
3. Plot the Input and Output characteristics of NPN transistor in Common Emitter configuration.
4. Plot the VI characteristics of Photo Diode
5. Plot the VI characteristics of LDR

2. Power Supplies

1. Implement Half Wave rectifier with and without filter.
2. Implement Full Wave rectifier with and without filter.
3. Implement Bridge Wave rectifier with and without filter.
4. Build a regulated power supply with (a) Zener Diode and (b) Voltage Regulator IC.

3. Amplifiers

1. Plot the frequency response characteristics of RC coupled amplifier.

4. Oscillators

1. Measure the frequency of Hartley oscillator.
2. Measure the frequency of Colpitts oscillator.

5. Linear Integrated Circuits

1. Implement Inverting Amplifier with IC 741 OpAmp.
2. Implement Inverting Integrator with IC 741 OpAmp.

Note : 1 This Lab is to be handled by Electronics & Communication Engg. faculty

2. Paper setting and paper evaluation is also to be done by Electronics &Communication
Engg Faculty.

HYPONATED COURSE CONTENTS

1. Semiconductor Devices

VI characteristics of PN junction diode - VI characteristics of Zener diode - Input and Output characteristics of NPN transistor in Common Emitter configuration - VI characteristics of Photo Diode - VI characteristics of LDR.

2. Power Supplies

Half Wave rectifier with and without filter - Full Wave rectifier with and without filter - Bridge Wave rectifier with and without filter - Regulated power supply with (a) Zener Diode and (b) Voltage Regulator IC.

3. Amplifiers

Frequency response characteristics of RC coupled amplifier.

4. Oscillators

Measure the frequency of Hartley oscillator - Measure the frequency of Colpitts oscillator.

5. Linear Integrated Circuits

Inverting Amplifier with IC 741 OpAmp - Inverting Integrator with IC 741 OpAmp

Competencies & Key competencies to be achieved by the student

Sl.No.	Experiment Title	Competencies	Key Competencies
1	VI Characteristics of Semiconductor Devices	• Understand the connection patterns in bread board • Identify diode,the correct rating of voltage sources and meters • Connection of circuit diagram on bread board with proper input sources and meters • Interpreting the responses of the various semiconductor devices.	• Connection of devices with exact ratings as per circuit diagram in bread board • Ability to plot the VI characteristics of various semiconductor devices(PNjunction diode,zener diode, photo diode, LDR) and to plotinput/output characteristics of NPN transistor in CE configuration
2		• Operating of CRO • Setting up the desired	

	Power Supplies	voltage source frequency • Connection of circuit diagram on kit with proper input sources with and without filter • Using CRO to observe output waveform patterns with and without filter	• Verifying the responses at CRO with and without filter for various rectifiers(HalfWaverectifier,fullwave and bridge rectifier) • Ability to build regulated power supply with zener diode and voltage regulator IC
3	Amplifiers	• Operating of CRO • Setting up the desired voltage source frequency • Connection of circuit diagram on kit with proper input sources • Using CRO to observe frequency response waveform patterns	• Verifying the response at CRO • Ability to plot the frequency response characteristics of RC coupled amplifier
4	Oscillators	• Operating of CRO • Setting up the desired voltage source frequency • Connection of circuit diagram on kit with proper input sources • Using CRO to observe frequency response waveform patterns	• Verifying the output waveform at CRO (Hartley and colpitts oscillators) • Ability to draw output waveform
5	Linear Integrated Circuits	• Identify the components • Setup the circuit on the breadboard and check the connections. • Switch on the power supply • Give input. • Observe input and output on the two channels of the oscilloscope simultaneously. • Note down and draw the input and output waveforms on the graph	• Verify the input and output waveforms are out of phase.(inverting amplifier) • Verify the obtained gain is same as designed value of gain. • Observe input and output on two channels of the oscilloscope simultaneously • Ability to draw input and outputwaveforms(integrating amplifier)

PROGRAMMINGINCLABORATORY

Course Code	Course Title	No. of periods /Week	Total No. of Periods	Marks for FA	Marks forSA
EE-310	PROGRAMMING IN CLABORATORY	3	45	40	60

Chapter No	Titles	No. of periods	CO's Mapped
1.	C Programming Basics	6	CO1
2.	Decision& Loop Control Statements	9	CO2
3.	Exercises on functions	6	CO3
4	Arrays, Strings and Pointers in C	9	CO4
5.	Structures, Unions & Pre-processor Directives	6	C05
	Total	**45**	

COURSE OBJECTIVES	i) To impart adequate knowledge on the need of programming languages and problem-solvingtechniques.
	ii) To develop programming skills using the fundamentals and basicsof C-language.
	iii) To enable effective usage of arrays, structures, functions, pointersandto implementthememorymanagement concepts.

COURSE OUTCOMES	CO1	EE-310.1	Design problems solving with flow chart and algorithm.
	CO2	EE-310.2	Practice conditionalanditerativestatementsto WriteC programs.
	CO3	EE-310.3	ExecuteCprogramsthatuse functions.
	CO4	EE-310.4	Execute C programs using arrays and strings
	CO5	EE-310.5	Practiceonstructures,unions.

LEARNINGOUTCOMES

1. C Programming Basics

1. Editing and executing simple programs (using printf and scanf functions) .
2. Exercises on operators in C.

2. Decision & Loop Control Statements

1 Exercises on conditional statements (if, if – else, else if statements).
2 Exercises on switch statements and conditional operator.
3 Exercises on looping statements (while, do–while and for statements).

3. Exercises on functions

1. Exercises on functions to demonstrate prototyping, parameter passing, function returning values
2. Exercises on recursion.

4. Arrays, Strings and Pointers in C

1. Exercises on one dimensional arrays and two dimensional arrays.
2. Exercises on Strings handling functions comparison, copying and concatenation.
3. Exercises to demonstrate use of Pointers, pointers as function arguments, functions returning pointers.

5. Structures, Unions & Pre-processor Directives

1. Exercise on structures.
2. Exercises on unions and C pre-processor Directives.

Note: 1.This Lab is to be handled by Computer Engg. faculty
2.Papersettingandpaperevaluationisalso to be done by Computer Engg Faculty.

HYPONATEDCOURSECONTENTS

1. C Programming Basics

Editing, compiling and executing simple programs (using printf and scanf functions) – Exercises on operators in C.

2. Decision & Loop Control Statements

Exercises on conditional statements (if, if – else, else if statements) , switch statements and conditional operator) –Exercises on looping statements(while, do–while and for statements).

3. Exercises on functions

Exercises on functions to demonstrate prototyping, parameter passing, function – returning values and recursion.

4. Arrays, Strings and Pointers in C

Exercises on one dimensional arrays and two dimensional arrays, Strings handling functions comparison, copying and concatenation - Exercises to demonstrate use of Pointers, pointers as function arguments, functions returning pointers

5. Structures, Unions & Preprocess or Directives

Exercise on structures, unions and C pre-processor Directives.

Competencies & Key competencies to be achieved by the student

Sl.No.	Experiment Title	Competencies	Key Competencies
1	**C Programming Basics**	• Opening of Turbo C • Understand about work space • Procedure to open new file in Turbo C • Able to write simple programs • Understanding the procedure to save file. • Understand about different tabs in Turbo C • To know about Execution of program in Turbo C • Understand to see outp-ut file	• Perform simple mathematics related programs by using Turbo C • Familiarization with work space of Turbo C
2	Decision & Loop Control Statements	• Opening of new file in Turbo C • Understand about different looping statements like if, if-else, while, do-while and for loop • Understand about SWITCH statements • Executing different programs related to loop control statements. • Save program file Turbo C • Understand about output of program	• Writing of different programs using loop control statements • Observation of outputs
3	Exercises on functions	• Opening of new file in Turbo C • Understand to use function in C program • Understand to use recursive functions in C • Understand to use Function call technique in C program • Save the program file • Understand about output of program	• Usage of recursive functions • Usage of External and internal variables • Usage of function call technique • Observation of outputs

4	Exercises on Arrays, Strings and Pointers in C	• Opening of new file in Turbo C • Understand about arrays and their usage • Understand about strings and their usage • Understand about pointers and their usage • Writing of C programs using arrays , strings and pointers • Save the program file • Understand about output of a program	• Usage of one dimensional and multi-dimensional arrays • Usage of string handling functions • Usage of pointers • Writing program using arrays, strings and pointers • Observation of outputs
5	Structures, Unions & Preprocessor Directives	• Opening of new file in Turbo C • Understand about Structures • Understand about unions • Understand about preprocessor directives • Usage of structures, unions and pointers in C program • Save the program file • Understand about output of a program	• Usage of structures in program • To know the difference between structures and unions • Types of pre processor directives and their importance in C program • Writing of programs using structures • Observation of outputs

IV SEMESTER

DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
(IV SEMESTER)

Subject Code	Name of the Subject	Instruction periods/week		Total Periods /year	Scheme of Examination			
		Theory	Practical / Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
EE-401	Electrical Installation & Estimation	4	-	60	3	20	80	100
EE-402	Electrical Machines-II	5	-	75	3	20	80	100
EE-403	Power Systems – I	4	-	60	3	20	80	100
EE-404	Power Electronics & PLC	4	-	60	3	20	80	100
EE-405	General Mechanical Engineering	4	-	60	3	20	80	100
PRACTICAL								
EE-406	Electrical EngineeringDrawing	-	6	90	3	40	60	100
EE-407	Electrical Machines-II Laboratory	-	3	45	3	40	60	100
EE-408	Communications Skills Laboratory	-	3	45	3	40	60	100
EE-409	Power Electronics Laboratory	-	3	45	3	40	60	100
EE-410	Hybrid Power Systems Laboratory	-	3	45	3	40	60	100
	TOTAL	**21**	**18**	**585**	**30**	**300**	**700**	**1000**
NOTE:03 periods per week are allotted to Student Centric Activity (Library, Sports& Games, Clean & Green, Preparation for placements etc)								
NOTE:EE-408 is common with all branches.								

ELECTRICAL INSTALLATION AND ESTIMATION

Course code	Course title	No. of periods/week	Total no. of periods	Marks for FA	Marks for SA
EE-401	ELECTRICAL INSTALLATION ANDESTIMATION	4	60	20	80

Chapter No.	Title	No.of Periods	Weightage	No. of short question (3 marks)	No. of Essay questions (10 marks)	CO'S Mapped
1	Wiring Systems	7	16	2	1	CO1
2	Estimation of Lighting and Power Loads	20	36	2	3	CO2
3	Estimation of OH Lines and Earthing systems	18	26	2	2	CO3
4	Departmental Tests	9	16	2	1	CO4
5	Electrical Safety	6	16	2	1	CO5
TOTAL		**60**	**110**	**10**	**8**	

COURSE OBJECTIVES	(i) To understand different wiring systems, service mains (ii) To estimate the cost of domestic installations, industrial installations of electrical equipment and earthing (iii) To know the safety precautions, Departmental procedure for acquiring electrical connection.

COURSE OUTCOMES	**CO1**	EE-404.1	Describing the specifications of various wiring accessories and different components of wiring system
	CO2	EE-404.2	Estimate the materials required and their cost in domestic installation and power wiring installation.
	CO3	EE-404.3	Estimate the electrical materials required for OH lines, Earthing systems.
	CO4	EE-404.4	Extending the knowledge on departmental procedure for acquiring electrical connection.

			Calculation of Transformer ratings for Rural electrification
	C05	EE-404.5	Extending the knowledge on electrical safety and precautions to be taken

LEARNING OUTCOMES:

1. Wiring systems

Mention the use of wires, cables, Types of Installations and wiring Accessories**.**
Explain (i) Surface conduit system (ii) Concealed wiring system.
State merits and demerits of (i) Surface conduit system (ii) Concealed wiring system.
List different types of knife switches.
List the MCB types with specifications and mention their applications (MCCB,ELCB AND RCCB)
List the different types of fuses and specify the materials used.
List different ratings of fuses and state their applications.
State the reasons for not using fuse in Neutral wire

2. Estimation of Lighting and Power Loads

Define service mains and explain different types of service mains
List the electrical material used in wiring the service mains.
List the schedule of rates used in preparing estimate for house wiring and service mains
Estimate the material requirement with cost for (i) PVC conduit wiring and (ii) PVC casing -capping wiring for the given plan of abuilding.
Draw the wiring layout for a big office building, workshop/ Electrical Laboratory
Prepare layout and draw single line wiring diagrams as per standard practice for a given
set of machines in aworkshop.
Prepare the estimate of the materials for the complete installation of machines in a work shop / laboratory as per standard practice
Select the type of wiring and service mains used for the irrigation pump set.
Prepare an estimate for electrifying the irrigation pump set scheme
Prepare estimation for submersible pump installation

3. Estimation of OH Lines and Earthingsystems

Select the type of insulators to be used for over headlines
3.2. Calculate the total number of insulators required for the givenOH Line
Select the type, size and number of cross arms required for the overheadline
Determine the size and total length of overhead conductor required for the line giving due
Consideration for the sag to be allowed
Estimate the quantity of all materials required for given 11 kV and 400V over headlines
Draw and explain plinth and Pole Mounted transformer substations

Estimate the quantity of all the electrical accessories and components required for the given

(i) Pole mounted transformer (ii) Plinth mounted transformer

State the purpose of Earthing and mention its types that are normally used.
Select the suitable type of Earthing for a given installation
Draw and explain (i) pipe earthing (ii) plateEarthing with neat sketches.
Estimate the materials required for pipe and plateearthing.

4. Departmental Tests

Describe the departmental procedure for obtaining a service connection
Specify insulation resistance desirable for a given electrical installation
Specify the value of earth resistance to be maintained for a given electrical Installations
List different tests to be conducted before energizing a newly constructed electrical installation.
Describe the test procedure for continuity of wiring in an electrical installation.
Explain the procedure for conducting insulation test of domestic wiring
Explain the Sureyof load particulars in a villagefor

(i) Domestic(ii)industrial (iii) agriculturalloads.

Calculate the capacity of a transformer required assuming suitable diversity factor
Determine the location point of transformer and calculate the tail end voltage regulations

5. Electrical Safety

State the importance of electrical safety.
State the common electrical hazards.
Define electric shock and state the effects of electric shock on human body.
State the safety precautions to be taken to avoid electric shock.
List safety equipments used while working with electricity.
Describe the procedure of first aid for shock treatment to an electrocuted person.
State the reasons for fire accidents and state the prevention techniques.
Define fire extinguisher and State fire extinguishing techniques.
List different fire extinguishers in common use.

HYPONATEDCOURSE CONTENT

1. Wiring Systems

Introduction, size of wires, standard wires, types of wires - various wiring systems -- Distribution boards - Main switches – Different types of fuses and fuse carriers.

2. Estimation of Lighting and power loads

Estimation of domestic lighting installation service main - specification - quantity of materials required for service main – estimation and selection of interior wiring system suitable to a given building - number of sub circuits - calculation of length of

wire and quantity of accessories required - estimates of materials for execution of the domestic wiring installation - Power wiring installation Drawing wiring layout for a big office building, electrical laboratory, - Irrigation pump installation - Estimation upto 10 HP service main - calculation of size and quantity of wire and other components required - Types of starter and control panel – Estimate for the installation of submersible pump.

3. **Estimation of OH Lines and Earthing**

Distribution lines of 11 kV and 400Volt OH lines estimation only -quantity of materials required for lines of length 1 km - number of poles - Cross arms - insulators - conductor length and size - Distribution transformer erection- Estimation of quantity of materials required for structures, isolators - HG fuse isolators, lightening arrestors for pole mounted substation and plinth mounted substation Quantity estimation for materials required in electrical Earthing for pipe earthling and plate Earthing

4. **Departmental Tests**

Electrical installation testing - departmental procedure for obtaining service connection - desirable insulation resistance for domestic and power circuits - procedure for conducting insulation resistance test and continuity tests, earth continuity test - Design of rural electrification scheme - Load survey-determination of capacity of transformer - estimation of quantity of materials required for the erection of distribution lines and11 kV feeder from a nearby 11 kV feeder - determining the feasibility of placement of distribution transformer

5. **Electrical Safety**

Safety procedures - Electric shock and first aid, causes for fire hazards in Electrical installations-reasons for fire accidents - prevention techniques -fire extinguisher-different fire extinguishers

REFERENCE BOOKS:

1. G.C Garg &S.L.Uppal-Electrical Wiring ,Estimating & costing Electrical wiring,
2. J.B.Gupta -Estimating &costing
3. BVS Rao -Maintenance and Operation of Electrical Equipment – Vol-I-TMH
4. S. Rao -Testing, Commissioning Operation & Maintenance of Electrical equipment–TMH
5. V.K Mehta- Electrical Estimating & costing

Syllabus to be Covered for Unit Tests

Unit Test	Learning Outcomes to be Covered
Unit Test-I	From 1.1 to 2.10
Unit Test-II	From 3.1 to 5.9

ELECTRICAL MACHINES-II

Course code	Course title	No. of periods/week	Total no. of periods	Marks for FA	Marks for SA
EE-402	ELECTRICAL MACHINES-II	5	75	20	80

Chapter No.	Title	No. of Periods	Weightage	No. of short question (3 marks)	No. of Essay questions (10 marks)	CO'S Mapped
1	3- Phase Induction Motors	20	29	3	2	CO1
2	1-Phase Induction Motors	12	13	1	1	CO2
3	Alternators	16	29	3	2	CO3
4	Parallel operation of Alternators	12	13	1	1	CO4
5	Synchronous motors	15	26	2	2	CO5
TOTAL		**75**	**110**	**10**	**8**	

COURSE OBJECTIVES	1) To familiarize with the knowledge of Induction Motors and Fractional Horse Power Motors 2) To understand the working of Alternators and its parallel operation 3) To Understand the working of Synchronous motors

COURSE OUTCOMES	**CO1**	EE-402.1	Explain the working of 3-phase induction motors and understand equivalent circuit parameters, power, torque, efficiency.
	CO2	EE-402.2	Explain the working of fractional Horse power motors.
	CO3	EE-402.3	Describe construction and working principle of Alternator.
	CO4	EE-402.4	Manipulate paralleling and synchronisation methods of Alternators.
	CO5	EE-402.5	Explain the working of Synchronous motors

LEARNING OUTCOMES

1. Three-phase Induction Motors

Principle of Production of Rotating Magnetic Field in 3-phaseSystem.
Explain the construction of Induction motor- slip ring and squirrel cage
Compare Slip ring & Squirrel cage Induction motors.
State the working principle of 3 phase induction motor.
Explain working of 3 phase induction motor on(i)no-load (ii) Load.
Derive the expression relating to TORQUE, POWER and SLIP and solve simple problems.
Draw Torque – Slip curves.
Explain(i)No-load test (ii) Blocked rotor test
State the Starters used for different ratings of induction motors.
Explain the working of the following starters with the help of circuitdiagram.

(i) D.O.L.starter (ii) Star/Delta Starter
(iii) Auto – Transformerstarter (iv) Rotor resistance starter

Explain the speed control of inductor motorsby

(i) Frequencychangingmethod(ii) Pole changingmethod (iii) Injecting voltage inrotor circuit(iv)Cascading

State the advantages of induction motors
List at least six applications of induction motors

2. 1-Phase Induction Motors.

List the types of 1- phase motors.
Explain why a Single-phase Induction motor is not a Self-starting motor.
Explain the working principle of 1 – phase Induction motorbyDouble field revolving theory.
Explain the working of the following 1-phase induction motors with legible sketch

(i) Splitphasemotor(ii) capacitor start motor (iii) shaded polemotor

Explain the working of the universal motor.
Explain the working of Stepper motor and list different types.
Listapplicationsof

(i) 1-phaseinductionmotors (ii)1-phase Commutator motors (iii)Steppermotors.

3. Alternators

Explain the working principle of Alternators.
Describe the Constructional details of Alternators with legible sketch.
Classify the Alternators based on rotor construction.
State the advantage of Stationary Armature.
Define Chording and Distribution factor
Derive EMF equation of an alternator taking into account distribution factor and pitch factor and solve problems
State the need for an exciter in an Alternator and list various types of exciters.
ExplainArmatureReactionofAlternatoratdifferentP.F's.
Define the term synchronous impedance and state its effects on operation of an alternator.
Define voltage regulation of an alternator
List the different methods of finding the regulation of alternator.

4. Parallel operation ofAlternators

Explain the necessity for parallel operation of alternators
State the conditions for synchronisation

Explain the procedure of synchronisation by using lamps and synchro scope methods.

Explain the method for adjusting the loads shared by two alternators (or one Alternator with infinite bus bar).

5. Synchronous motors

Explain the working principles of synchronous motors.

Explain the effects of varying excitation at constant load with phasor diagrams

Explain'V' and inverted 'V'curves with neat sketch.

Explain how a Synchronous motor can be used as a Synchronous condenser.

Explain the phenomenon ofHUNTING and how HUNTING can be prevented.

List the applications of synchronousmotor.

Compare synchronous motors with induction motors.

HYPONATED COURSE CONTENT

1. Three Phase Induction Motors

Introduction – Rotating Magnetic field - Construction of Induction motors – Comparison – working principle of three phase Induction motor – working of Induction motor at different conditions (Starting and Running) - Derive the relationship between Torque, Power and slip of Induction motor, problems – Torque-slip characteristics –Testing of Induction motors - Types of starters – Methods of speed control of Induction motor – Advantages and applications of Induction motors.

2. 1-Phase Induction Motors

Types of 1-phase motors – Reasons for not self starting-working principle of 1-phase induction motors- Double field revolving theory- Working of split phase, capacitor start and shaded pole types – principles of working – Universal motor- principle of working- Stepper motor – types-Applications of1-phase motors.

3. Alternators

Classification of alternators - Brief description of parts with sketches and function of each part, construction, Exciter and pilot exciter – Stationary armature type construction – Advantages**,** Concentrated and distributed windings - short pitch and full pitch coils - Effect of chording and distribution factors - EMF equation - Derivation – Problems **-** Armature reaction - Synchronous impedance concepts - phasor diagram for unity, lagging and leading power factor loads - Regulation definition - Different methods of finding regulation.

4. Parallel operation ofalternators

Necessity for parallel Operation - condition to be fulfilled for synchronisation - Synchronisation by lamps & synchroscope methods - Load sharing.

5. Synchronous Motors

Introduction - synchronous speed – Excitation of rotor - working Principle– Effects of change of Excitation at constant Load, Vector diagrams for(a) Normal, (b)Under and c)Over excitation conditions- V – Curves and inverted V –curves– Synchronous motor as synchronous condenser - Hunting phenomenon – prevention of Hunting-Applications of synchronous motor - Comparison with Induction motor.

REFERENCE BOOKS:

1. B.L. Theraja-Electrical Technology - Vol –II S.Chand&Co.
2. M.G Say –ACmachines
3. DP Kothari, IJ Nagrath – Electric Machines-Mc.Graw.Hill
4. P.S. Bhimbra -Electrical machines – Khanna Publishers
5. MV Deshpande-Electric machines – Wheeler publishing.

Syllabus for Unit Tests

Unit Test	Learning Outcomes to be Covered
Unit Test - I	From 1.1 to 3.6
Unit Test - II	From 3.7to 5.7

POWER SYSTEMS – I

Course code	Course title	No. Of periods/week	Total No. of periods	Marks for FA	Marks for SA
EE-403	POWER SYSTEMS - I	4	60	20	80

Chapter No.	Title	No. of Periods	Weightage	No. of short question (3 marks)	No. of Essay questions (10 marks)	CO'S Mapped
1	Sources of Electrical Energy	10	16	2	1	CO1
2	Thermal, Hydro Electrical, Nuclear & Gas Power Stations	18	36	2	3	CO2
3	Combined Operation and Economics	12	26	2	2	CO3
4	Switchgear and Reactors	10	16	2	1	CO4
5	Protective relays, Protection of Alternators and Transformers	10	16	2	1	CO5
TOTAL		**60**	**110**	**10**	**8**	

COURSE OBJECTIVES	(i) To understand the need for non-conventional method of power generation (ii) To analyse the working of various power generation stations. (iii) To familiarise the fundamental concepts of combined operation and economics (iv) To understand the role of circuit Breakers and relays in power system protection and to analyse the protection of transformers and alternators.

COURSE OUTCOMES	**CO1**	**EE-403.1**	Recognizing of various sources of power generation
	CO2	**EE-403.2**	Analyze the working of Thermal, Hydro,

			Nuclear and Gas power stations.
	CO3	**EE-403.3**	Understand the concept of load dispatching and Analyse various tariffs.
	CO4	**EE-403.4**	Analyse the working of various circuit breakers
	CO5	**EE-403.5**	Interpret the applications of relays and analyse various protection schemes used for protection of alternators and transformers.

LEARNING OUTCOMES

1. Sources of Electrical Energy

Know the different sources of energy and classify them into conventional and Non-conventional types.
State necessity of developing non-conventional methods of power generation.
Describe the method of power generation by (i) Solar Power plant(ii) Tidal Power plant (iii) Wind Power plant(iv) Biomass Power plant
State the relative merits and limitations of Conventional and Non- Conventional types of
sources
Appreciate the need of energy conservation and its methods.

2. Thermal, Hydro Electrical, Nuclear & Gas Power Stations

State working principle of Thermal power plant.
State the factors required for selection of site.
Draw the detailed line diagram of a condensing type thermal power station and explain the
working of each component of thermal power station.
State the advantages of(i) Pulverisation and the machine used for it(ii) Cooling towers and their types.
State the causes of pollution and methods to control them.
State the advantages and disadvantages of Thermal power plants.
State the principle of working of Hydro power station.
State the factors required for selection of site for Hydro power station.
Explain Hydrograph.
Define various hydraulic terms
Write water power equation
Classify the Hydro Electric Plants based upon head, duty, location and hydraulic considerations.
Explain with layout diagram working of i) High Head ii) Medium Head iii) Low Head Power
stations.
Explain the need and working of (i) Surge Tank ii) Forebay iii) Spill gates.
State the advantages and disadvantages of hydroelectric power station.
State merits and risks involved in using nuclear energy
List out the nuclear fuels.
Explain fission and fusion reactions.
Explain sustained chain reaction.

Explain the working of a moderate type nuclear power station with a block diagram.
Explain the need and working of coolant, reflector, and control rods. Mention the materials used for them
List the types of Reactors used in Nuclear Power Station
Explain the principle of working of gas power station with the help of schematic diagram and
mention its merits and demerits

3. Combined Operation and Economics of Power Stations.

State the need for integrated operation of power plants and list the merits of it.
Differentiate between isolated operation and integrated operation of power stations
Understand the concept of load dispatching and its process.
List the various charges and expenses in power station and classify them as fixed and running.
Define the terms load curve, connected load, Maximum demand, Demand factor, load factor, diversity factor, capacity factor and plant use factor.

Comprehend the cost of generation and effects of load factor and diversity factor on it.
Solve problems on above topics.
Explain various types of consumer tariffs and compare them.
List the causes of lower power factor
State the effects of power factor (p.f.) on electricity charges and mention the methods to
improve it.

4. Switch gear and Reactors

Define faults and list types if faults in power systems.
Define and classify switchgear.
Define isolators, air break switches, their uses and limitations.
Explain the phenomenon of arc, arc voltage, arc current and its effects.
List the methods of arc quenching.
Classify the circuit breakers based upon medium of arc quenching.
State the principle of M.O.C. Band explain its working.
State properties of SF_6 gas and explain the working of SF_6 circuit breaker.
Explain working principle of Vacuum circuit breaker (V.C.B).
Define current limiting reactors and state their importance.

5. Protective relays, Protection of Alternators and Transformers

Define relay and State the basic requirements of relays.
Classify there lays based upon(i) Principle of operation(ii)Time of operation(iii)Duty
Define current setting and time setting.
State the applications of (i) Induction type over current relay(ii) Directional over current induction type relay(iii)Distance relay (iv)Differential Relay
List the probable faults in Stator and rotor of Alternator.
Explain the differential protection for alternator stator.
List the possible faults and their types in a transformer.
Explain the working of Buchholz relay in a transformer.

HYPONATED COURSE CONTENTS

1. **Sources of Electrical Energy**

   Different sources of energy – Conventional and Non-conventional sources –Methods of generation of energy from different sources of power- Working principle of Solar, Tidal, Wind and Biomass power plants- Merits and limitations of conventional and Non- conventional sources - Need for energy conservation and their methods.

2. **Thermal, Hydro Electrical, Nuclear & Gas Power Stations**

   Thermal Power Station –Principle of working–Factors for selection of site–Block diagram of condensing type thermal power station- Components and its working - pulverization, Cooling towers and their types -Causes of pollution and methods to control them.

   Principle of working of hydroelectric power station – limitations in location and operation. Hydraulic terms used – Water power equation – Classification of hydroelectric power stations based on head, duty, location and hydraulic considerations- Layout diagram of i)High Head ii) Medium Head iii) Low Head Power Stations- Working of surge tank, fore bay, spill gates.

   Nuclear fuels - Fission and fusion reactions with mass energy balance, sustained chain reaction – Working of moderate type nuclear power station with a block diagram- Need and working of coolant, reflector, control rods – Materials used for them – reactors used in nuclear power plant-Principle and working of gas power plant.

3. **Combined Operation and economics of Power Stations**

   Isolated operation and integrated operation of power stations –– Load dispatching and its process –Charges/Expenses involved in power station – Their classification as fixed and running-Load curve, load factor, diversity factor and maximum demand – Effects of load factor and diversity factor in power generation – Solve numerical problems. Consumer tariffs and their comparison – Effect of power factor on the electricity charges and methods to improve it.

4. **Switch Gear and Reactors**

   Faults in power systems - Switch gear and their classification – Isolators, air break switches and explain the phenomenon of arc, arc voltage, arc current and their effects – methods of arc quenching. Circuit breakers and their classification based on the medium of arc quenching – M.O.C.B – Properties of SF_6 gas and working of SF_6 circuit breakers – Working of V.C.B, M.O.C.B, SF_6 C.B. Reactors – Current limiting reactors and their importance.

5. **Protective relays, Protection of Alternators and Transformers**

   Requirements of relays – Classifications based on duty, principle of operation and time of operation – Construction and working of induction type over current relays – applications of induction type over current relay, directional over current relay, distance relay and differential relay Faults in Alternator stator and rotor- its effects – differential protection for alternator stator- Possible faults and their types in the transformer – bucholzite relay in transformers.

REFERENCE BOOKS

1. Electrical Power by S.L.Uppal
2. Generation, Transmission and Utilisation by A.T.Starr
3. Power System by C.L.Wadhwa
4. Electrical power plants by J B Guptha
5. Switch gear and protection by Sunil S. Rao

Syllabus to be covered for Unit Tests

Unit Test	Learning Outcomes to be Covered
Unit Test - 1	From 1.1 to 2.22
Unit Test – 2	From 3.1 to 5.8

POWER ELECTRONICS & PLC

Course code	Course title	No. Of periods/week	Total No. of periods	Marks for FA	Marks for SA
EE-404	POWER ELECTRONICS & PLC	4	60	20	80

Chapter No.	Title	No.of Periods	Weightage	No. of short question (3 marks)	No. of Essay questions (10 marks)	CO'S Mapped
1	Power Electronic devices	12	26	2	2	CO1
2	Power Transistors	8	13	1	1	CO2
3	Converters, AC Voltage controllers & Inverters	14	29	3	2	CO3
4	Applications of Power Electronic circuits	14	26	2	2	CO4
5	PLC and SCADA	12	16	2	1	CO5
TOTAL		**60**	**110**	**10**	**8**	

COURSE OBJECTIVES	(i) To introduce the basic theory of power semiconductor devices. (ii) To familiarize with the principle of operation, design and synthesis of different power conversion circuits and their applications. (iii) To provide strong foundation for further study of power electronic circuits and systems and To maintain PLCs and SCADA systems used in different applications.

COURSE OUTCOMES	CO1	EE-404.1	Describe the operation of SCR, TRIAC and DIAC, SCR Commutation circuits.
	CO2	EE-404.2	Describe the operation of IGBT, Power MOSFET and MCT
	CO3	EE-404.3	Design and Analyze power converter circuits, A.C Voltage controllers and Inverters.
	CO4	EE-404.4	Analyse the speed control of AC motors and DC motors using power semiconductor devices.
	CO5	EE-404.5	Develop PLC ladder programs for the given applications and understand the necessity of

			SCADA and its applications

LEARNING OUTCOMES

1. **Power Electronic Devices**
   List different thyristors family devices and draw the circuit symbols for each device.
   Describe constructional details and operation of SCR
   Explain the Volt – Ampere characteristics of SCR with the help of adiagram.
   Draw the Gate characteristics of SCR
   Mention the ratings of SCR.
   Give the advantages of SCR as a switch.
   List ten applications of SCR.
   Explain the Volt-ampere characteristics of Diac under forward / reverse bias.
   Explain the Volt-ampere characteristics of Triac under forward / reverse bias.
   State the necessity of Commutation in SCR's and list different methods of commutation
2. **Power Transistors**
   Classify power transistor.
   Describe the basic structure and operation of IGBT.
   Explain the characteristics of IGBT.
   Mention the applications of IGBT.
   List the types of MOSFETs.
   Describe the working of Power MOSFET.
   Explain the characteristics of MOSFET.
   Mention the applications of MOSFET.
   Compare MOSFET with BJT.
   Compare IGBT with MOSFET.
   Describe the basic structure and operation of MOS –Controlled Thyristor (MCT).
3. **Converters, AC Voltage Controllers and Inverters**
   Define rectifier, AC voltage controller, inverter, chopper and cyclo converter
   Explain the working of single-phase half wave converter with resistive and R-L loads.
   Understand need for freewheeling diode.
   Explain the working of single phase full wave converter with resistive and R- L loads.
   Explain the working of three-phase half wave converter with resistive load
   Explain the working of three phase full wave converter with resistive load.
   Explain the working of single phase AC voltage controller with resistive load.
   Explain the working of three phase AC voltage controller with resistive load.
   Compare AC voltage controller with transformer.
   Classify inverters.
   Explain the working of single-phase bridge inverter.
   Explain the working of three-phase bridge inverter.
   State the advantages of MOSFET based inverters over SCR based inverters.
   List the applications of Inverters.
4. **Applications of Power Electronic Circuits**
   List applications of power electronic circuits.
   Mention the factors affecting the speed of DC Motors.
   Explain the speed control of DC Shunt motor using converter.
   Explain the speed control of PMDC motor using converter.
   List the factors affecting speed of the AC Motors.
   Explain the speed control of induction motor by using AC voltage controller.

Explain the speed control of induction motor by using converter and inverter (V/F control).

Devices used to suppress the spikes in supply system.

Working of UPS with block diagram.

Explain the illumination control circuit using TRIAC and DIAC with the help of a legible sketch.

Explain the anti-theft alarm circuit using SCR with the help of a diagram.

Explain the emergency lamp circuit using SCR with the help of a diagram.

Explain the battery charger circuit using SCR with the help of a diagram.

Explain the power factor improvement circuit using SCR with the help of a diagram.

Explain the DC circuit breaker using SCR with the help of a diagram.

5. PLC and SCADA

Need for automation and advantages of automation.

Define Programmable Logic Controller(PLC) and state the advantages of PLC

Explain the different parts of PLC by drawing the Block diagram and state the purpose of each part.

State the applications of PLC

Explain Ladder diagram

Explain contacts and coils used in PLC

Draw ladder diagrams for

(i) AND gate (ii)OR gate (iii) NOT gate

(iv) NAND gate (iv) NOR gate (iv) X-OR gate

Explain the following Timers and counters

(i) TON (ii)T OFF (iii) Retentive timer (iv) CTU (v) CTD

Draw ladder diagrams using Timers and counters

Explain PLC Instruction set

Explain ladder diagrams for following

(i) DOL starter and STAR-DELTA starter(ii) Stair case lighting

(iii) Traffic light control(iv) Temperature Controller

Explain the need of data acquisition.

State the advantages of supervisory control.

List the softwares used for SCADA and explain them.

State various communication methods used in SCADA.

Explain the working of SCADA with PLC and applications of SCADA.

HYPONATED COURSE CONTENTS

1. Power Electronic Devices

Types of power semiconductor devices – SCR, DIAC, TRIAC - Construction, Working principle of all devices, symbols - Two transistor analogy for SCR – V-I & Gate characteristics, Forward break over voltage, latching current, holding current, turn on triggering time, turn off time - triggering of SCR using UJT- Necessity of Commutation- various methods of Commutation.

2. Power Transistor

Classification of power transistor - basic structure and operation of IGBT - characteristics of IGBT - applications of IGBT - types of MOSFETs - working of Power MOSFET - characteristics of MOSFET - applications of MOSFET – Comparison of MOSFET with BJT – Comparison of IGBT with MOSFET - basic structure and operation of MOS –Controlled Thyristor (MCT).

3. Converters, AC Voltage Controllers and Inverters

Classification of converters - single phase half wave converter - freewheeling diode-single phasefullwave converter- threephasehalfwave converter- fullwaveconverter–singlephase ac voltage controller- three phase ac voltage controller - Classification of Inverters - Single Phase bridge Inverter – Three phase bridge Inverter – applications of inverter.

4. Application of Power ElectronicCircuits

DC Motor control - Speed control of DC shunt Motor by using converters - AC Motor Controls - speed control of induction Motor by using AC voltage controllers - V/F control (Converters and invertors control) - Devices used to suppress spikes in supply system.- Working of UPS with block diagram – Illumination Control Circuit - Anti theft alarm circuit - Emergency lamp - Battery charger Circuit using SCR - power factor improvement circuit - DC circuitbreaker.

5. PLC and itsapplications

PLC Definition-advantages-Block diagram-Ladder diagrams for AND, OR, NOT, NAND, NOR - Instruction set-Ladder diagram for DOL starter, Star-Delta Starter, Stair case lighting, Traffic light control, Temperature controller – Data Acquisition – Supervisory Control – SCADAsoftwares – Communication methods – SCADA with PLC - Applications of SCADA.

REFERENCE BOOKS

1. Power Electronics – P.S. Bimbhra
2. Jamil Asghar -Power Electronics– PHI, NewDelhi.
3. P.C.Sen.-Advanced Power Electronics
4. S.K.Bhattacharya -Control of Electrical Machines
5. John W.Webb -Programmable Logic controllers

Syllabus to be covered for Unit Tests

Unit Test	Learning Outcomes to be Covered
Unit Test – 1	From 1.1 to 3.14
Unit Test – 2	From 4.1 to 5.16

GENERAL MECHANICAL ENGINEERING

Course code	Course Tilte	No. of periods /week	Total No. of periods	Marks for FA	Marks for SA
EE-405	GENERAL MECHANICAL ENGINEERING	4	60	20	80

Chapter No.	Title	No.of Periods	Weightage	No. of short question (3 marks)	No. of Essay questions (10 marks)	CO'S Mapped
1	Simple Stresses and Strains	10	16	2	1	CO1
2	Torsion in Shafts	10	16	2	1	CO2
3	I.C. Engines	12	26	2	2	CO3
4	Boilers and Turbines	18	26	2	2	CO4
5	Pumps	10	26	2	2	CO5
TOTAL		**60**	**110**	**10**	**8**	

COURSE OBJECTIVES	i) Understand Stress, Strain and Torsional Stress
	ii) Understand the working of I.C.Engines, Boilers, Turbines and pumps

COURSE OUTCOMES	CO1	EE-405-1	Understand the concept of stress and strain and various constituent relations
	CO2	EE-405-2	Understand the Torsional Stresses in circular shafts and find them in solid and circular shafts
	CO3	EE-405-3	Analyze the Working of I C Engine Systems
	CO4	EE-405-4	Analyze the Working of Boilers and Turbines
	CO5	EE-405-5	Analyze the Working of Pumps

LEARNING OBJECTIVES:

Simple Stress and Strain

Definitions of Tensile stress, Compressive stress, Shear stress, Linear strain, lateral strain and, Poisson's ratio, elastic limit, Identify the different types of stresses and Strains
State Hooke's law
Draw stress-strain curves for ductile and brittle materials under tension
Define a) Working stress, ultimate stress, yield stress, factor of safety and Young's modulus. solve simple problems on above topics
State the factors to be considered in selecting factor of safety
Solve Simple problems on uniform bars subjected to loads

2.0 Torsion in Shafts

State the function of shafts
Classify shafts
Specify the standard sizes of shafts
Write the torsion equations with usual notations
State the procedural steps in design of shaft (both solid and hallow types)
Design a shaft from given data on the basis of strength and solve problems.

I.C.Engines

Classify I.C. Engines
Functions of main components of an I.C.Engine
Illustrate the working of four stroke petrol engine
Illustrate the working of four stroke diesel engine
Illustrate the working of two stroke petrol engine
Compare four stroke and two stroke engines
Compare petrol engine and diesel engine

Boilers and Turbines

Classify steam boilers
Compare fire tube and water tube boilers
Differentiate between boiler mountings and accessories
List out a) Popular boiler mountings b) Popular boiler accessories
Illustrate the working of Lamont boiler
State the working principle of steam turbine
Classify steam turbines
Explain the working of a) De-laval steam turbine, b) Parson's reaction turbne
Compare impulse and reaction turbines
Classify hydraulic turbines
Explain the working of
(i) Pelton wheel
(ii) Francis turbine
(iii) Kaplan turbine

Pumps

Classify hydraulic pumps
Compare between centrifugal and reciprocating pumps
Illustrate the working of
(i) Single acting and Double acting reciprocating pump
(ii) Single stage centrifugal pump
(iii) Jet pump
(iv) Submersible pump

Note: 1. This subject is to be taught by Mechanical Engineering Faculty.
2. Paper setting and paper valuation is also to be done by Mechanical Engineering Faculty.

HYPONATED COURSE CONTENT

1. Simple stress and strains

Definitions of Tensile stress, Compressive stress, Shear stress, Linear strain, lateral strain and, Poisson's ratio, elastic limit, Hook's law - stress-strain diagram for ductile and brittle materials under tension - Working stress, Ultimate stress, yield stress - Factor of safety – selection of factor of safety-Young's modulus - Simple problems on bars of uniform section subjected to external loading.

2. Torsion in Shafts

Function of shafts – classification of shafts - standard shaft sizes - Torsion equation (derivation omitted) – simple problems on its application - Step by step procedure of designing a shaft- Problems on design of shaft based on strength.

3. I.C. Engines

Classification of I.C Engines - Main components of IC Engine - Sketch and description of four stroke petrol engine - Sketch and description of four stroke diesel engine - Sketch and description of two stroke petrol engine - Comparison between two stoke and four stroke engines - Comparison between petrol and diesel engine.

4. Boilers and Turbines

Classification of boilers - Comparison between fire tube and water tube boilers - Difference between Boiler Mountings and Accessories – Functions of popular mountings and accessories (without sketches) - Sketch and description of Lamont high pressure boiler - Classification of steam turbines - Sketch and description of a De-Laval impulse turbine - Sketch and description of Parson's reaction turbine - Comparison between impulse and reaction turbines - Classification of hydraulic turbine - Sketch and description of Pelton wheel - Sketch and description of Francis turbine - Sketch and description of Kaplan turbine.

5. Pumps

Classification of hydraulic pumps - Comparison between Centrifugal and Reciprocating pumps - Sketch and description of a single acting and double acting reciprocating pump - Sketch and description of single stage centrifugal pump - Sketch and description of a jet pump - Sketch and description of a submersible pump

REFERENCES

1. Surender Singh- Strength of materials - Vikas publishing
2. R.K. Rajput - Strength of Materials- S.Chand& CO

3. R.S. Kurmi - Strength of Materials- S.Chand& CO
4. P.K. Nag, K,Tripathi, C B Pawar – Basic Mechanical Engineering – McGraw Hill
5. Pravin Kumar – Basic Mechanical Engineering - Pearson

Syllabus to be covered for Unit Tests

Unit Test	Learning Outcomes to be Covered
Unit Test - 1	From 1.1 to 3.7
Unit Test – 2	From 4.1 to 5.3

ELECTRICAL ENGINEERING DRAWING

Course code	Course title	No.of periods / week	Total no. of periods	Marks for FA	Marks for SA
EE-406	ELECTRICAL ENGINEERING DRAWING	6	90	40	60

Chapter No.	Title	No.of Periods	Weightage	No. of short question (5 marks)	No. of Essay questions (20 marks)	CO'S Mapped
1	Graphical symbols, couplings, and Guarding systems	15	10	2	0	CO1
2	D.C.Machines	24	25	1	1	CO2
3	Induction Motors	15	25	1	1	CO3
4	Transformers	15				CO4
5	D.C and A.C Windings	21	20	0	1	CO5
	TOTAL	**90**	**80**	**4**	**3**	

COURSE OBJECTIVES	(i) To familiarise with the different electrical symbols, couplings and guarding systems. (ii) To draw the views of D.C. machine, induction motors and Transformers. (iii) To draw different winding diagrams of DC and AC machines.

COURSE OUTCOMES	CO1	EE-406.1	Understand different types of symbols, couplings and guarding system in electrical drawing.
	CO2	EE-406.2	Comprehend and draw different views of DC machine.
	CO3	EE-406.3	Comprehend and draw different views of Induction motors.
	CO4	EE-406.4	Comprehend and draw different views of Transformers.
	CO5	EE-406.5	Design the different types of DCand AC machine windings.

LEARNING OUTCOMES

1. **Graphical symbols, couplings and Guarding systems.**
   Draw the standard symbols of electrical components andfixtures.
   Draw sectional elevation and end views of a Protected type and Unprotected type shaft couplings.
   Draw the views of the guarding systems in the followingcases.
   (i) Telephone lines under power lines (ii) H.V. line over L.V. line crossing
   (iii) H.V. Line over L.V. line on same supports (iv) H.V. Line crossing over railway lines.
2. **DC machines.**
   Draw the assembled sectional views of Pole and Field coils.
   Draw the half sectional end view and elevation of armature of DC machine with the given data.
   Draw the end view of commutator in a DCMachine with the given data.
   Draw the Half sectional End view and Elevation of a D.C machine from the given data.
3. **InductionMotors.**
   Draw the Half - sectional elevation and end views of an assembled 3-phase squirrel cage
   induction motor from the givendata.
   Draw the Half - sectional elevation and end views of an assembled 3-phase slip ring induction motor from the givendata.

4. Transformers.

Draw different plan and elevational views of core stepping sections (one, two, three and four
stepped cores) of aTransformer.
Draw sectional plan and elevation of a 1-phase core type transformer from the given data.
Draw sectional plan and elevation of a 3-phase core type transformer from the givendata.

5. D.C and A.C Windings.

Draw the development winding diagrams of a Single Layer Lap and wave connected D.C
Machines with the given data with ring diagram showing brush positions and windingtable.
Draw the developed winding diagrams of a 3-phase, single layer lap and wave windings with
windingtable from the given data.

HYPONATEDCOURSE CONTENTS

1. **Graphical symbols, couplings and Guarding systems**
   Graphical symbols as per ISI standards, Shaft coupling (Protected and unprotected

type) - Guarding Systems employed for the Poles while crossing the Roads and Railway Lines.

2. **DC machines**
   Stator pole and field coil assembly, Armature of a small DC machine, Commutator of DC machine - Half sectional end view and elevation of D.C machine.
3. **InductionMotors**
   Sectional elevation and end views of 3 - phase Squirrel Cage Induction Motor and 3-Phase Slip Ring Induction motor.

4. **Transformers**
   Core stepping sections -Sectional views of single-phase core type and three phase core type transformers.
5. **D.Cand AC Windings**
   Single Layer Lap and Wave DC Windings - Winding tables- -Brush location – Equalizer rings - Three phase single Layer Lap and Wave AC Windings - Winding tables.

REFERENCE BOOKS

1. Simpson - Electrical Engineering Drawing
2. Dargon. - Electrical Engineering Drawing
3. K.L.Narang - Electrical Engineering Drawing
4. Surjit singh - Electrical Engineering Drawing
5. Dr. SK Bhattacharya - Electrical Engineering Drawing

Syllabus to be Covered for Unit Tests

Unit Test	Learning Outcomes to be Covered
Unit Test-I	From 1.1 to 3.1
Unit Test-II	From 3.2 to 5.2

ELECTRICAL MACHINES – II LABORATORY

Course code	Course title	No. of periods/week	Total no. of periods	Marks for FA	Marks for SA
EE-407	ELECTRICAL MACHINES – II LABORATORY	3	45	40	60

Chapter No.	Title	No.of Periods	CO'S Mapped
1	Tests on 3-phase Induction Motors	18	**CO1**
2	Tests on 1-Ph Fractional Motors	9	**CO2**
3	Tests on Alternators and Synchronous Motors	18	**CO3**
Total Periods		**45**	

COURSE OBJECTIVES	(i) To conduct tests and estimate the parameters of three phase induction motors and predict the performance (ii) To operate fractional horse power Motors and analyse their performance (iii) To conduct tests and interpret the performance of three phase Alternators and Synchronous motors

COURSE OUTCOMES	**CO1**	EE-407.1	Demonstrate the skill of planning and organising experimental setup for three phase Induction Motors and observe various parameters, their variations, sketch them graphically and draw the circle Diagram.
	CO2	EE-407.2	Analyse the experimental results from the load test data of 1 phase induction motors to calculate the machine parameters
	CO3	EE-407.3	Conduct of various tests on Alternators and Synchronous Motors to know their performance

LEARNING OUTCOMES:

1. Tests on 3-phase Induction Motors

1. Conduct brake test on 3-phase squirrel cage induction motor.
2. Conduct Brake test on 3-phase slip ring induction motor.
3. Conduct suitable tests and draw circle diagram for a squirrel cage induction motor.
4. Conduct suitable tests and draw circle diagram for a slip ring induction motor.

2. Tests on Fractional H.P Motors

1. Perform Load test on single phase capacitor start motor.
2. Perform Load test on single phase split phase induction motor.
3. Perform Load test on a single-phase Universal motor.

3. Tests on Alternators and Synchronous Motors

1. Conduct (direct) load test on Alternator and obtain voltage regulation.
2. Obtain the regulation of Alternator by using synchronous impedance method.
3. Conduct load test on synchronous motor and draw 'V' and inverted 'V' curves.

Competencies & Key competencies to be achieved by the student

S.No	Experiment Title	Competencies	Key competency
1	Brake test on 3-phase squirrel cage induction motor.	▪ Draw the circuit diagram ▪ Identify the different terminals of 3-ph induction motor ▪ Select the suitable starter. ▪ Identify the terminals of the starter. ▪ Select the range and type of the meters ▪ Make the connections as per the circuit diagram ▪ Start the motor using a starter Apply the load up to full load insteps ▪ Pour water in the braked rum ▪ Note down the readings of ammeter and voltmeter for each load. ▪ Calculate the output, torque and efficiency etc ▪ Plot the performance characteristics ▪ Verify the performance of the machine.	▪ Apply the load up to full load in steps ▪ Pour water in the brake drum ▪ Before Switching off the motor remove the load
2	Brake test on 3-phase slip ring induction motor.	▪ Draw the circuit diagram ▪ Interpret the name plate details ▪ Identify the different terminals of the 3-ph induction motor ▪ Select the suitable starter. ▪ Identify the terminals of the starter. ▪ Select the range and type of the meters ▪ Make the connections as per the circuit	▪ Before giving supplySlipri ngs must be short circuited ▪ Speed should be

		diagram ▪ Start the motor using a starter	▪ measured
		▪ Verify the performance of the machine.	accurately
3,4	Conduct suitable tests and draw circle diagram of a)squirrel cage induction Motor c) slip ringinductionMotor	▪ Draw the circuit diagram for No-load test and Blocked rotor test ▪ Make the connections for no-load test and Blocked rotor test as per the circuit diagram ▪ Start the motor without load ▪ Apply the rated voltage to the motor in the no-load test and rated current to the blocked rotor test. ▪ During the Blocked rotor test fully tighten the rotor shaft ▪ Record the meter readings ▪ Calculate the output, torque ,efficiency etc. ▪ Plot the performance characteristics. ▪ Verify the performance of the machine. ▪ Draw the circle diagram on a graph sheet using the test data ▪ Select proper scale to draw the circle diagram	▪ Apply the rated voltage to the motor in the no- load test ▪ and rated current to the blocked rotor test. ▪ During the Blocked rotor test fully tighten the rotor
5,6	Load test on a) split phase induction motor. b) Capacitor start induction motor	▪ Draw the circuit diagram ▪ Identify the different terminals of the 1-ph split phase induction motor /1-ph capacitor type induction motor and the starter ▪ Select the ranges and type of the meters ▪ Make the connections as per circuit diagram ▪ Start the motor using a starter ▪ Apply the load in steps ▪ Record the meter readings ▪ Verify the performance of the machine.	▪ Start the motor using a ▪ starter without load ▪ Apply the load up to full load in steps
7	Load test on single-phase Universal motor.	▪ Draw the circuit diagram ▪ Identify the different terminals of the 1-ph universal motor ▪ Select the range and type of the meters ▪ Make the connections as per the circuit diagram ▪ Start the motor using a starter ▪ Apply the brake load lightly ▪ Verify the performance of the machine	▪ Apply the brake load lightly ▪ Take the readings properly

8	Conduct (direct) load test on Alternator and Obtain the regulation And by synchronous impedance method	▪ Draw the circuit diagram ▪ Identify different terminals of the 3-ph alternator ▪ Select the range and type of the meters ▪ Make the connections as per the circuit ▪ Start the alternator as per the procedure ▪ Increase the load and take the readings ▪ Reduce the load to zero gradually. ▪ Switch off the alternator. ▪ Disconnect the circuit. ▪ Plot the performance characteristics.	▪ Switch on the excitation at correct time ▪ Apply the brake load lightly Take the readings properly
9	Conduct load test on synchronous motor and draw V and inverted V curves	▪ Draw the circuit diagram ▪ Identify different terminals of the 3-ph synchronous motor ▪ Select the range and type of the meters ▪ Make the connections as per the circuit ▪ Start the motor as per the procedure ▪ Switch on the excitation at correct time ▪ Vary the excitation insteps ▪ Pour water in the brake drum for cooling. ▪ Reduce the load to zero gradually. ▪ Switch off the motor. ▪ Disconnect the circuit. ▪ Calculate the output, torque ,efficiency etc. ▪ Plot the performance characteristics. ▪ First switch off the excitation and then only switch off the mains ▪ Draw the V and inverted V curves on a single graph sheet	▪ Switch on the excitation at correct time ▪ Vary the excitation insteps ▪ First switch off the excitation and then only switch ▪ off mains

HYPONATED COURSE CONTENTS:

Test on three phase Induction Motors

Brake test on three phase squirrel cage induction motor and slip ring induction motor, calculate the efficiency and plot the torque slip characteristics**.** No-load test and blocked rotor test on squirrel cage and slip ring induction motor, calculate output power, Torque, Efficiency, calculate the machine parameters, Draw the circle diagram, estimate the performance and verify the performance.

Load Test on Fractional Horse Power Motors

Load test on – split-phase induction motor, single phase capacitor starts induction motor- universal motor -calculate output power, Torque, Efficiency, calculate the machine parameters

Tests on Alternators and Synchronous Motors

Load test on Alternator – obtain the regulation of alternator by using synchronous Impedance method – Draw the v curves and inverted v curves

ENGLISH COMMUNICATION SKILLS
(LAB PRACTICE)

Course code	Course title	No.of periods/week	Total no. of periods	Marks for FA	Marks for SA
EE-408	ENGLISH COMMUNICATION SKILLS	3	45	40	60

Chapter No.	Title	Teaching Hours
1	Listening Skills	6
2	Workplace Etiquette	3
3	Introducing Oneself	3
4	Short presentation (JAM)	6
5	Group Discussion	6
6	Resume Writing and Cover Letter	3
7	Interview Skills	9
8	Presentation Skills	9
Total		***45***

COURSE OBJECTIVES	- to communicate effectively in diverse academic, professional and everyday situations
	- exhibit appropriate body language and etiquette at workplace
	- be employable through preparing appropriate job applications and attend interviews confidently with all necessary skills

COURSE OUTCOMES	**CO1**	Listen and comprehend the listening inputs related to different genres effectively
	CO2	Communicate effectively in interpersonal interactions, interviews, group discussions and presentations
	CO3	Acquire employability skills: job hunting, resume writing, attending interviews
	CO4	Practice appropriate body language and professional etiquette

Course Delivery: Text book: **"English Communication Skills"**by State Board of Technical Education and Training, AP

COURSE CONTENT:

UNIT I:Listening Skills **6 periods**

Pre – While- Post-listening activities- Listening to audio content (dialogues/ speech/ narrations) - answering the questions and fill in the blanks- vocabulary

UNIT 2: **Workplace Etiquette** **3 periods**

Basics of Etiquette- politeness/ courtesy, good manners- features of work place etiquette- adaptability, positive attitude, body language.

UNIT 3: Introducing Oneself **3 periods**

Speak about oneself - introduce oneself to a gathering/ formal & informal situations- Know about others- filling in the grid- introducing oneself in interviews

UNIT 4: Short Presentation **6 periods**

Dos and Don'ts in short presentation- speak for a minute without repetition, deviation & hesitation - the techniques to speak fluently – defining and describing objects, people, phenomena, events.- speaking on randomly chosen topics.

UNIT 5: Group Discussion **6 periods**

Fundamentals of Group Discussion- Dos and Don'ts- filling the Grid- possible list of topics- practice sessions- sample videos-Group activity

UNIT 6: Resume Writing and Cover Letter **3 periods**

Pre activity: answer the questions- jotting down biographical information- sample resumes- tips, Dos and Don'ts- model resumes- practice exercises on Resume writing

UNIT 7: Interview Skills **9 periods**

Pre –while-post activities: - things to do at three stages – respond to notifications- know the information about the organisation-practice FAQs - preparation of good/ suitable C V, Body language, tips for success in interviews, model / mock interviews.

UNIT 8: Presentation Skills **9 periods**

Preparatory work: observe pictures and answer questions- different kinds of presentations- PPTs, Flash cards, Posters, Charts. - tips to prepare aids, slide show, model PPTs, - checklist on pre, while and post presentations.

Mapping Course Outcomes with Programme Outcomes:

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**
CO	**POs 1 to 5 are applications of Engineering Principles, can't be directly mapped to English Communication Skills**					**1,2,3,4**	**1,2,3,4**

Unit wise Mapping of CO –PO

CO	**Course Outcome**	**COs / Unit Mapped**	**POs** mapping	**Cognitive levels as per Bloom's Taxonomy R/U/A/An (Remembering / Understanding / Applying/ Analyising)**
CO 1	Listen and comprehend listening inputs related to different genres effectively	Unit 1	6,7	R/U/A
CO2	Communicate effectively in interpersonal interactions, interviews, group discussions and presentations	Units 3,4,5,7,8	6,7	R/U/A/An
CO3	Acquire employability skills: job hunting, resume writing, attending interviews	Units 6,7	6,7	R/U/A/An
CO4	Practise appropriate body language and professional etiquette	Units 2, 3, 4,5,7,8	6,7	R/U/A

POWER ELECTRONICS LABORATORY

Course code	Course title	No. Of periods/week	Total No. of periods	Marks for FA	Marks for SA
EE-409	POWER ELECTRONICS LABORATORY	3	45	40	60

Chapter No.	Title	No. of Periods	CO'S Mapped
1.	Characteristics of Power Electronic Devices - SCR, DIAC and TRIAC	6	CO1
2.	Characteristics of Power Transistors – IGBT and Power MOSFET	6	CO2
3.	Performance of different converter circuits	12	CO3
4.	Speed control of the electrical motors using the Power Electronic Devices	12	CO4
5.	Power Electronic circuits	9	CO5
Total		**45**	

COURSE OBJECTIVES	i) To understand the operation and characteristics of SCR, DIAC, TRIAC, IGBT and Power MOSFET. ii) To provide a practical exposure to operating principles, design and synthesis of different power electronic converters. iii) To perform the speed control of electric motors by using power electronic circuits.

COURSE OUTCOMES	CO1	EE-409.1	Understand the operation of SCR, DIAC and TRIAC, Plot their characteristics.
	CO2	EE-409.2	Understand the operation of IGBT and Power MOSFET, Plot their characteristics.
	CO3	EE-409.3	Analyse the performance of different converter circuits.
	CO4	EE-409.4	Controlling the speed of electrical motors by using power electronic circuits.
	CO5	EE-409.5	Designing of power electronic circuits for practical applications.

LEARNING OUTCOMES

1. Characteristics of Power Electronic Devices - SCR, DIAC and TRIAC

1. Plot the Characteristics of SCR
2. Plot the Characteristics of DIAC and TRIAC.

2. Characteristics of Power Transistors – IGBT and Power MOSFET

1. Plot the Characteristics of IGBT.
2. Plot the Characteristics of Power MOSFET.

3. Performance of different converter circuits

1. Perform the experiment on single phase half wave-controlled converter and draw its waveforms at different firing angles.
2. Perform the experiment on single phase full wave fully controlled centre tapped converter and draw its waveforms at different firing angles.
3. Perform the experiment on single phase full wave fully controlled bridge converter and draw

its waveforms at different firing angles.

4. Speed control of the electrical motors using the Power Electronic Devices

1. Perform speed Control of DC motor by using single phase bridge converter.
2. Perform speed Control of 1-phase AC induction motor using AC voltage controller.

5. Power Electronic circuits

1. Illumination control circuit using TRIAC and DIAC.
2. Ceiling fan regulator circuit using TRIAC.

HYPONATED COURSE CONTENTS

1. Characteristics of Power Electronic Devices - SCR, DIAC and TRIAC
Plot the Characteristics of SCR, DIAC and TRIAC.

2. Characteristics of Power Transistors – IGBT and Power MOSFET
Plot the Characteristics of IGBT and Power MOSFET.

3. Performance of different converter circuits
Single phase half wave-controlled converter, single phase full wave fully controlled converter and single-phase full wave fully controlled bridge converter.

4. Speed control of the electrical motors using the Power Electronic Devices
Speed Control of DC motor by using single phase bridge converter and speed Control of 1-phase AC induction motor using AC voltage controller.

5. Power Electronic circuits
Illumination control circuit using TRIAC and DIAC, Ceiling fan regulator circuit using TRIAC.

Competencies & Key competencies to be achieved by the student

S. NO.	Experiment Title	Competencies	Key competencies
1	i) Characteristics of SCR, DIAC and TRIAC ii)Characteristics of IGBT and Power MOSFET	Identify the different Power electronic devices available in the laboratory like SCR, DIAC, TRIAC, IGBT and Power MOSFET.	Identify the different terminals; Make the connections of the circuit as per the circuit diagram.
		Draw the symbols of the above devices.	
		Identify the different terminals.	
		Draw the necessary circuit diagram and identify the apparatus required	
		Make the connections of the circuit as per the circuit diagram	
		Record the different values of voltage and current	
		Plot the characteristics on a graph sheet	
2	i) single phase half wave converter ii) single phase full wave fully controlled converter iii) single phase full wave fully controlled bridge converter	Draw the circuit diagram for the single-phase half wave-controlled converter	Verify the waveforms in the CRO at different firing angles
		Identify the different components and apparatus required for the circuit	
		Make the necessary connections as per the circuit diagram with resistive load.	
		Verify the waveforms in the CRO at different firing angles	
		Change the R- load with R-L load and observe the waveforms at different firing angles	
		Implement the same for single phase full wave fully controlled converter with R load and R-L load	
		Implement the same for single phase full wave fully controlled bridge converter with R load and R-L load	
3	i) speed Control of DC motor by using single phase bridge converter ii) speed Control of 1-phase AC induction motor using AC voltage controller	Draw the circuit diagram for the speed control of the DC motor using the single phase bridge convertor	change the triggering angles. Draw the graph between Speed Vs Triggering Angles
		Identify the different apparatus required from the circuit diagram	
		Make the necessary connections according to the circuit	
		Change the triggering angles and Note down the readings of the speed of the DC motor	
		Plot the graph Speed Vs Triggering	

		Angles	
		Implement the same procedure for speed control of single-phase AC induction motor using AC voltage controller	
4	i) Illumination control circuit using TRIAC and DIAC ii) Ceiling fan regulator circuit using TRIAC.	Draw the circuit diagram for Illumination control circuit using TRIAC and DIAC	i) change the firing angles and observe the illumination of the lamp ii) observe the speed of the ceiling fan
		Identify the different apparatus required from the circuit diagram	
		Make the necessary connections according to the circuit	
		Change the triggering angles and Note down the readings of voltage across the load. Note down the firing angles	
		Implement the same procedure for Ceiling fan regulator circuit using TRIAC	

HYBRID POWER SYSTEMS LABORATORY

Course code	Course title	No. of periods/week	Total no. of periods	Marks for FA	Marks for SA
EE-410	HYBRID POWER SYSTEMS LABORATORY	03	45	20	30

Chapter No.	Title	No. of Periods	CO'S Mapped
1.	Identify various switchgear equipment and write their specifications	3	**CO1**
2.	Dismantle MCCB/ELCB and identify various parts	3	**CO1**
3.	Test fuse, MCB and electromagnetic over-current relay by performing the load test	6	**CO2**
4.	Test the working of the single phasing preventer using a three phase induction motor	3	**CO1**
5.	Perform plug setting and Time setting in induction type electromagnetic relay	3	**CO1**
6.	Knowledge on electrical load survey in institution campus/hostel building and electrical/mechanical workshop	6	**CO2**
7.	Knowledge on different maintenance works such as Earth Pit, Distribution Transformer yard.	6	**CO2**
8.	Fire extinguishers used for different fire accidents with demonstration	6	**CO2**
9.	Visit to any Industry or any power station and Electrical Sub substation	9	**CO3**
TOTAL		**45**	

COURSE OBJECTIVES	(i) To acquire knowledge on different switchgear equipment used in electrical power systems. (ii) To perform the required load survey, load tests and able to judge its performance. (iii) To explore the practical knowledge in industries by visits.

COURSE OUTCOMES	CO1	EE-410.1	Identify and testing of different switch gear equipment
	CO2	EE-410.2	Gain knowledge about electrical load survey, maintenance works and safety apparatus
	CO3	EE-410.3	Co relates the theoretical knowledge with real life practical environment in electrical engineering context.

LEARNING OUTCOMES

1. Switchgear Equipment

1. Carry out the identification of different electrical switch gear equipment.
2. Test the operation of a miniature circuit breaker (MCB) by connecting to a load.
3. Carry out the testing of single phasing preventer for a three-phase induction motor.
4. Carry out the Plug setting and Time setting in induction type electromagnetic relay by connecting to a load.

2. Electrical Load survey, maintenance and safety

5. Conduct load survey at your institute main building/hostel and submit a brief report.
6. Conduct load survey of electrical labs/mechanical workshop and submit a brief report.
7. Conduct load survey of your institution class rooms/office/other room and submit a brief report.
8. Identify the faults in electrical circuit of your institution and perform necessary electrical
   maintenance works.
9. Identify the fire-extinguishers to be used for different fire accidents and demonstrate its operation to extinguish fire.

3. Industrial visits

1. Demonstrate different types of insulators and cables used in power system and understand its applications in power system.
2. Visit any nearby power plant to observe protection systems and submit a brief report on
   industrial visit.
3. Visit nearby relevant industry to observe latest trends related to protection of electrical equipment and submit a brief report on industrial visit.
4. Visit any electrical substation/electrical traction substation to observe different power system protection schemes for different faults and submit a brief report.

HYPONATED COURSE CONTENTS

1. Switchgear Equipment

Identification of different electrical switch gear equipment – testing of fuse, MCB and electromagnetic over-current relay by performing the load test - testing the working of

single phasing preventer using a three phase induction motor-Plug setting and Time setting in induction type electromagnetic relay.

2. Electrical Load survey, maintenance and safety

Electrical load survey in institution campus/hostel building, institution main building/classrooms/office and electrical/mechanical workshop etc - maintenance works to be carried out periodically at Earth Pit, Distribution Transformer yard, - Fire extinguishers used for different fire accidents.

3. Industrial visits

Visiting to any Industry or any power station - Visiting to any Electrical Sub substation.

Competencies & Key competencies to be achieved by the student

Sl. No	Experiment title	Competencies	Key Competencies
1.	Identification of various switchgear equipment and writing their specifications	• Identify the various switch gear equipment like fuses, switches, relays, isolators , circuit breakers, current transformers, potential transformers • Identify specifications of various switch gear equipment used in power system protection.	• Understand the purpose of different equipment. • Understand the usage and operating principle of different equipment.
2.	Dismantle MCCB/ELCB and identify various parts	• Identify MCCB equipment • Dismantle MCCB • Identify its various parts • Identify ELCB equipment • Dismantle ELCB • Identify its various parts	• Knowing safety precautions in dismantling the MCCB/ELCB • Assembling the dismantled parts in their correct position
3.	Test fuse , MCB and electromagnetic over-current relay by performing the load test	• Draw the relevant circuit diagram for performing load test. • Select a fuse of proper rating/MCB of particular current rating/presetted relay of particular current value. • Apply load gradually until it reaches slightly above the rated value of fuse/MCB current rating/above the preset value of over current relay • Observe whether fuse melts or not/ MCB trips or not/over current relay operates or not when the load applied is greater than the rated current value	• Slowly increase the load current • Observe the operation of relay while load is increasing, at what value, the relay is starting to operate, performs its tripping mechanism.

4.	Test the working of the single phasing preventer using a three phase induction motor	• Draw the relevant circuit diagram for testing the working of single phasing preventer. • Give three phase supply to the induction motor • Start the running of induction motor by operating suitable starter • Observe the running of induction motor, note down torque developed by the motor for particular load current • Observe any severe vibrations are occurring or not • Observe any abnormal noise is coming or more heat is developed or any smoke is releasing or not • Now, suddenly open one of the lines by removing fuse in any one line or by any means • Now, observe for any of the above mentioned abnormalities like drawing more current in remaining lines, severe vibrations occurrence, more noise etc., • Give normal three phase supply immediately after observing the abnormalities	• Know the connection of single phasing preventer in the supply circuit • Know that single phasing preventer consists of phase failure relay and this relay detects the single phasing condition and trips the circuit breaker or contactor in the motor control circuit • Observe the noise or sound of motor, torque developed, occurrence of severe vibrations rotor gets heated, draws more current from remaining two phases.
5.	Plug setting and Time setting in induction type electromagnetic relay	• To understand the significance of plug setting and time setting in induction type electromagnetic relay • Know about the PSM and TSM facilities provided in the induction type electromagnetic relay et the values • set PSM for any arbitrary	• Know that operating time of relay would be multiplied with time setting multiplier in order to get actual time of operation of relay. for example if say that time setting of the relay is 0.1, therefore, the actual

		value • set time setting • to know the setting of time of operation of relay	time of operation of the relay for PSM 10 is 3x0.1=0.3 sec or 300ms.
6.	Electrical Load Survey	• Record the details of total load and layout of the Electrical installation. • Prepare the Electrical circuit layout. • List the quantity required and specifications of electrical material. • List the different tools required to execute the installation work. • Prepare the work schedule and identify the Vendors. • Estimate the cost of material and labour. • Execute the Electrical installation.(with dummy loads)	• Draw the Electrical wiring diagram. • Estimate the Materials, tools and labour cost for the work. • Identify the vendors. • Execute work schedules.
7.	Maintenance works such as Earth Pit, Distribution Transformer yard, Measurement of Insulation resistance etc.,	• Identify the different locations of earth pits in the institution • Know which type of earthing is done • Know the details of required quantity and arrangement method of sand, coal to be arranged in earth pit • Water is to poured at periodical intervals of maintenance to maintain the desired earth resistance value • To observe the layout of Distribution Transformer yard present in the institution • Keep the complete details of the items to be inspected in a chart • Checking of oil leakages, bushings, breather, oil level, fuses etc., is t be done keeping	• Execute the work with safety precautions • Perform the work of earth pit by own • Able to carry out the maintenance schedule of pole and plinth mounted transformer yards • To be well versed with the usage of megger for measuring insulation resistance, rotating the megger handle with rated speed and giving its connections correctly.

		in view of monthly, quarterly schedules • To know about routine DGA testing of plinth mounted transformer yard • To know about the external inspection. This is to be carried out regularly and at minimum, at least quarterly. • To know the importance of insulation resistance and how it is to be measured • To know the usage of megger in measuring insulation resistance of the electrical machinery or system.	
8.	Fire extinguishers used for different fire accidents with demonstration	• Identification of type of Extinguisher • Study different types of classes of fires (class A, class B, class C, class D fires) and fire Extinguishers • To know the applications of different fire extinguishers • Usage of extinguishers for particular situation.	• Identify the type of fire accident and take necessary action
9.	Visit to any Industry or any power station and any Electrical Sub substation	• Draw the layout of Industry or any power station and any Electrical Sub substation to be visited • Obtain the knowledge of every equipment used in substations. • Record the technical specifications of each equipment (Incoming and outgoing feeders, Bus-bar, Lightning arrester, Circuit breakers, Isolators, Protective relays, Current transformers, Potential transformers, Metering and Indicating instruments used, Distribution	• Understand the common rules and procedural steps/layouts to be followed while walking through the industry • Understand the various faults occurring frequently and safety equipmentsused. • Understand the working culture /environment of the industry/power

		Transformers, Wave trappers, capacitor banks, Batteries, Earth switches etc. in case of substations) • Note the staff structure and duties of each staff and day to day activities carried by staff. • Record the maintenance procedures adopted as per IS code and note typical earth resistance values. • Record the preventive maintenance schedule of all industrial equipment/substation equipment • Record the details of frequent faults/breakdowns that had occurred. • Note the safety equipment's used and precautions tobe taken. • Understand the various faults occurring frequently and safety equipment used.	station/substation