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

4.1 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.**

4.2 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

4.3 Medium of Instruction

The medium of instruction and examination shall be English.

4.4 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.

4.5 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.

4.6 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.

4.7 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.

4.8 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.

4.9 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 (c) 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.

4.10 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.

4.11. 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.

4.12. 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.

4.13. 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.

4.14. 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.

4.15. 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.

4.16. 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.

4.17. MAXIMUM PERIOD FOR COMPLETION OF DIPLOMA PROGRAMMES:

Maximum period for completion of the diploma courses is twice the duration of the course 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.

4.18. 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.

4.19. 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.

4.20. 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.

4.21. 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.

4.22. 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.

4.23. 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.

4.24. 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.								

DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
(V 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 501	Industrial Management &Smart Technologies	4	-	60	3	20	80	100
EE-502	Electric Vehicle Technology	5	-	75	3	20	80	100
EE-503	Power Systems - II	5	-	75	3	20	80	100
EE-504	Digital Electronics & Micro Controllers	5	-	75	3	20	80	100
EE-505	Electrical Utilisation & Traction	5	-	75	3	20	80	100
PRACTICAL								
EE-506	MATLAB Practice Laboratory	-	3	45	3	40	60	100
EE-507	PLC & SCADA Laboratory	-	3	45	3	40	60	100
EE-508	Life Skills	-	3	45	3	40	60	100
EE-509	Digital Electronics & Micro Controllers Laboratory	-	3	45	3	40	60	100
EE-510	Project Work	-	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 -508 is common with all branches.								

DIPLOMA IN ELECTRIAL AND ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
VI SEMESTER
INDUSTRIAL TRAINING

<table>
<tr><th rowspan="2">SI. No.</th><th rowspan="2">Course Title</th><th rowspan="2">Duration</th><th colspan="3">Scheme of evaluation</th><th>Remarks</th></tr>
<tr><th>Item</th><th>Nature</th><th>Max. Marks</th><th></th></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Industrial Training</td><td rowspan="5">6 months</td><td>1.First Assessment at training place/ Industry (After 12 Weeks)</td><td>Assessment of Learning outcomes by both the faculty and training Mentor of the industry</td><td>120</td><td rowspan="2">Pass marks is 50% in assessment at training place/industry (first and second assessment put together)</td></tr>
<tr><td>2.Second Assessment at training place/Industry (After 20 weeks)</td><td>Assessment of Learning outcomes by both the faculty and training Mentor of the industry</td><td>120</td></tr>
<tr><td rowspan="3">Final Summative assessment at institution level after completion of training.</td><td>Training Report</td><td>20</td><td rowspan="3">Pass marks is 50% in final summative assessment</td></tr>
<tr><td>Demonstration of any one of the skills listed in learning outcomes</td><td>30</td></tr>
<tr><td>Viva Voce</td><td>10</td></tr>
<tr><td colspan="5">TOTAL MARKS</td><td>300</td><td></td></tr>
</table>

FIRST YEAR

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	Engineering Physics	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	Engineering Drawing	-.	3	90	3	40	60	100
EE-108	Electrical Wiring 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.

ENGLISH

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for FA	Marks for SA
EE-101	English	3	90	20	80

Time Schedule : EE- 101 : ENGLISH						
Chapter No.	**Title**	**No. of Periods**	**Weightage**	**No. of short questions**	**No. of Essay questions**	**CO'S Mapped**
1	English for Employability	8	16	2	1	CO1, CO2, CO3, CO4, CO5
2	Living in Harmony	8			2	CO1, CO2, CO3, CO4, CO5
3	Connect with Care	8	26	2		CO1, CO2, CO3, CO4, CO5
4	Humour for Happiness	8				CO1, CO2, CO3, CO4, CO5
5	Never Ever Give Up!	8	10	1	1	CO1, CO2, CO3, CO4, CO5
6	Preserve or Perish	9	23		2	CO1, CO2, CO3, CO4, CO5
7	The Rainbow of Diversity	8		2		CO1, CO2, CO3, CO4, CO5
8	New Challenges - Newer Ideas	8	19		1	CO1, CO2, CO3, CO4, CO5
9	The End Point First	8		1		CO1, CO2, CO3, CO4, CO5
10	The Equal Halves	8		1	1	CO1, CO2, CO3, CO4,

			16			CO5
11	Dealing with Disaster	9		1		CO1, CO2, CO3, CO4, CO5
	Total	**90**	**110**	**30**	**80**	

S. No.	Title of the Unit	No of Periods	COs Mapped
1	English for Employability	8	CO1, CO2, CO3, CO4,CO5
2	Living in Harmony	8	CO1, CO2, CO3, CO4,CO5
3	Connect with Care	8	CO1, CO2, CO3, CO4,CO5
4	Humour for Happiness	8	CO1, CO2, CO3, CO4, CO5
5	Never Ever Give Up!	8	CO1, CO2, CO3, CO4, CO5
6	Preserve or Perish	9	CO1, CO2, CO3, CO4, CO5
7	The Rainbow of Diversity	8	CO1, CO2, CO3, CO4, CO5
8	New Challenges- Newer Ideas	8	CO1, CO2, CO3, CO4, CO5
9	The End Point First	8	CO1, CO2, CO3, CO4, CO5
10	The Equal Halves	8	CO1, CO2, CO3, CO4, CO5
11	Dealing with Disaster	9	CO1, CO2, CO3, CO4, CO5
Total Periods		**90**	

COURSE OBJECTIVES	- To improve grammatical knowledge and enrich vocabulary.
	- To develop effective reading, writing and speaking skills.
	- To comprehend themes related to Personality, Society, Environment to exhibit Universal Human Values.

	CO1	Learn and apply various grammatical concepts to communicate in academic, professional and everyday situations.
	CO2	Use appropriate vocabulary in various contexts.

COURSE OUTCOMES	CO3	Read and comprehend different forms of academic, professional and general reading material.
	CO4	Communicate effectively in speaking and writing in academic, professional and everyday situations.
	CO5	Display human values by applying the knowledge of themes related to Self, Society, Environment, Science and Technology for holistic development and harmonious living through communication.

CO-PO Matrix

<table>
<tr><th>Course Code
EE-101</th><th colspan="4">Course Title: English
Number of Course Outcomes: 5</th><th>No. of Periods: 90</th></tr>
<tr><td rowspan="2">POs</td><td rowspan="2">Mapped CO No.</td><td colspan="2">CO Periods Addressing PO in Column 1</td><td rowspan="2">Level of Mapping
(1,2,3)</td><td rowspan="2">Remarks</td></tr>
<tr><td>Number</td><td>Percentage</td></tr>
<tr><td>PO1</td><td></td><td colspan="4" rowspan="4">Not directly Applicable for English course, however, the language activities make use of the content from Science and Technology relevant to the programme to enhance English communication skills.</td></tr>
<tr><td>PO2</td><td></td></tr>
<tr><td>PO3</td><td></td></tr>
<tr><td>PO4</td><td></td></tr>
<tr><td>PO5</td><td>CO5</td><td>16</td><td>18%</td><td>Level 1</td><td rowspan="3">Up to 20%: Level 1
21%-50%: Level 2
>50%: Level 3</td></tr>
<tr><td>PO6</td><td>CO1, CO2, CO3, CO4,</td><td>52</td><td>58%</td><td>Level 3</td></tr>
<tr><td>PO7</td><td>CO1, CO2, CO3, CO4,CO5</td><td>22</td><td>24%</td><td>Level 2</td></tr>
</table>

Level 3 – Strongly Mapped, Level 2- Moderately Mapped; Level 1- Slightly Mapped

LEARNING OUTCOMES

1. English for Employability

1.1. Perceive the need for improving communication in English for employability

1.2. Use adjectives and articles effectively while speaking and in writing

1.3. Write simple sentences

2. Living in Harmony

2.1. Develop positive self-esteem for harmonious relationships
2.2. Use affixation to form new words
2.3. Use prepositions and use a few phrasal verbs contextually

3. Connect with Care

3.1. Use social media with discretion
3.2. Speak about abilities and possibilities
3.3. Make requests and express obligations
3.4. Use modal verbs and main verbs in appropriate form
3.5. Write short dialogues about everyday situations

4. Humour for Happiness

4.1. Realize the importance of humour for a healthy living
4.2. Improve vocabulary related to the theme
4.3. Inculcate reading and speaking skills
4.4. Frame sentences with proper Subject – Verb agreement
4.5. Understand the features of a good paragraph and learn how to gather ideas as a preliminary step for writing a good paragraph.

5. Never Ever Give Up!

5.1. Learn to deal with failures in life
5.2. Use the present tense form for various every day communicative functions such as speaking and writing about routines, professions, scientific descriptions and sports commentary
5.3. Write paragraphs with coherence and other necessary skills

6. Preserve or Perish

6.1. Understand the ecological challenges that we face today and act to save the environment.
6.2. Narrate / Report past events and talk about future actions
6.3. Develop vocabulary related to environment
6.4. Write e-mails

7. The Rainbow of Diversity

7.1. Appraise and value other cultures for a happy living in multi-cultural workspace
7.2. Understand the usage of different types of sentences
7.3. Ask for or give directions, information, instructions
7.4. Use language to express emotions in various situations
7.5. Write letters in various real life situations

8. New Challenges – Newer Ideas

8.1. Understand the functional difference between Active Voice and Passive Voice
8.2. Use Passive Voice to speak and write in various contexts
8.3. Understand the major parts and salient features of an essay
8.4. Learn about latest innovations and get motivated

9. The End Point First!

9.1. Understand the importance of setting goals in life
9.2. Report about what others have said both in speaking and writing
9.3. Write an essay following the structure in a cohesive and comprehensive manner
9.4. Apply the words related to Goal Setting in conversations and in life

10. The Equal Halves

10.1. Value the other genders and develop a gender-balanced view towards life
10.2. Identify the use of different conjunctions in synthesising sentences
10.3. Write various types of sentences to compare and contrast the ideas
10.4. Apply the knowledge of sentence synthesis in revising and rewriting short essays
10.5. Develop discourses in speech and writing

11. Dealing with Disasters

11.1. be aware of different kinds of disasters and the concept of disaster management
11.2. Generate vocabulary relevant to disaster management and use it in sentences
11.3. Analyze an error in a sentence and correct it
11.4. Learn and write different kinds of reports

Textbook: **'INTERACT'** (A Text book of English for I Year Engineering Diploma Courses) - by SBTET, AP

Reference Books:

1. Martin Hewings: *Advanced Grammar in Use,* Cambridge University Press
2. Murphy, Raymond : *English Grammar in Use,*Cambridge University Press
3. Sidney Greenbaum : *Oxford English Grammar*, Oxford University Press
4. Wren and Martin (Revised by N.D.V. Prasad Rao) : *English Grammar and Composition*, Blackie ELT Books, S. Chand and Co.
5. Sarah Freeman: *Strengthen Your Writing*, Macmillan

	End Exam (80 Marks)	**1,2,3 Unit Tests (20 Marks each)**
Part A	10 Question @ 3 Marks	5 Questions @ (1Q X4M) + (4Q X3M =12)
	Total = 30 Marks	Total = 16 Marks
Part B	5 Questions (+ 3 Choice) @10 Marks	3 Questions (with internal choice) @ 8 Marks
	Total = 50 Marks	Total = 24 marks
Grand Total	**80 Marks**	**40 Marks**

ENGINEERING MATHEMATICS-I
(Common to all Branches)

Course Code	Course Title	No. of Periods/week	Total No. of periods	Marks for FA	Marks for SA
EE-102	Engineering Mathematics-I	5	150	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	Algebra	31	22	4	1	CO1
2	Trigonometry	44	29	3	2	CO2
3	Co-ordinate Geometry	23	13	1	1	CO3
4	Differential Calculus	34	26	2	2	CO4
5	Applications of Derivatives	18	20	0	2	CO5
TOTAL		**150**	**110**	**10**	**8**	

S.No.	Chapter	No. of Periods	Marks Allotted	Short type	Essay type	CO's mapped
Unit - I: Algebra						
1	Functions	6	3	1	0	CO1
2	Partial Fractions	5	3	1	0	CO1
3	Matrices and Determinants	20	16	2	1	CO1
Unit - II: Trigonometry						
4	Trigonometric Ratios	2	0	0	0	CO2
5	Compound Angles	5	3	1	0	CO2
6	Multiple and Submultiple angles	8	3	1	0	CO2
7	Transformations	6	5	0	1/2	CO2
8	Inverse Trigonometric Functions	6	5	0	1/2	CO2
9	Trigonometric Equations	6	5	0	1/2	CO2
10	Properties of triangles	5	5	0	1/2	CO2
11	Complex Numbers	6	3	1	0	CO2
Unit III: Co-ordinate Geometry						
12	Straight Lines	5	3	1	0	CO3
13	Circles	6	5	0	1/2	CO3
14	Conic Sections	12	5	0	1/2	CO3
Unit – IV: Differential Calculus						
15	Limits and Continuity	6	3	1	0	CO4
16	Differentiation	28	23	1	2	CO4

Unit – V: Applications of Derivatives						
17	Geometrical Applications	4	5	0	1/2	CO5
18	Physical Applications	6	5	0	1/2	CO5
19	Maxima and Minima	4	5	0	1/2	CO5
20	Errors and Approximations	4	5	0	1/2	CO5
	Total	150	110	10	8	
			Marks	**30**	**80**	

COURSE OBJECTIVES	(i) To apply the principles of Algebra, Trigonometry and Co-ordinate Geometry to real-time problems in engineering. (ii) To comprehend and apply the concept of Differential Calculus in engineering applications.

COURSE OUTCOMES	CO1	Identify functions as special relations, resolve partial fractionsand solve problems on matrices and determinants.
	CO2	Solve problems using the concept of trigonometric functions, their inverses and complex numbers.
	CO3	Find the equations and properties of straight lines, circles and conic sections in coordinate system.
	CO4	Evaluate the limits and derivatives of various functions.
	CO5	Find solutions for engineering problems using differentiation.

LEARNING OUTCOMES

UNIT - I

C.O. 1 Identify functions, resolve partial fractions and solve problems on matrices and determinants.

L.O. 1.1 Define Set, Ordered pair and Cartesian product of two sets - examples.

1.2 Explain Relations and Functions – examples

1.3 Find Domain & Range of functions – simple examples.

1.4 Define one-one and onto functions.

1.5 Find the inverse of a function – simple examples.

1.6 Define rational, proper and improper fractions of polynomials.

1.7 Explain the procedure of resolving proper fractions of the types mentioned below into partial fractions

i) $\frac{f(x)}{(ax+b)(cx+d)}$ *ii)* $\frac{f(x)}{(ax+b)^2(cx+d)}$

1.8 Define a matrix and order of a matrix.

1.9 State various types of matrices with examples (emphasis on 3rd order square matrices).

1.10 Compute sum, difference, scalar multiplication and product of matrices. Illustrate the properties of these operations such as commutative, associative and distributive properties with examples and counter examples.

1.11 Define the transpose of a matrix and state its properties – examples.

1.12 Define symmetric and skew-symmetric matrices with examples. Resolve a square matrix into a sum of symmetric and skew-symmetric matrices and provide examples.

1.13 Define determinant of a square matrix; minor, co-factor of an element of a 3x3 square matrix with examples. Expand the determinant of a 3 x 3 matrix using Laplace expansion formula. State and apply the properties of determinants to solve problems.

1.14 Distinguish singular and non-singular matrices. Define multiplicative inverse of a matrix and list properties of adjoint and inverse. Compute adjoint and multiplicative inverse of a square matrix.

1.15 Solve a system of 3 linear equations in 3 unknowns using Cramer's rule and matrix inversion method.

UNIT - II

C.O. 2 Solve problems using the concept of trigonometric functions, their inverses and complex numbers.

L.O. 2.1 Define trigonometric ratios of any angle - List the values of trigonometric ratios at specified values.

2.2 Draw graphs of trigonometric functions - Explain periodicity of trigonometric functions.

2.3 Define compound angles and state the formulae of sin(A±B), cos(A±B),tan(A±B) and cot(A±B).

2.4 Give simple examples on compound angles to derive the values of $\sin 15^0$,$\cos 15^0$, $\sin 75^0$, $\cos 75^0$, $\tan 15^0$, $\tan 75^0$ etc.

2.5 Derive identities like $\sin(A+B)\sin(A-B) = \sin^2 A - \sin^2 B$ etc.

2.6 Solve simple problems on compound angles.

2.7 Derive the formulae of multiple angles 2A, 3A etc and sub multiple angleA/2 in terms of angle A of trigonometric functions.

2.8 Derive useful allied formulae like $\sin^2 A = (1 - \cos 2A)/2$ etc.

2.9 Solve simple problems using the multiple and submultiple formulae.

Syllabus for Unit test-I completed

2.10 Derive the formulae on transforming sum or difference of two trigonometric ratios into a product and vice versa - examples on these formulae.

2.11 Solve problems by applying these formulae to sum or difference or product of two terms.

2.12 Explain the concept of the inverse of a trigonometric function by selecting an appropriate domain and range.

2.13 Define inverses of six trigonometric functions along with their domains and ranges.

2.14 Derive relations between inverse trigonometric functions so that the given inverse trigonometric function can be expressed in terms of other inverse trigonometric functions with examples.

2.15 State various properties of inverse trigonometric functions and identities like

$\sin^{-1}x+\cos^{-1}x = \frac{\pi}{2}$, etc.

2.16 Apply formulae like $\tan^{-1}x+\tan^{-1}y=\tan^{-1}\left(\frac{x+y}{1-xy}\right)$, *where* $x\geq 0, y\geq 0, xy<1$ etc.,

to solve Simple problems.

2.17 Explain what is meant by solution of trigonometric equations and find the general solutions of sin x=k, cos x =k and tan x=k with appropriate examples.

2.18 Solve models of the type $a\sin^2 x + b\sin x + c=0$ and $a\sin x + b\cos x=c$.

2.19 State sine rule, cosine rule, tangent rule and projection rule and solve a triangle using these formulae.

2.20 List various formulae for the area of a triangle with examples.

2.21 Define a complex number, its modulus, conjugate, amplitude and list their properties.

2.22 Define arithmetic operations on complex numbers with examples.

2.23 Represent the complex number in various forms like modulus-amplitude (polar) form, Exponential (Euler) form with examples.

UNIT - III

Coordinate Geometry

C.O. 3 Find the equations and properties of straight lines, circles and conic sections in coordinate system.

L.O. 3.1 Write different forms of a straight line – general form, point-slope form, slope-intercept form, two-point form, intercept form and normal form (or perpendicular form).

3.2 Find distance of a point from a line, acute angle between two lines, intersection of two non-parallel lines and distance between two parallel lines.

3.3 Define locus of a point and circle.

3.4 Write the general equation of a circle and find its centre and radius.

3.5 Find the equation of a circle, given (i) centre and radius, (ii)two ends of the diameter(iii) three non collinear points of type (0,0) (a,0), (0, b).

3.6 Define a conic section - Explain the terms focus, directrix, eccentricity, axes and latus-rectum of a conic with illustrations.

3.7 Find the equation of a conic when focus, directrix and eccentricity are given.

3.8 Describe the properties of Parabola, Ellipse and Hyperbola in standard forms whose axes are along the co-ordinate axes and solve simple examples on these conics.

Syllabus for Unit test-II completed

C.O.4 Evaluate the limits and derivatives of various functions.

L.O. 4.1 Explain the concept of limit and meaning of $\lim_{x\to a} f(x)=l$ and state the properties of limits.

4.2 Evaluate the limits of the type $\lim^{f(x)}$ and $\lim \frac{f(x)}{}$

$x \to \infty$ $g(x)$

4.3 State the Standard limits $\lim_{x \to a} \frac{x^n - a^n}{x - a}$, $\lim_{x \to 0} \frac{\sin x}{x}$, $\lim_{x \to 0} \frac{\tan x}{x}$, $\lim_{x \to 0} \frac{a^x - 1}{x}$, $\lim_{x \to 0} \frac{e^x - 1}{x}$, $\lim_{x \to 0} \frac{1}{x}$, $\lim_{x \to 0} (1+x)^x$, $\lim_{x \to \infty} \left(1 + \frac{1}{x}\right)^x$ **(**without proof) and solve simple problems using these standard limits.

4.4 Explain the concept of continuity of a function at a point and on an interval

4.5 State the concept of derivative of a function y = f(x) – definition, first principle as $\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ and also provide standard notations to denote the derivative of a function.

4.6 Explain the significance of derivative in scientific and engineering applications.

4.7 Find the derivative of standard algebraic, logarithmic, exponential and trigonometric functions using the first principle.

4.8 Find the derivatives of inverse trigonometric, hyperbolic and inverse hyperbolic functions.

4.9 State the rules of differentiation of sum, difference, scalar multiplication, product and quotient of functions with simple illustrative examples.

4.10 Explain the method of differentiation of a function of a function (Chain rule) with illustrative examples.

4.11 Explain the method of differentiation of parametric functions with examples.

4.12 Explain the procedure for finding the derivatives of implicit functions with examples.

4.13 Explain the need of taking logarithms for differentiating some functions of $[f(x)]^{g(x)}$ type – examples on logarithmic differentiation.

4.14 Explain the concept of finding the second order derivatives with examples.

4.15 Explain the concept of functions of several variables, finding partial derivatives and difference between the ordinary and partial derivatives with simple examples.

4.16 Explain the concept of finding second order partial derivatives with simple problems.

C.O. 5 Evaluate solutions for engineering problems using differentiation

L.O. 5.1 State the geometrical meaning of the derivative - Explain the concept of derivative to find the slopes of tangent and normal to a given curve at any point on it with examples.

5.2 Find the equations of tangent and normal to to a given curve at any point on it – simple problems.

5.3 Explain the derivative as a rate of change in distance-time relations to find the velocity and acceleration of a moving particle with examples.

5.4 Explain the derivative as a rate measurer in the problems where the quantities like areas, volumesvary with respect to time- illustrative examples.

5.5 Define the concept of increasing and decreasing functions - Explain the conditions to find points where the given function is increasing or decreasing with illustrative examples.

5.6 Explain the procedure to find the extreme values (maxima or minima) of a

function of single variable- simple problems for quadratic and cubic polynomials.

5.7 Apply the concept of derivatives to find the errors and approximations - simple problems.

Syllabus for Unit test-III completed

CO/PO – Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	3				3	2	2
CO2	3	3	2	2				3	2	2
CO3	3	3	2	2				3	2	2
CO4	3	3	3	3				3	3	3
CO5	3	3	3	3				3	3	3
Avg.	3	2.8	2.4	2.6				3	2.4	2.4

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
		No	%		
1	CO1, CO2, CO3, CO4, CO5	150 (31+44+23+34+18)	100%	3	>40% Level 3 Highly addressed 25% to 40% Level 2 Moderately addressed 5% to 25% Level 1 Low addressed <5% Not addressed
2	CO1, CO2, CO3, CO4, CO5	80 (8+23+12+22+15)	53.3%	3	
3	CO1, CO2, CO3, CO4, CO5	61 (9+14+9+14+15)	40.6%	3	
4	CO1, CO2, CO3, CO4, CO5	61 (14+9+9+14+15)	40.6%	3	
PSO 1	CO1, CO2, CO3, CO4, CO5	150 (31+44+23+34+18)	100%	3	
PSO 2	CO1, CO2, CO3, CO4, CO5	62 (10+14+9+14+15)	41.3%	3	
PSO 3	CO1, CO2, CO3, CO4, CO5	62 (10+14+9+14+15)	41.3%	3	

COURSE CONTENT

Unit-I
Algebra

1. **Functions**:

Definitions of Set, Ordered pair, Cartesian product of two sets, Relations, Functions, Domain & Range of functions – One-one and onto functions, inverse of a function.

2. **Partial Fractions:**

Definitions of rational, proper and improper fractions of polynomials. Resolve rational fractions (proper fractions) into partial fractions covering the types mentioned below.

i) $\dfrac{f(x)}{(ax+b)(cx+d)}$ *ii)* $\dfrac{f(x)}{(ax+b)^2(cx+d)}$

3. **Matrices:**
Definition of a matrix, types of matrices - Algebra of matrices, equality of two matrices, sum, difference, scalar multiplication and product of matrices. Transpose of a matrix, Symmetric, skew-symmetric matrices-Determinant of a square matrix, minor and cofactor of an element, Laplace's expansion, properties of determinants - Singular and non-singular matrices, Adjoint and multiplicative inverse of a square matrix-System of linear equations in 3 variables-Solutions by Cramer's rule and Matrix inversion method.

Unit-II
Trigonometry

4. **Trigonometric ratios:**

Definition of trigonometric ratios of any angle, values of trigonometric ratios at specified values, draw graphs of trigonometric functions, periodicity of trigonometric functions.

5. **Compound angles:**
Formulas of sin(A±B), cos(A±B), tan(A±B), cot(A±B), and related identities.
6. **Multiple and sub multiple angles:**
Formulae for trigonometric ratios of multiple angles 2A, 3A and sub multiple angle A/2.
7. **Transformations:**
Transformations of products into sums or differences and vice versa.
8. **Inverse trigonometric functions:**
Definition, domains and ranges-basic properties.
9. **Trigonometric equations:**
Concept of a solution, principal value and general solution of trigonometric equations: Sinx =k, cosx= k, tanx =k, where k is a constant. Solutions of simple quadratic equations and equations of type a sin x + b cos x=c.
10. **Properties of triangles:**
Relations between sides and angles of a triangle- sine rule, cosine rule, tangent rule and projection rule-area of a triangle.
11. **Complex Numbers:**

Definition of a complex number, modulus, conjugate and amplitude of a complex number – Arithmetic operations on complex numbers - Modulus-Amplitude (polar) form, Exponential form (Euler form) of a complex number.

UNIT-III

Coordinate geometry

12 **Straight lines:** Various forms of a straight line - Angle between two lines, perpendicular distance from a point, intersection of non-parallel lines and distance between parallel lines.

13. **Circle:** Locus of a point, Circle Definition-Circle equation given (i) centre and radius, (ii) two ends of a diameter (iii) three non-collinear points of type (0,0), (a,0), (0, b) - General equation of a circle –its centre and radius.

14. Definition of a conic section - Equation of a conic when focus, directrix and eccentricity are given - Properties of parabola, ellipse and hyperbola in standard forms.

UNIT-IV

Differential Calculus

15. **Concept of Limit-** Definition and Properties of Limits and Standard Limits -Continuity of a function at a point.

16. **Concept of derivative-** Definition (first principle)- different notations- Derivatives of standard algebraic, logarithmic, exponential, trigonometric, inverse trigonometric, hyperbolic and inverse hyperbolic functions - Derivatives of sum, difference, scalar multiplication, product, quotient of functions - Chain rule, derivatives of parametric functions, derivatives of implicit functions, logarithmic differentiation - Second order derivatives - Functions of several variables, first and second order partial derivatives.

UNIT-V

Applications of Derivatives

17. Geometrical meaning of the derivative, equations of tangent and normal to a curve at any point.

18. Physicalapplications of derivatives – Velocity, acceleration, derivative as a rate measurer.

19. Applications of the derivative to find the extreme values – Increasing and decreasing functions, maxima and minima for quadratic and cubic polynomials.

20. Absolute, relative and percentage errors - Approximate values due to errors in measurements.

Textbook:

Engineering Mathematics-I, a textbook for first year diploma courses, prepared & prescribed by SBTET, AP.

Reference Books:

1. Shanti Narayan, A Textbook of matrices, S.Chand&Co.
2. Robert E. Moyer & Frank Ayers Jr., Schaum's Outline of Trigonometry, 4th Edition, Schaum's Series.
3. G.B.Thomas, R.L.Finney, Calculus and Analytic Geometry, Addison Wesley, 9th Edition, 1995.
4. Frank Ayers & Elliott Mendelson, Schaum's Outline of Calculus, Schaum's Series.
5. M.Vygodsky, Mathematical Handbook, Mir Publishers, Moscow.

ENGINEERING PHYSICS

Course code	Course title	No. of periods per week	Total no. of periods	Marks for FA	Marks for SA
EE -103	Engineering Physics	03	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	Units and measurements	09	03	1	0	CO1
2	Statics	11	13	1	1	
3	Gravitation	12	20	0	2	CO2
4	Concepts of energy	10	13	1	1	
5	Thermal physics	10	13	1	1	CO3
6	Sound	12	16	2	1	
7	Electricity &Magnetism	13	16	2	1	CO4
8	Modern physics	13	16	2	1	
TOTAL		**90**	**110**	**10**	**8**	

COURSE OBJECTIVES	(1) To understand the basic concepts of physics for various Engineering applications as required for industries. (2) To equip the students with the scientific advances in technology and make the student suitable for any industrial or scientific organization.

COURSE OUTCOMES	CO1	Familiarize with various physical quantities, their SI units and errors in measurements; understand the concepts of vectors and various forces in statics.
	CO2	Understand the concepts of gravitation with reference to applications in satellites, provide the knowledge of various forms of energy and their working principles.
	CO3	Familiarize with the knowledge of transmission of heat and gas laws; provide the knowledge on musical sound and noise as pollution and also the concepts of echo and reverberation.
	CO4	Provide basic knowledge of electricity and concepts of magnetism and magnetic materials; familiarize with the advances in Physics such as photoelectric ell, optical fibers, semiconductors, superconductors and nanotechnology.

Matrix showing mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1			2	2		2
CO2	3	2	2	2	2		2	1		2
CO3	2		1		2		1		1	1
CO4	3	2	3	2	2		3	2		2

CO-PO Mapping Strength

Course code EE-103	**Engineering Physics No of Course Objectives: 4**				**No of periods 90**
POs	Mapped with CO No	CO periods addressing PO in Col 1 NO	%	1,2,3	remarks
PO1	CO1, CO2, CO3, CO4	44	48.9 %	3	>40% level 3 (highly addressed) 25% to 40% level2 (moderately addressed) 5% to 25% level1 (Low addressed) < 5% (not addressed)
PO2	CO1, CO2, CO4	11	12.2%	1	
PO3	CO1, CO2, CO3, CO4	10	11.1%	1	
PO4	CO1, CO2, CO4	8	8.9%	1	
PO5	CO2, CO3, CO4	8	8.9%	1	
PO6					
PO7	CO1, CO2, CO3, CO4	9	10.0%	1	

3 = strongly mapped, 2 = moderately mapped, 1 = slightly mapped

Note: The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following.

(i) Seminars (ii) Tutorials (iii) Guest Lecturers (iv) Assignments
(v) Quiz competitions (vi) Industrial visits (vii) Techfest
(viii) Mini project
(ix) Group discussions (x) Virtual classes (xi) Library visit for e-books

LEARNING OUTCOMES

Upon completion of the course the student shall be able to

1.0 Understand the concept of units and measurements

1.1 Explain the concept of units
1.2 Define the terms
a) Physical quantity, b) Fundamental physical quantities and
c) Derived physical quantities
1.3 Define unit
1.4 Define fundamental units and derived units
1.5 State SI units with symbols for fundamental and some derived quantities
1.6 State Multiples and Submultiples in SI system
1.7 State rules of writing S.I units
1.8 State advantages of SI units
1.9 What are direct and indirect measurements.
1.10 Define accuracy and least count
1.11 Define error in measurement
1.12 Define absolute, relative and percentage errors with their formulae
1.13 Solve simple problems on absolute, relative and percentage errors

2.0 Understand the concepts of statics

2.1 Explain the concept of Vectors
2.2 Define scalar and vector quantities with examples
2.3 Represent vectors geometrically
2.4 Define the types of vectors (equal, negative, unit, co-initial, co-planar, position vector)
2.5 Resolve the vector into rectangular components
2.6 State and explain triangle law of addition of vectors
2.7 Define concurrent forces, co-planar forces and equilibrant.
2.8 State and explain Lami's theorem
2.9 State the parallelogram law of addition of forces with diagram.
2.10 Write the expressions for magnitude and direction of resultant (no derivation)
2.11 Illustrate parallelogram law with examples (i) flying of bird and (ii) working of sling.
2.12 Define moment of force and couple.
2.13 Write the formulae and S.I units of moment of force and couple.
2.14 Solve simple problems on (i)Resolution of force and
(ii) Parallelogram law of forces (finding R,α and θ).

3.0 Understand the concepts of Gravitation

3.1 State and explain Newton's universal law of gravitation.
3.2 Define G and mention its value.
3.3 Explain the acceleration due to gravity (g)
3.4 Explain the factors affecting the value of g
3.5 Derive the relationship between g and G.
3.6. State and explain the Kepler's laws of planetary motion
3.7 Define a satellite.
3.8 What are natural and artificial satellites? Give examples.
3.9 Define orbital velocity and write its formula.
3.10 Define escape velocity and write its formula.
3.11 Write a brief note on Polar satellites.
3.12 Write a brief note on Geo-stationary satellites.
3.13 Mention the applications of artificial satellites.

3.14 Solve simple problems on (i) Newton's law of gravitation and (ii) calculation of orbital and escape velocities.

4.0 Understand the concepts of Energy.

4.1 Define work done and energy. Mention their SI units.
4.2 List various types of energy.
4.3 Define P.E with examples. Write its equation.
4.4 Define K.E with examples. Write its equation.
4.5 Derive relationship between K.E and momentum.
4.6 State the law of conservation of energy. Give various examples.
4.7 Write a brief note on solar energy.
4.8 Explain the principle of solar thermal conversion.
4.9 Explain the principle of photo voltaic effect
4.10 Solve simple problems on (i) work done (ii) P.E & K.E and (iii) Relation between K.E& momentum.

5.0 Understand the concepts of thermal physics

5.1 Define the concepts of heat and temperature
5.2 State different modes of transmission of heat
5.3 Explain conduction, convection and radiation with two examples each.
5.4 State and explain Boyle's law
5.5 Define absolute zero temperature
5.6 Explain absolute scale of temperature
5.7 State the relationship between degree Celsius, Kelvin and Fahrenheit temperatures
5.8 State Charle's law and write its equation
5.9 State Gay-Lussac's law and write its equation
5.10 Define ideal gas
5.11 Derive ideal gas equation
5.12 Explain why universal gas constant (R) is same for all gases
5.13 Calculate the value of R for 1-gram mole of gas.
5.14 Solve simple problems on (i) Interconversion of temperatures between °C, K and F (ii) Gas laws and (iii) Ideal gas equation.

6.0 Understand the concepts of Sound

6.1 Define the term sound
6.2 Define longitudinal and transverse waves with one example each
6.3 Explain the factors which affect the velocity of sound in air
6.4 Distinguish between musical sound and noise
6.5 Explain noise pollution and state SI unit for intensity of sound
6.6 Explain sources of noise pollution
6.7 Explain effects of noise pollution
6.8 Explain methods of minimizing noise pollution
6.9 Define Doppler effect.
6.10 List the Applications of Doppler effect
6.11 Define reverberation and reverberation time
6.12 Write Sabine's formula and name the physical quantities in it.
6.13 Define echoes and explain the condition to hear an echo.
6.14 Mention the methods of reducing an echo
6.15 Mention the applications of an echo
6.16 What are ultra-sonics
6.17 Mention the applications of ultra-sonics, SONAR
6.18 Solve simple problems on echo

7.0 Understand the concepts of Electricity and Magnetism

7.1 Explain the concept of P.D and EMF
7.2 State Ohm's law and write the formula
7.3 Explain Ohm's law
7.4 Define resistance and specific resistance. Write their S.I units.
7.5 State and explain Kirchhoff's first law.
7.6 State and explain Kirchoff's second law.
7.7 Describe Wheatstonebridge with legible sketch.
7.8 Derive an expression for balancing condition of Wheatstone bridge.
7.9 Describe Meter Bridge experiment with necessary circuit diagram.
7.10 Write the formulae to find resistance and specific resistance in meter bridge
7.11 Explain the concept of magnetism
7.12 What are natural and artificial magnets (mention some types)
7.13 Define magnetic field and magnetic lines of force.
7.14 Write the properties of magnetic lines of force
7.15 State and explain the Coulomb's inverse square law of magnetism
7.16 Define magnetic permeability
7.17 Define para, dia, ferro magnetic materials with examples
7.18 Solve simple problems on (i) Ohm's law (ii) Kirchoff's first law (iii) Wheatstone bridge (iv) meter bridge and (v) Coulomb's inverse square law

8.0 Understand the concepts ofModern physics

8.1 State and explain Photo-electric effect.
8.2 Write Einstein's Photo electric equation and name the physical quantities in it.
8.3 State laws of photo electric effect
8.4 Explain the Working of photo electric cell
8.5 List the Applications of photoelectric effect
8.6 Recapitulate refraction of light and its laws
8.7 Define critical angle
8.8 Explain the Total Internal Reflection
8.9 Explain the principle and working of Optical Fiber
8.10 List the applications of Optical Fiber
8.11 Explain the energy gap based on band structure
8.12 Distinguish between conductors, semiconductors and insulators based on energy gap
8.13 Define doping
8.14 Explain the concept of hole
8.15 Explain the types of semi-conductors: Intrinsic and extrinsic
8.16 Explain n-type and p-type semiconductors
8.17 Mention the applications of semiconductors
8.18 Define superconductor and superconductivity
8.19 List the application
s of superconductors
8.20 Nanotechnology definition, nanomaterials and applications

COURSECONTENT

1. Units and measurements

Introduction – Physical quantity – Fundamental and Derived quantities – Fundamental and derived units - SI units – Multiples and Sub multiples – Rules for writing S.I. units- Advantages of SI units – Direct and indirect measurements – Accuracy and least count – Errors: Absolute, relative and percentage errors –Problems.

2. Statics

Scalars and Vectors– Representation of a vector - Types of vectors - Resolution of vector into rectangular components – Triangle law of vectors – Concurrent forces - Lami's theorem - Parallelogram law of forces : Statement, equations for magnitude and direction of resultant, examples – Moment of force and couple – Problems.

3. Gravitation

Newton's law of gravitation and G – Concept of acceleration due to gravity (g) – Factors affecting the value of g – Relation between g and G- Kepler's laws – Satellites: Natural and artificial – Orbital velocity and escape velocity – Polar and geostationary satellites – Applications of artificial satellites – Problems.

4. Concepts of energy

Work done & Energy-Definition and types of energy - potential energy - kinetic energy- - K.E and momentum relation – Law of Conservation of energy, examples - Solar energy, principles of thermal and photo conversion – Problems.

5. Thermal physics

Modes of transmission of heat – Expansion of Gases - Boyle's law – Absolute scale of temperature - Thermometric scales and their inter conversion - Charle's law - Gay-Lussac's law - Ideal gas equation - Universal gas constant (R) - Problems.

6. Sound

Sound - Nature of sound - Types of wave motion, Longitudinal and transverse – Factors affecting the velocity of sound in air - musical sound and noise - Noise pollution – Causes &effects - Methods of reducing noise pollution - Doppler effect - Echo- Reverberation - Reverberation time-Sabine 's formula – Ultrasonic & applications – SONAR - Problems.

7. Electricity & Magnetism

Concept of P.D and EMF - Ohm's law and explanation-Specific resistance - Kirchhoff's – Wheatstone's bridge - Meter bridge.

Natural and artificial magnets – magnetic field and magnetic lines of force – Coulomb's inverse square law – Permeability – Magnetic materials – Para, Dia, ferro – Examples – Problems.

8. Modern Physics

Photoelectric effect – laws of photoelectric effect – photoelectric cell – Applications of photoelectric cell - Total internal reflection - Fiber optics - Principle and working of an optical fiber - Applications of optical fibers – Semiconductors : Based on Energy gap – Doping – Hole - Intrinsic and extrinsic semiconductors (n-type & p-type) – Applications of semiconductors – Superconductivity – applications – Nanotechnology definition, nano materials, applications.

REFERENCES

1. Intermediate physics - Volume - I & 2 Telugu Academy (English version)

2. Unified physics Volume 1, 2, 3 and 4 — Dr. S.L Guptha and Sanjeev Guptha
3. Concepts of Physics, Vol 1 & 2 — H.C. Verma
4. Text book of physics Volume I & 2 — Resnick & Halliday
5. Fundamentals of physics — Brijlal& Subramanyam
6. Text book of applied physics — Dhanpath Roy
7. NCERT Text Books of physics — Class XI & XII Standard
8. e-books/e-tools/websites/Learning Physics software/eLMS

Table showing the scope of 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 6.18
Unit test - 3	From 7.1 to 8.20

ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES

Course code	Course Title	No. of Periods per week	Total No. of Periods	Marks for FA	Marks f or SA
EE-104	Engineering Chemistry and Environmental Studies	3	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	Fundamentals of Chemistry	14	21	2	1.5	CO1
2	Solutions, Acids and Bases	16	21	2	1.5	CO1
3	Electrochemistry	12	13	1	1	CO2
4	Corrosion	8	13	1	1	CO2
5	Water Treatment	8	13	1	1	CO3
6	Polymers& Engineering Materials	12	13	1	1	CO4
7	Fuels	6	3	1	0	CO4
8	Environmental Studies	14	13	1	1	CO5
TOTAL		**90**	**110**	**10**	**8**	

COURSE OBJECTIVES	1. To familiarize with the concepts of chemistry involved in the process of various Engineering Industrial Applications. 2. To know the various natural and man-made environmental issues and concerns with an interdisciplinary approach that include physical, chemical, biological and socio-cultural aspects of environment. 3. to reinforce theoretical concepts by conducting relevant experiments/exercises

COURSE OUTCOMES	CO1	Explain Bohr`s atomic model, chemical bonding, mole concept, acids and bases, P^H and Buffer solutions.
	CO2	Explain electrolysis, Galvanic cell, batteries and corrosion
	CO3	Explain the chemistry involved in the treatment of hardness in water.
	CO4	Explain the methods of preparation and applications of Polymers and Elastomers, chemical composition and applications of Alloys, Composite Materials, Liquid Crystals, Nano Materials and Fuels.
	CO5	Explain Global impacts due to air pollution, causes, effects and controlling methods of water pollution and understand the environment, forest resources, e-Pollution and Green Chemistry Principles.

EE-104	Engineering. Chemistry and Environmental studies No of Course Outcomes:5				No Of periods 90
POs	Mapped with CO No	CO periods addressing PO in Col NO. 1	%	Level 1,2,3	remarks
PO1	CO1,CO2,CO3	42	46.7 %	3	>40% level 3 (highly addressed) 25% to 40% level 2(moderately addressed) 5% to 25% level 1 (Low addressed) < 5%(not addressed)
PO2	CO2,CO3	16	17.8%	1	
PO3	CO4	12	13.3%	1	
PO4	CO4	6	6.7%	1	
PO5	CO5	14	15.5%	1	
PO6					
PO7					

COs-POs mapping strength (as per given table)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-
CO2	3	1	-	-	-	-	-	-	-	-
CO3	3	1	-	-	-	-	-	-	-	-
CO4	-	-	1	1	-	-	1	-	-	-
CO5	-	-	-	-	1	-	-	1	-	-
Average	3	1	1	1	1		1	1	1	-

3=strongly mapped 2= moderately mapped 1= slightly mapped

Note: The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

i) Seminars ii) Tutorials iii) Guest Lectures iv) Assignments v) Quiz competitions vi) Industrial visit vii) Tech Fest viii) Mini project ix) Group discussions x) Virtual classes xi) Library visit for e-books

LEARNING OUTCOMES

1.0 Atomic structure

1.1 Explain the charge, mass of fundamental particles of an atom (electron, proton and neutron) and the concept of atomic number and mass number.
1.2 State the Postulates of Bohr's atomic theory and its limitations.
1.3 Explain the significance of four Quantum numbers and draw the atomic structures of Silicon and Germanium.
1.4 Define Orbital of an atom and draw the shapes of s,p and d-orbitals.
1.5 Explain 1. Aufbau principle, 2. Pauli's exclusionprinciple3. Hund's principle.
1.6 Write the electronic configuration of elements up to atomic number 30.
1.7 Explain the significance of chemical bonding.
1.8 Explain the Postulates of Electronic theory of valency.
1.9 Define and explain Ionic and Covalent bonds with examples of NaCl , $*H_2$,$*O_2$ and $*N_2$.(* Lewis dot method).
1.10 List out the Properties of Ionic compounds and covalent compounds and distinguish between their properties.

2.0 Solutions, Acids and Bases

2.1 Define the terms 1. Solution, 2. Solute and 3. Solvent.
2.2 Classify solutions based on solubility.
2.3 Define the terms 1. Atomic weight, 2. Molecular weight and 3. Equivalent weight. Calculate Molecular weight and Equivalent weight of the given acids (HCl, H_2SO_4, H_3PO_4) Bases (NaOH, $Ca(OH)_2$, $Al(OH)_3$ and Salts (NaCl, Na_2CO_3, $CaCO_3$).
2.4 Define mole and solve numerical problems on mole concept.
2.5 Define molarity, normality and solve numerical problems on molarity and normality.
a) Calculate the Molarity or Normality, if weight of solute and volume of solution are given.
b) Calculate the weight of solute, if Molarity or Normality with volume of solution are given.
c) Problems on dilution to convert high concentrated solutions to low concentrated solutions.
2.6 Explain Arrhenius theory f Acids and Bases and give its limitations.
2.7 Define ionic product of water, pH and solve numerical problemson pH (Strong Acids and Bases).
2.8 Define buffer solution and classify buffer solutions with examples. Give its applications.

3.0 Electrochemistry

3.1 Define the terms1. Conductor 2. Semiconductor 3. Insulator, 4. Electrolyte5. Non–electrolyte.Give two examples each.
3.2 Distinguish between Metallic conduction and Electrolytic conduction.
3.3 Explain electrolysis by taking an example of used NaCl and list out the applications of electrolysis.
3.4 Define Galvanic cell. Explain the construction and working of Galvanic cell.
3.5 Distinguish between electrolytic cell and galvanic cell.
3.6 Define battery and list the types of batteries with examples.
3.7 Explain the construction, working and applications of i) Dry cell (Leclanche cell), ii)

Lead storage battery, iii) Lithium-Ion battery and iv) Hydrogen-Oxygen fuel cell.

4.0 Corrosion

4.1 Define the term corrosion.

4.2 state the Factors influencing the rate of corrosion.

4.3 Describe the formation of (a)composition cell (b) stress cell (c)concentration cell during corrosion.

4.4 Define rusting of iron and explain the mechanism of rusting of iron.

4.5 Explain the methods of prevention of corrosion by
(a)Protective coatings (anodic and cathodic coatings).
(b) Cathodic protection (Sacrificial anode process and Impressed–voltage process).

5. 0 Water Treatment

5.1 Define soft water and hard water with respect to soap action.

5.2 Define and classify the hardness of water.

5.3 List out the salts that causing hardness of water (with Formulae).

5.4 State the disadvantages of using hard water in industries.

5.5 Define Degree of hardness and units of hardness (mg/L and ppm).

5.6 Solve numerical problems on hardness.

5.7 Explain the methods of softening of hard water by (i) Ion-exchange process and (ii) Reverse Osmosis process.

6.0 Polymers& Engineering materials.

A) Polymers

6.1 Explain the concept of polymerization.

6.2 Describe the methods of polymerization(a)addition polymerization of ethylene (b)condensation polymerization of Bakelite (Only flowchart).

6.3 Define plastic. Explain a method of preparation and uses of the following plastics:
1. PVC 2. Teflon3. Polystyrene 4. Nylon 6,6.

6.4 Define elastomers. Explain a method of preparation and applications of the following:
1. Buna- S 2. Neoprene.

B) Engineering Materials

6.5 Define an alloy. Write the composition and applications of the following:
1.Nichrome2. Duralumin 3. Stainless Steel.

6.6 Define Composite Materials and give any two examples. Statetheir Properties and applications.

6.7 Define Liquid Crystals and give any two examples. State their Properties and applications.

6.8 Define Nano Materials and give any two examples. State their Properties and applications.

7.0 Fuels

7.1 Define the term fuel.

7.2 Classify the fuels based on occurrence.

7.3 Write the composition and uses of the following:
1. LPG 2. CNG 3. Biogas 4.Power alcohol

7.4 Write the commercial production of Hydrogen as future fuel. Give its advantages and disadvantages.

8.0 ENVIRONMENTAL STUDIES

8.1 Explain the scope and importance of environmental studies.

8.2 Define environment. Explain the different segments of environment.
1.Lithosphere2. Hydrosphere3. Atmosphere4. Biosphere

8.3 Define the following terms:

1. Pollutant 2. Pollution 3. Contaminant 4. Receptor 5. Sink 6. Particulates 7. Dissolved oxygen (DO)8. Threshold Limit Value (TLV) 9. BOD 10.COD 11. Eco system12 . Producers13. Consumers14. Decomposers with examples.

8.4 State the renewable and non- renewable energy sources with examples.

8.5 State the uses of forest resources.

8.6 Explain the causes and effects of deforestation.

8.7 Define air pollution and explain its Global impacts 1. Greenhouseeffect, 2. Ozone layer depletion and 3. Acidrain.

8.8 Define Water pollution. Explain the causes, effects and controlling methods of Water pollution.

8.9 Define e-Pollution, State the sources of e-waste. Explain its health effects and control methods.

8.10 Define Green Chemistry. Write the Principles and benefits of Green Chemistry.

COURSE CONTENT

ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES

1. **Fundamentalsof Chemistry**

   Atomic Structure: Introduction - Fundamental particles – Bohr's theory – Quantum numbers – Atomic structure of Silicon and Germanium - Orbitals, shapes of s, p and d orbitals -Aufbau's principle - Hund's rule - Pauli's exclusion Principle -Electronic configuration of elements.

   Chemical Bonding: significance–Electronic theory of valency- Types of chemical bonds – Ionic and covalent bond with examples–Properties of Ionic and Covalent compounds.

2. **Solutions, Acids and Bases**

   Solutions: Types of solutions - Mole concept – Numerical problems on mole concept - Methods of expressing concentration of a solution – Molarity and Normality – Numerical problems on molarity and normality.

   Acids and Bases: Arrhenius theory of acids and bases – Ionic product of water- pH– Numerical problems on pH–Buffer solutions – Classification- applications.

3. **Electrochemistry**

   Conductors, semiconductors, insulators, electrolytes and non-electrolytes – Electrolysis of fused NaCl–Applications of electrolysis - Galvanic cell – Battery-Types- Dry Cell (Leclanche Cell),Lead- Storage battery- Lithium-Ion battery -Hydrogen- Oxygen Fuel cell.

4. **Corrosion**

   Introduction - Factors influencing corrosion - Composition, Stress and Concentration Cells– Rusting of iron and its mechanism – Prevention of corrosion by Protective Coating methods, Cathodic Protection methods.

5. **Water treatment**

   Introduction– Soft and Hard water– Causes of hardness– Types of hardness– Disadvantages of hard water – Degree of hardness (ppm and mg/lit) – Numerical problems on hardness - Softening methods – Ion-Exchange process– Reverse Osmosis process.

6. **Polymers & Engineering materials**

   Polymers:

   Concept of polymerization – Types of polymerization – Addition, condensation with examples – Plastics - Preparation and uses of i).PVC ii) Teflon iii) Polystyrene and iv)

Nylon 6,6.
Elastomers: Preparation and application of i)Buna-s and ii) Neoprene.
Engineering Materials:
Alloys- Composition and applications of i) Nichrome, ii)Duralumin and iii) Stainless Steel.
Composite Materials- Properties and applications.
Liquid Crystals- Properties and applications.
Nano Materials- Properties and applications.

7. **Fuels**
Definition and classification of fuels – Composition and uses of i) LPG ii) CNG iii) Biogas
and iv) Power alcohol – Hydrogen as a future fuel-production- advantages and disadvantages.

8. **ENVIRONMENTALSTUDIES**
Scope and importance of environmental studies – Environment - Important terms related to environment–Renewable and non-renewable energy sources–Forest resources – Deforestation –Air pollution–Global impacts on environment –Water pollution – causes – effects – control measures- e-Pollution –Sources of e-waste - Health effects - Control methods - Green Chemistry- Principles -Benefits.

REFERENCEBOOKS

1. Telugu Academy — Intermediate chemistry Vol. 1&2
2. Jain & Jain — Engineering Chemistry
3. O.P. Agarwal, Hi-Tech. — Engineering Chemistry
4. D.K.Sharma — Engineering Chemistry
5. A.K. De — Engineering Chemistry

Syllabus for Unit tests

Unit Test	Learning outcomes to be covered
Unit Test – 1	**From 1.1 to 2.8**
Unit Test – 2	**From 3.1 to 5.7**
Unit Test – 3	**From 6.1 to 8.10**

ELECTRICAL ENGINEERING MATERIAL SCIENCE

Course code	Course title	No. of periods/week	Total no. of periods	Marks for FA	Marks for SA
EE-105	ELECTRICAL ENGINEERING MATERIAL SCIENCE	04	120	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	Conducting Materials and Semiconducting Materials	25	26	2	2	CO1
2	Insulating Materials and Di- electric Materials	30	26	2	2	CO2
3	Magnetic Materials	15	13	1	1	CO3
4	Magnetic effects of Electric Current and Electromagnetic Induction	30	29	3	2	CO4
5	Electrostatics and Capacitance	20	16	2	1	CO5
TOTAL		**120**	**110**	**10**	**8**	

COURSEOBJECTIVES	1) To familiarise with the knowledge of different electrical engineering materials. 2) To comprehend the magnetic effects of electric current. 3) To know the concept of electro-magnetic induction and electrostatic field.

COURSE OUTCOMES	CO1	EE-105.1	Explain the properties of different conducting and semi-conducting materials and their applications
	CO2	EE-105.2	Analyze Insulating materials and dielectric materials
	CO3	EE-105.3	Describe Magnetic materials and their properties
	CO4	EE-105.4	Comprehend the principles of Magnetic effects of Electric Current and Electromagnetic Induction
	CO5	EE-105.5	Understand the concepts of Electrostatics and Capacitance

LEARNING OUTCOMES

1. Conducting Materials and Semiconducting Materials

1.1 Define Conducting Materials
1.2 State the properties of conducting materials
1.3 Define the terms (i) Hardening (ii)Annealing
1.4 State the main requirements of (i) Low Resistivity Materials (ii) High resistivity materials
1.5 List some examples of i)Low Resistivity Materials ii)High Resistivity materials
1.6 Mention the Properties & Applications of Copper and Aluminium
1.7 Distinguish between Copper and Aluminium
1.8 Mention the properties & applications of ACSR Conductors and AAAC.
1.9 List the properties & Applications of High Resistive Materials of (i) Nichrome (ii) Tungsten
(iii) Carbon
1.10 Define Semiconducting materials
1.11 Classify Semiconducting materials
1.12 Define (i)IntrinsicSemiconductors and(ii)ExtrinsicSemiconductors
1.13 Distinguish between Intrinsic and Extrinsic semiconductors.
1.14 Explain the formation of (i) P – type semiconductor and (ii) N – type semiconductor
1.15 Distinguish between P and N typeSemiconductors

2. Insulating Materials and Di-electricmaterials

2.1 Define Insulating Materials
2.2 Draw energy level diagrams of conductors, insulators and semi-Conductors
2.3 Distinguish between Conductors, Insulators and Semiconductors
2.4 Define Insulation resistance and explain factors affecting insulationresistance
2.5 Classify insulatingmaterials

2.6 State the properties and applications of (i) Impregnated paper(ii) Wood (iii)Asbestos(iv)Mica (v)Ceramics (vi) Glass

2.7 Explain the properties and applications of PVC

2.8 State the effects of the following on P.V.C. (i)Filler (ii)Stabilizer(iii)Plasticizer (iv)Additives.

2.9 Know the Permittivity of commonly used di – electric materials (i) Air (ii)Bakelite (iii)Glass (iv)Mica (v)Paper (vi) Porcelain (vii) Transformer oil

2.10 Explain Polarization

2.11 Explain Di-electric Loss

2.12 List any four applications ofDi-electrics

3. MagneticMaterials

3.1 Classify the Magnetic Materials (i)Ferro (ii) Para (iii) Dia-Magnetic materials withexamples

3.2 Explain (i) Soft Magnetic materials (ii) Hard Magnetic materials

3.3 Draw (i) B-H Curve (ii) Hysteresis loop

3.4 Explain Hysteresis loop

3.5 Explain Hysteresis loss and State Steinmetz equation(No-Problems)

3.6 Explain Eddy CurrentLosses

3.7 State Curie point

3.8 DefineMagnetostriction

4. Magnetic effects of ElectricCurrent and Electromagnetic Induction

4.1 State Coulombs laws ofMagnetism

4.2 Define the terms Absolute and Relative Permeability ofmedium and give relation between them

4.3 Explain the concept of lines of force & magneticfield

4.4 State Right hand Thumbrule

4.5 Draw the field patterns dueto (i) Straight currentcarryingconductor (ii) Solenoid

4.6 State and list the applications of (i) Work law (ii) Biot-Savart'sLaw(Laplacelaw)

4.7 Explain the Mechanical force on a current carrying Conductor placed inside a Magneticfield.

4.8 Derive an expression for the magnitude of the force on a current carrying conductor inside a magneticfield.

4.9 StateFleming'sLeftHandrule

4.10 Understand the concept of the Magneticcircuit and Define the terms MMF, Flux and Reluctance

4.11 Compare Magnetic circuit with Electric circuit in differentaspects

4.12 Explain the effect of air gap in a magneticcircuit

4.13 Explain the terms leakage flux and leakage co-efficient

4.14 State Faraday's laws of Electro-Magnetic Induction
4.15 Explain Dynamically and Statically induced E.M.Fs
4.16 State Lenz's law
4.17 Explain Fleming's Right Hand rule
4.18 State the concept of Self and Mutual inductance and write their expressions
4.19 State Co-efficient of coupling
4.20 Develop an expression for the energy stored in a magnetic field

5. Electrostatics andCapacitance

5.1 StateCoulomb'slawsofElectrostaticsandsolve the problems
5.2 Define the following terms
(i) Unit Charge (ii) Absolute permittivity (iii) Relativepermittivity(iv) Electric Flux
(v) Flux Density (vi) Field intensity
5.3 Draw the field patterns dueto
i) Isolated positivecharge
ii) Isolated negativecharge
iii) Unlike charges placed side byside
iv) Like charges placed side byside
5.4 Compare Electrostatic and Magnetic lines of force in differentaspects.
5.5 Define the concept of electric potential and potentialdifference
5.6 Define Di-electric strength and Di-electricconstant
5.7 Give the permittivity of commonly used Di-electricmaterials
5.8 Define Capacitance and state factors affecting the capacitance of a capacitor
5.9 Derive the formula for capacitance of a parallel plate capacitor
5.10 State different types ofcapacitors with its uses
5.11 Derive an expression for equivalent capacitance
i) When two Capacitors are connected inseries
ii) When two Capacitors are connected inparallel
5.12 Derive an expression for the Energy stored in acapacitor

HYPONATED COURSE CONTENTS

1. Conducting Materials and Semiconducting materials:

Conducting Materials – Properties -Hardening, Annealing - Low Resistivity Materials – Requirements – Properties and applications of Copper and Aluminium - Comparison between Copper and Aluminium - ACSR Conductors, AAAC - High Resistive Materials – Requirements- Properties and applications of Nichrome, Tungsten and Carbon- Semiconducting materials-classification-comparison between intrinsic and extrinsic semiconductors –Formation of P-type and N-type semiconductors-comparison of P-type and N-type semiconductors.

2. Insulating Materials and Di-electric materials

Insulating materials – Energy level diagrams of Conductors, Insulators and Semiconductors - Distinguish between Conductors, Insulators and Semiconductors- Factors effecting Insulation resistance - Classification of Insulating materials - Properties & Applications of Impregnated Paper, Wood, Asbestos, Mica, Ceramics, Glass -

properties and applications of PVC- effects of the (i)Filler (ii) Stabilizer (iii) Plasticizer (iv) Additives on P.V.C. - Permittivity of differentDi - electric materials- Polarization - Dielectric Loss – Applications of Dielectrics.

3. **Magnetic Materials**

Classification of magnetic materials - Soft & Hard magnetic materials- B-H Curves - Hysteresis loop - Hysteresis loss - Steinmetz equation - Eddy Current Loss -- Curie Point – Magnetostriction.

4. **Magnetic effects of Electric Current and Electromagnetic Induction**

Coulombs laws- Permeability - Lines of force – Right Hand Thumb rule - Field pattern due to (i) long straight current carrying conductor (ii) solenoid -Work Law and its applications – Biot Savart's Law (Laplace Law)- Mechanical force on a current carrying conductor placed inside a magnetic field - Direction of force - Fleming's Left Hand rule- Magnetic circuit- mmf- Flux - Reluctance - Comparison of Magnetic circuit With Electric circuit - Magnetic leakage flux and leakage Co-efficient.Faraday'slaws – DynamicallyandStaticallyinducedE.M.F-Lenz'sLaw&Fleming'sRight Hand rule -Self and Mutual inductance - Co-efficient of coupling - Energy stored in a magnetic field

5. **Electrostatics andCapacitance**

Coulomb's Laws of Electrostatics–Permittivity, Electric flux, Flux density, Field intensity - Electrostatic field patterns due to (i) Isolated positive charge (ii) Isolated negative charge(iii)Unlike charges placed side byside (iv) Like charges placed side byside - Comparison of Electrostatic and Magnetic lines of force - Concept of Electric potentialand Potential difference –Di-electric strength – Di-electric constant - Capacitance – Factors affecting the Capacitance of Capacitor– capacitance of a parallel plate capacitor - Types of Capacitors- Equivalent capacitance when connected in series and parallel - Uses- Energy stored in a Capacitor.

REFERENCE BOOKS

1 Dr.K.Padmanabham - Electronic Components – Laxmi publications (P) Ltd.
2 Electrical Engineering Materials – N.I T.T.T.RPublications
3 B.K.Agarwal - Introduction to Engineering materials – Tata McGraw Hill Publishers
4 Ian P.Jones- Material science for Electrical and Electronic Engineers – Oxford Publications
5 B.L.Theraja – Electrical Technology, Vol.-1 – S.Chand& Co. Publications

Syllabus to be Covered for Unit Tests

Unit Test	Learning Outcomes to be Covered
Unit Test – I	From 1.1 to 2.6
Unit Test – II	From 2.7 to 4.6
Unit Test – III	From 4.7 to 5.12

BASIC ELECTRICAL TECHNOLOGY

Coursecode	Course title	No. of periods/week	Total no. of Periods	Marks for FA	Marks for SA
EE-106	BASIC ELECTRICAL TECHNOLOGY	06	180	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	Basic Principles of Electricity	35	19	3	1	CO1
2	Resistive Circuits	40	23	1	2	CO2
3	Work, Power, Energy and Heating effects of Electric Current	40	29	3	2	CO3
4	Conversion Techniques	25	13	1	1	CO4
5	Network Theorems	40	26	2	2	CO5
TOTAL		**180**	**110**	**10**	**8**	

COURSE OBJECTIVES	i. To understand the basic principles of Electricity and analysing resistive circuits. ii. To comprehend the heating effects of electriccurrent iii. To analyse various DC network theorems.

COURSE OUTCOMES	**CO1**	EE-106.1	Understand basic principles of electricity
	CO2	EE-106.2	Familiarise with various laws and analysis of resistive circuits
	CO3	EE-106.3	Understand work, power, energy concepts and heating effects of Electric current
	CO4	EE-106.4	Analyse various electric circuit source conversion techniques
	CO5	EE-106.5	Analyse various DC network theorems

LEARNING OUTCOMES

1. **Basic Principles of Electricity**
   - 1.1 Define Electric Current, Potential difference, Voltage and EMF
   - 1.2 State Ohm's Law and solve problems
   - 1.3 List the limitations of Ohm's Law
   - 1.4 Define the terms
     i) Specific resistance ii)Conductanceiii)Conductivity
   - 1.5 Derive the relation $R = \rho l/a$ and solve the problems
   - 1.6 Explain the effects of temperature on resistance
   - 1.7 Develop the expression for resistance at any temperature as $R_t = R_o (1+\alpha_o t)$
   - 1.8 Define temperature Co-efficient of resistance and give its unit
   - 1.9 Write the formula for Co-efficient of resistance at any temperatures $\boldsymbol{\alpha_t = \frac{\alpha_0}{1+\alpha_0 t}}$

2. **Resistive Circuits**
   - 1.1 Develop the expressions for equivalent Resistance with simple SERIES and PARALLEL
     connections
   - 1.2 Solve problems on equivalent resistance in case of Series- Parallel networks
   - 1.3 State the concept of division of current when two Resistors are connected in parallel and
     solve the problems
   - 1.4 Differentiate between active and passive circuits.
   - 1.5 Define junction, branch and loop in circuits
   - 1.6 State (i) Kirchhoff's current law (KCL) (ii) Kirchhoff's voltage law (KVL)
   - 1.7 Solve problems by applying branch current method only

3. **Work, Power, Energy and Heating effects of Electric Current**
   - 3.1 State and explain electric Work, Power and Energy
   - 3.2 Solve problems on Work, Power and Energy
   - 3.3 Mention the typical power ratings of home appliances like Electric lamps(Incandescent,
     fluorescent, CFL & LED), Water heater, Electric Iron, Fans, Refrigerators, Air and Water
     coolers, Television sets, Air Conditioners, Water Pumps, Computers, Printers etc.
   - 3.4 Calculate Electricity bill of domestic consumers as per the Electricity Tariff
   - 3.5 Define Joule's law and state its expression.
   - 3.6 Define Thermal efficiency
   - 3.7 Solve problems on Electric heating
   - 3.8 Explain the applications of heat produced due to Electric current in
     (i) Metal Filament lamp (ii) Electric kettle (iii) Electric Cooker (iv) Geyser

4. **Conversion Techniques**
   - 4.1 Explain star and delta circuits
   - 4.2 Explain the concept of circuit transformation and equivalent circuits
   - 4.3 Develop transformation formulae for star- delta transformations and vice-versa
   - 4.4 Solve problems on Star Delta Transformation.
   - 4.5 Explain ideal voltage source & ideal current source

4.6 Explain Source transformation technique
4.7 Solve simple problems on Source transformation technique

5. Network Theorems

5.1 State the need for network theorems
5.2 list different types of theorems applied to DC circuits
5.3 State and explain Super position theorem.
5.4 State and explain Thevenin's theorem.
5.5 State and explain Norton's theorem
5.6 State and explain Maximum power transfer theorem.
5.7 Solve problems on the above theorems (All the theorems with reference to D.Conly)

HYPONATED COURSE CONTENTS

1. Basic Principles of Electricity

Electric current – Electric Potential, Potential difference, voltage and EMF - Ohm's law and its limitations –Resistance– Specific Resistance –Conductance- Conductivity – effects of temperature on resistance- Temperature coefficient of Resistance.

2. Resistive Circuits

Resistances in series, parallel and series-parallel combinations -concept of division of current when two Resistors are connected in parallel - active and passive circuits-junction, branch, loop – KCL& KVL.

3. Work, Power &Energy and Magnetic Effects of Electric Current

Units of electric Work, Power and Energy– Ratings of different Domestic Appliances - Calculation of Electricity bill of Domestic Consumer – Mechanical Equivalent of Heat (Joules Law) -Thermal Efficiency - Heat produced due to flow of Current in Metal Filament lamps, Electrical Kettle, Electric Cooker, Geyser

4. Conversion Techniques

Star and delta circuits-ideal voltage source & ideal current source -source transformation- Star-Delta& Delta-Star Transformations.

5. Network Theorems

Need for network theorems-superposition theorem-Thevenin's Theorem- Norton's theorem-Maximum transfer theorem.

REFERENCE BOOKS

1) B.L.Theraja – Electrical Technology, Vol.-1 – S.Chand& Co. Publications
2) V. K. Mehta - Introduction to ElectricalEngg
3) J.B.Gupta – A course in Electrical Technology – KATSON BOOKS
4) G.B.Bharadhwajan& A. SubbaRao - Elements of Electrical Engineering.
5) William H. Hayt – Engineering Circuit Analysis – Tata McGraw - Hill

Syllabus to be Covered for Unit Tests

Unit Test	Learning Outcomes to be Covered
Unit Test – I	From 1.1 to 2.4
Unit Test – II	From 2.5 to 4.2
Unit Test – III	From 4.3 to 5.7

ENGINEERING DRAWING

Course code	Course Title	No. of periods /week	Total No. of periods	Marks for FA	Marks for SA
EE-107	ENGINEERING DRAWING	3	90	40	60

Chapter No.	Title	No.of Periods	Weightage	No. of short question (5 marks)	No. of Essay questions (10 marks)	CO'S Mapped
1	Use of Drawing Instruments, Free Hand Lettering and Dimensioning Practice	10	10	2	0	CO1
2	Principles of Geometric Constructions	15	15	1	1	CO2
3	Projections of points, lines, planes and solids	20	25	1	2	CO3
4	Sectional Views	20	10	0	1	CO4
5	Orthographic projection	25	20	0	2	CO5
TOTAL		**90**	**80**	**4**	**6**	

COURSE OBJECTIVES	Upon completion of the course the student shall be able to understand the basic graphic skills and use them in preparation, reading and interpretation of engineering drawings.

COURSE OUTCOMES	**CO1**	EE-107.1	Practice the use of engineering drawing instruments and Familiarise with the conventions to be followed in engineering drawing as per BIS
	CO2	EE-107.2	Construct the i) basic geometrical constructions ii) engineering curves
	CO3	EE-107.3	Visualise and draw the projections of i) Points ii) Lines iii) Regular Planes iv) Regular Solids
	CO4	EE-107.4	Visualise and draw the sectional views of components

	CO5	EE-107.5	Visualise and draw the orthographic projections of components

LEARNING OUTCOMES

Upon completion of the course the student shall able to

1.0 Use of Drawing Instruments, Free Hand Lettering and Dimensioning Practice

1.1 State the importance of drawing as an engineering communication medium

1.2 Select the correct instruments to draw the different lines / curves.

1.3 Use correct grade of pencil and other instruments to draw different types of lines and for different purposes

1.4 Identify the steps to be taken to keep the drawing clean and tidy.

1.5 Write titles using vertical and slopping (inclined) lettering and numerals of 7mm, 10mm and 14mm height.

1.6 Acquaint with the conventions, notations, rules and methods of dimensioning in engineering drawing as per the B.I.S.

1.7 Dimension a given drawing using standard notations and desired system of dimensioning.

2.0 Principles of Geometric Constructions

2.1 Practice the basic geometric constructions like i) dividing a line into equal parts
i) Exterior and interior tangents to the given two circles
ii) Tangent arcs to two given lines and arcs

2.2 Draw any regular polygon using general method when i) side length is given
i) Inscribing circle radius is given ii) describing circle radius is given

2.3 Draw the engineering curves like i) involute ii) cycloid

3.0 Projections of points, lines, planes and solids (All in first quadrant only)

3.1 Explain the basic principles of the orthographic projections

3.2 Visualise and draw the projection of a point with respect to reference planes (HP&VP)

3.3 Visualise and draw the projections of straight lines with respect to two reference Planes (up to lines parallel to one plane and inclined to other plane)

3.4 Visualise and draw the projections of planes (up to planes perpendicular to one plane and inclined to other plane)

3.5 Visualise and draw the projections of regular solids like Prisms, Pyramids, Cylinder, Cone(up to axis of solids parallel to one plane and inclined to other plane)

4.0 Sectional Views

4.1 Identify the need to draw sectional views.

4.2 Draw sectional views of regular solids by applying the principles of hatching.

5.0 Orthographic projection

5.1 Draw the orthographic views of an object from its pictorial drawing.

5.2 Draw the minimum number of views needed to represent a given object fully.

Competencies and Key competencies to be achieved by the student

S.No	Major topic	Key Competency
1.	Use of Drawing Instruments, Free Hand Lettering and Dimensioning Practice	• Explain the linkages between Engineering drawing and other subjects of study in Diploma course.
		• Select the correct instruments to draw various entities in different orientation
		• Write titles using sloping and vertical lettering and numerals as per B.I.S (Bureau of Indian standards)
		• Dimension a given drawing using standard notations and desired system of dimensioning
2.	Geometrical construction	• Dividing a line into equal parts, tangents to circles, Construct involute, cycloid from the given data.
3.	Projection of points, Lines, Planes & Solids	• Draw the projections of points, straight lines, planes & solids with respect to reference planes (HP& VP)
4.	Sectional Views	• Differentiate between true shape and apparent shape of section • Apply principles of hatching. • Draw simple sections of regular solids
5.	Orthographic Projection	• Draw the minimum number of views needed to represent a given object fully.

COURSE CONTENTS:

NOTES: 1. B.I.S Specification should invariably be followed in all the topics.

2. A-3 Size Drawing Sheets are to be used for all Drawing Practice Exercises.

1.0 Use of Drawing Instruments, Free Hand Lettering and Dimensioning Practice

Explanation of the scope and objectives of the subject of Engineering Drawing. Its importance as a graphic communication -Need for preparing drawing as per standards – SP-46 –1988 – Mention B.I.S - Role of drawing in -engineering education - Basic Tools, tools for drawing– Mentioning of names under each classification and their brief description -Scales: Recommended scales reduced & enlarged -Lines: Types of lines, selection of line thickness - Selection of Pencils -Sheet Sizes: A0, A1, A2, A3, A4, A5, Layout of drawing sheets in respect of A0, A1, A3 sizes, Sizes of the Title block and its contents - Care and maintenance of Drawing Sheet,

Importance of lettering – Types of lettering -Guide Lines for Lettering Practicing of letters & numbers of given sizes (7mm, 10mm and 14mm)-Advantages of single stroke

or simple style of lettering - Use of lettering stencils- Purpose of engineering Drawing, Need of B.I.S code in dimensioning -Shape description of an Engineering object -Definition of Dimensioning size description -Location of features, surface finish, fully dimensioned Drawing -Notations or tools of dimensioning, dimension line extension line, leader line, arrows, symbols, number and notes, rules to be observed in the use of above tools -Placing dimensions: Aligned system and unidirectional system (SP-46-1988)-Arrangement of dimensions Chain, parallel, combined progressive, and dimensioning by co-ordinate methods-The rules for dimensioning standard, features "Circles (holes) arcs, angles, tapers, chamfers, and dimension of narrow spaces.

2.0 Geometric Constructions

Division of a straight line into given number of equal parts –Drawing interior and exterior tangents to two circles of given radii and centre distance-Drawing tangent arc of given radius to touch two lines inclined at given angle (acute, right and obtuse angles), Tangent arc of given radius touching a circle or an arc and a given line, Tangent arcs of radius R, touching two given circles internally and externally- Construction of any regular polygon by general method for given side length, inscribing circle radius and describing/superscripting circle radius - Involute, Cycloid, explanations as locus of a moving point, their engineering application, viz., Gear tooth profile, screw threads, springs etc. – their construction

3.0 Projection of points, lines and planes and Solids (All in first quadrant only)

Classification of projections, Observer, Object, Projectors, Projection, Reference Planes, Reference Line, Various angles of projections –Differences between first angle and third angle projections

Projections of points -Projections of straight line –(a) Parallel to both the planes, (b)Perpendicular to one of the planes and (c) Inclined to one plane and parallel to other planes-Projections of regular planes-(a) Plane parallel to one of the reference planes, (b) Plane perpendicular to HP and inclined to VP and vice versa- Projections of regular solids-(a) Axis perpendicular to one of the planes, (b) Axis parallel to VP and inclined to HP and vice versa.

4.0 Sectional Views

Need for drawing sectional views – what is a sectional view - Hatching – Section of regular solids inclined to one plane and parallel to other plane.

5.0 Orthographic Projections

Meaning of orthographic projection - Using a viewing box and a model – Number of views obtained on the six faces of the box, - Legible sketches of only 3 views for describing object -Concept of front view, top view, and side view sketching these views for a number of engineering objects - Explanation of first angle projection. – Positioning of three views in First angle projection -Projection of points as a means of locating the corners of the surfaces of an object – Use of meter line in drawing a third view when other two views are given -Method of representing hidden lines -Selection of minimum number of views to describe an object fully.

REFERENCE BOOKS

1 Engineering Graphics by P I Varghese – (McGraw-hill)
2 Engineering Drawing by Basant Agarwal & C.M Agarwal - (McGraw-hill)
3 Engineering Drawing by N.D.Bhatt.
4 T.S.M. & S.S.M on " Technical Drawing" prepared by T.T.T.I., Madras.
5 SP-46-1998 – Bureau of Indian Standards.

Table specifying syllabus to be covered for UNIT TEST I, II and III.

Unit Test	Learning Outcomes to be Covered
Unit Test – I	From 1.1 to 2.3
Unit Test – II	From 3.1 to 3.5
Unit Test – III	From 4.1 to 5.2

ELECTRICAL WIRING LABORATORY

Course code	Course title	No. of periods/ week	Total No. of periods	Marks for FA	Marks for SA
EE-108	ELECTRICAL WIRING LABORATORY	06	180	40	60

S.no	Chapter Title	No. of Periods	CO'S Mapped
1	Wiring tools and Accessories	20	**CO1**
2	Electrical Wiring Joints and Soldering Practice	30	**CO2**
3	Lamp Circuits	50	**CO3**
4	DC and AC circuits	40	**CO4**
5	Test and repair of domestic appliances	40	**CO5**
TOTAL		**180**	

COURSE OBJECTIVES	1) To familiarise with the knowledge of different wiring tools used in electrical wiring 2) To know the etiquette of working in the domestic wiring 3) To identify and rectify the simple faults that can occur in domestic appliances

COURSE OUTCOMES	CO1	EE-108.1	Understanding various tools and know their usage
	CO2	EE-108.2	Perform different joints, soldering practice and execute different wiring circuits
	CO3	EE-108.3	Perform various lamp control methods
	CO4	EE-108.4	Identify the difference between DC and AC
	CO5	EE-108.5	Testing and repairing of domestic applications.

LEARNING OUTCOMES

1. Wiring Tools and Accessories

1.1 Identify the following electrical wiring tools with respect to
i) Size ii) Shape iii) Purposive) Speed v) Use
a) Screw drivers
b) Pliers
c) Drilling machines & Drilling Bits.
d) Raw plug jumper, and poker
e) Voltage/line tester
f) Splicers (insulation remover)
g) Standard Wire gauge

1.2 Identify different types of Electrical Wiring accessories with respect to
i) Size ii) Shape iii) Purpose iv) Use.
a) Switches
b) Ceiling roses
c) Lamp Holders and Adopters
d) Sockets
e) Plug
f) Fuses

1.3 Identify different types of main switches with respect to
i) Rating ii) Purpose iii) Use.
SP, DP mains, TP, ICDP, ICTP, SPDT, DPDT, TPDT, Changeover-Knife type, Rotary, Micro, Modular switches, 2-pole and 3-pole MCBs

1.4 Study different types of wires and cables (1/18,3/20,7/20) with respect to sizes rating, purpose and use etc

2. Electrical Wiring Joints and Soldering Practice

2.1 Prepare Straight joint/ Married joint
2.2 Prepare T joint
2.3 Prepare Western union joint
2.4 Prepare Pigtail joint
2.5 Familiarisation to use soldering tools and components
2.6 Soldering simple electronic circuits on PCB

3. Lamp Circuits

3.1 Make a circuit with One lamp controlled by one switch using PVC surface conduit system
3.2 Make a circuit with Two lamps controlled by two switches using PVC surface conduit system
3.3 Make a circuit with One lamp controlled by one switch and provision of 2/3-pinsocket.
3.4 Make a circuit for Stair-case wiring
3.5 Make a circuit for Go-down wiring
3.6 Control two Lamps by Series - Parallel connection using one 1-way switch & two 2-

way switches with PVC surface conduit system

3.7 Control two sub-circuits through Energy meter, MCB'sandtwo1-wayswitches.

3.8 Prepare switch board with star delta starter, MCB, Pilot lamps for 3 phase motor

3.9 Control and practice the wiring for Fluorescent Lamp

3.10 Connect Computer by main switch board with a miniature circuit breaker.

4. DC and AC circuits

4.1 Demonstrate unidirectional current flow with 12 V battery

4.2 Determine polarity using a Voltmeter/LED

4.3 Demonstrate AC using a Low voltage Transformer

4.4 Practice Series and Parallel connection of Lamps

4.5 Practice Bright and Dim light arrangement

5. Test and repair of the Domestic appliances

5.1 Testing and repair of electric heater

5.2 Testing and repair of iron box

5.3 Testing and repair of electric kettle

5.4 Testing and repair of electric cooker

5.5 Testing and repair of electric geyser

Competencies to be achieved by the Student:

S.No	Competencies	Key Competencies
1	Handle the different wiring tools and accessories a) Select switches, and MCB's b) Identify wires and cables as per the requirements of the load.	• Identify the size and specifications of various tools used for electricalwiring. • Understand the usage of the standard wiregauge. • Identify the type, size and specifications of DP mains,
2.1	To prepare a Straight joint/Married joint using a 7/20 Al. Cable	• Identify the size of thecable • Perform splicing of Insulationproperly. • Perform Straight joint/Marriedjoint
2.2	To prepare a T joint using a 7/20 Al. Cable	• Insert the leads of the wires properly as per the sketches. • Twist the wiresproperly.
2.3	To prepare a Western union joint using a single strand Al. Cable	• Overlap the two wiresproperly • Twist the binding wiresproperly
2.4	To prepare a Pig tail joint using a single strand Copper Cable	• Place the wires inV-shape. • Twist the wires in clock wisedirection.

2.5	To Familiarise various soldering tools and components	• Identifying Soldering gun, flux, lead
2.6	To solder simple electronic circuits on PCB	• Draw the layout of circuit • Carefully Soldering the circuit on PCB.
3.1	To control one lamp by one 1-way switch with PVC surface conduit wiring system	• Draw wiringdiagram • Identify the size of cable, PVC pipe, type of1-way switch and lampholder. • Make Connections as per WiringDiagram
3.2	To control two lamps by two 1-way switches with PVC surface conduit wiring system	• Draw wiringdiagram • Handle the screw driver, electrician Knife, line tester to fix the PVC pipe using saddles and junctionboxes. • Select colour and length of wire for phase and neutral • Switch on the supply after making of the connections • Disconnect the circuit aftertesting.
3.3	To control one lamp and 2/3 pin socket by two1-way switches with PVC surface conduit wiring system	• Connect 2/3 pin socket properly with respect to phase, neutral andearth. • Connect phase wire throughswitches.
3.4	Stair-case wiring	• Select two 2-wayswitches • Connect 2- way switches as per circuitdiagram. • Test with 1-phase, 230V, 50 Hz supply to the circuit connected through ICDPswitch.
3.5	Go-down wiring scheme	• Draw wiringdiagram • Connect the circuit as per thediagram. • Observe sequence of operation ofswitches • Test with 1-phase,230 V,50 Hz supply to the circuit, neutral wire to the bottom point of the 1- way switch and phase to the first point of lamp holder
3.6	Series-Parallel connection	• Select colour and length of wire for phase and neutral. • Make connections as per wiringdiagram. • Draw wire through PVC pipeproperly • Observe glow intensity of lamps for series and parallelconnections

3.7	Control two sub circuits through Energymeter,MCB'sandtwo1-way switches	• Draw wiringdiagram. • Identify the size of cable,1-way switch, PVC pipe, MCB, capacity of Inverter andSocket • Read the specifications of MCB, capacity of Inverter andSocket • Make connections as per wiringdiagram. • Draw wire through PVC pipeproperly. • Connect supply to Inverter through MCBproperly. • Select appropriate socket with switchcontrol. • Make earth wire connections for requiredpoints.
3.8	Prepare switch board with star delta starter, MCB, Pilot lamps for 3 phase motor	• Select the size of cable, PVC pipe, star-delta starter, MCB and lampholder • Make connections as per wiringdiagram. • Draw wire through PVC pipeproperly. • Draw wire of the 3-phase to the motor through star-delta starter. • Test with 3-phase, 415 V, 50 Hz supply to the circuit connected through ICDPswitch. • Test by changing any two phases of inputsupply
3.9	Wiring practice of fluorescent lamp	• Make connections as per wiringdiagram. • Connect top point and bottom point of the choke to tube lightproperly. • Note the importance and working ofstarter.
3.10	Connect computer by main switch board with a miniature circuit breaker.	• Draw wiringdiagram. • Identify the size of cable, 1-way switch, PVC pipe, MCB andSockets • Read the specifications of MCB andSockets • Make connections as per wiringdiagram. • Connect supply to Computer through MCB properly. • Select appropriate sockets with 1-way switch control. • Make earth wire connections for requirepoints.
4.1	Demonstrate difference between DC and AC	• Connect DC source and measure V &I • Connect proper AC source and measure V&I • Makeinferences.

5.1	Testing and repair of domestic appliances	• Inspect the appliancevisually. • Check for anydiscrepancies. • Perform the disassemblingoperation • Test the inner parts for anyfaults • Rectify the faults if any. • Replace the parts ifnecessary. • Perform theassembling. • Test theDomestic appliance for proper functioning.

Note:

1. Every student has to bring insulated tool kit and follow the general safety precautions throughout the labsessions
2. Should not touch the live terminals.

PHYSICS LAB

Course code	Course title	No. of periods/ week	Total no.of periods	Marks for FA	Marks for SA
EE-109	PHYSICS LAB	1.5	45	20	30

S.No	List of experiments	No.of Periods	CO's Mapped
1.	Vernier calipers	03	CO1
2.	Micrometer (Screw gauge)	03	
3.	Verification of Lami's theorem using concurrent forces	03	
4.	Determination of 'g' using simple pendulum	03	CO2
5.	Focal length and focal power of convex lens	03	
6.	Refractive index of solid using travelling microscope	03	
7.	Verification of Boyle's law using Quill tube	03	CO3
8	Determination of pole strength of the bar magnet through magnetic field lines	03	
9	Resonance apparatus – Determination of velocity of sound in air	03	
	Experiments for demonstration		
10	Meter bridge – Determination of resistance and specific resistance of a wire	03	CO4
11	Verification of Newton's law of cooling	03	
12	Photo electric cell – Study of its characteristics	03	
	Revision	06	
	Test	03	
	Total:	**45**	

COURSE OBJECTIVES	(1) To provide strong practical knowledge of Physics to serve as a tool for various device applications in Engineering. (2) To enhance scientific skills of the students by incorporating new experiments so as to enrich the technical expertise of the students as required for industries.

COURSE OUTCOMES	CO1	Improving accuracy in various measurements; understanding the nature of the forces keeping the body in equilibrium.
	CO2	Estimating the acceleration caused by the gravity of earth; Practical study of the concepts of refraction of light at curved/plane surface.
	CO3	Understanding the pressure of the gas as function of its volume; study of the combined magnetic field of the earth and an artificial magnet to estimate its pole strength; Estimating the velocity of sound in air through resonance phenomenon.
	CO4	Applying Kirchoff's laws to evaluate the specific resistance of a wire; Study of exchange of heat from system to surrounding by graphical analysis, Conversion of light energy to micro currents as potential engineering application.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	2	2	1	2
CO2	3		1	1	1	1	1
CO3	3	2			1		
CO4	3	2	2			1	2

CO-PO Mapping Strength

EE-109	PHYSICS LAB **No of Course Objectives : 4**			**No of periods 45**
POs	Mapped with CO No	riods addressing PO in Col 1 NO %	1,2,3	remarks
PO1	CO1,CO2,CO3,CO4	15 33.3 %	2	>40% level 3 (highly addressed) 25% to 40% level 2 (moderately addressed) 5% to 25% level 1 (Low addressed) < 5% (not addressed)
PO2	CO1,CO3, CO4	8 17.8%	1	
PO3	CO1, CO2, CO4	6 13.3%	1	
PO4	CO1, CO2	3 6.7%	1	
PO5	CO1,CO2, CO3	5 11.1%	1	
PO6	CO1, CO2, CO4	3 6.7%	1	
PO7	CO1, CO2, CO4	5 11.1%	1	

3 = strongly mapped, 2 = moderately mapped, 1 = slightly mapped

Note: The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following.

(i) Seminars (ii) Viva-voce (iii) Assignments
(iv) Quiz competitions (v) Industrial visits (vi) Tech fest
(vii) Mini project
(viii) Group discussions (ix) Virtual labs (x) Library visit for e-books

LEARNING OUTCOMES

Upon completion of the course the student shall be able to

1.0 Practice with Vernier calipers to determine the volumes of cylinder and sphere.
2.0 Practice with Screw gauge to determine thickness of a glass plate and cross sectional area of a wire.
3.0 Verify the Lami's theorem using concurrent forces.
4.0 Determine the value of acceleration due to gravity (g) using Simple Pendulum. To verify the result from $l\text{-}T^2$ graph.
5.0 Calculate the Focal length and focal power of convex lens using distant object method

and U-V method. To verify the result from U-V graph and 1 / U – 1 / V graph methods.

6.0 Determine the refractive index of a solid using travelling microscope

7.0 Verify the Boyle's law using Quill tube. To draw a graph between P and 1/l.

8.0 Determination of magnetic pole strength of a bar magnet by drawing magnetic lines of force and locating null points (either N - N or N - S method)

9.0 Determine the velocity of sound in air at room temperature and its value at zero degree Centigrade using resonance apparatus.

10.0 Determine the resistance and specific resistance of material of a wire using Meter Bridge

11.0 To verify the Newton's law of cooling.

12. .0 To study the characteristics of photo electric cell.

Competencies and Key competencies to be achieved by the student

Name of the Experiment (Nu	**Competencies**	**Key competencies**
1 . Practice on Vernier Calipers (03)	• Find the Least count • Fix the specimen in position • Read the scales • Calculate the physical quantities of given object	• Read the scales • Calculate the requisite physical quantities of given objects • Calculating volumes of the cylinder and sphere
2. Practice on Screw gauge(03)	• Find the Least count • Fix the specimen in position • Read the scales • Calculate thickness of glass plate and cross section of wire from radius	• Read the scales • Noting zero error • Calculate thickness of given glass plate • Calculate cross section of wire from radius
3. Verification of Lami's theorem forces(03)	• Making experimental set up • Fix suitable weights • Note the positions of threads on drawing sheet • Find the angles between the concurrent forces • Changing weights appropriately • Verify Lami's theorem	• Measuring angles between the forces • Marking the directions forces on a paper • Verifying Lami's theorem from the weights and measured angles between the forces.

4. Simple pendulum(03)	• Fix the simple pendulum to the stand • Adjust the length of pendulum • Find the time for number of oscillations (say 20) • Find the time period • Calculate the acceleration due to gravity • Draw l-T^2 graph	• Find the time for number of oscillations • Find the time period • Calculate the acceleration due to gravity • Verify form l-T^2 graph
5. Focal length and Focal power of convex lens (03)	• Fix the object distance • Find the Image distance • Calculate the focal length and power of convex lens • Draw u-v and 1/u – 1/v graphs	• Find focal length from distant object method. • Calculate the focal length and power of convex lens • Verify result from u-v and 1/u – 1/v graphs
6 Refractive index of solid using traveling microscope(03)	• Find the least count of Vernier on microscope • Place the graph paper below microscope • Read the scales	• Reading the scales on Microscope. • Fiding real and apparent thickness of the slab • Calculate the refractive
7 . Boyle's law verification (03)	• Note the atmospheric pressure • Fix the Quill tube to retort stand • Find the length of air column • Find the pressure of enclosed air • Find and compare the calculated values of P x l	• Fixing Quill tube in various positions on retort stand. • Find the length of air column • Find the pressure of enclosed air • Find the values of Px l • Verify Boyle's law.
8. Mapping of magnet lines of force (03)	• Draw magnetic meridian • Place the bar magnet in N-N or N-S directions • Draw magnetic lines of force • Locate the neutral points	• Draw the pattern of magnetic lines of force • Locate the neutral points • Calculating pole strength of the bar magnet

9. Velocity of sound in air – Resonance method (03)	• Arrange the resonance apparatus • Adjust the reservoir level for booming sound • Find the first and second resonanting lengths • Calculate velocity of sound .	• Adjust the reservoir level • Find the first and second resonanting lengths • Calculate velocity of sound at room temperature and at 0^0 C
10. Meter bridge(03)	• Make the circuit connections • Find the balancing length • Calculate unknown resistance • Find the radius of wire • Calculate the specific resistance	• Making connections as per circuit diagram. • Find the balancing length • Calculate unknown resistance • Calculate the specific resistance of the given wire
11. Verification of Newton's law of Cooling (03)	• Heating liquid in a beaker using a heating element • Inserting thermometer in liquid in calorimeter • Stirring liquid • Measuring temperatures as a function of time using thermometer • Plotting a cooling curve	• Measuring temperature of a liquid as function of time. • Plotting a cooling curve. • Verifying Newton's law of cooling.
12. Photo electric cell – Study of its Characteristics (03)	• Experimental set up and making connections • Veryfying intensity of light by varying distances between light source and photocell. • Measuring Voltage and current values.	• Making connections for experimental set up. • Varying distances appropriately • Measuring Voltage and current values. • Study of V- I Characteristics form graph.

Scheme of Valuation for End Practical Examination :

Activity	Marks
For writing, Apparatus, formulae, least count (if applicable)	5
Procedure & precautions	5
Drawing Tables	3
Readings, calculations, graph (if applicable), reporting the findings	12
Viva-voce	5
Total marks	**30**

CHEMISTRY LAB

Course code	Course title	No. of periods/ week	Total no.of periods	Marks for FA	Marks for SA
EE-110	CHEMISTRY LAB	1.5	45	20	30

S.No	Name of the Experiment	o.ofPeriods	Mapped with COs
1.	a) Recognition of chemical substances and solutions used in the laboratory by senses. b) Familiarization of methods for Volumetricanalysis.	03	CO 1
2.	Preparation of Std.Na_2CO_3solution and making solutions of	03	CO1
3.	EstimationofHClsolutionusingStd.Na_2CO_3solution.	03	CO2
4.	EstimationofNaOHusingStd. HCl solution.	03	CO2
5.	Determinationofacidityofwatersample.	03	CO2
6.	Determinationofalkalinityofwatersample.	03	CO2
7.	EstimationofMohr'sSalt usingStd.$KMnO_4$. Solution.	03	CO3
8.	Estimation of Ferrous ion by using Std. $K_2Cr_2O_7$solution.	03	CO3
9.	Determinationoftotalhardnessofwatersample usingStd.EDTAsolution	03	CO4
10.	EstimationofChloridespresentinwatersample by usingStd. $AgNO_3$ solution.	03	CO4
11.	EstimationofDissolvedOxygen(D.O)inwatersampleby using Std. hypo solution.	03	CO5
12.	Determinationof pH usingpHmeter.	03	CO 5
13.	Determinationofconductivityofwater and adjusting ionic	03	CO 5
14.	Determinationofturbidityofwater.	03	CO
15.	Estimationoftotalsolidspresentinwatersample.	03	CO
	Total:	**45**	

COURSE OUTCOMES	**CO1**	Operate and practice volumetric apparatus and preparation of standard solution.
	CO2	Evaluate and judge the neutralization point in acid base titration.
	CO3	Evaluate the end point of reduction and oxidation reaction.
	CO4	Judge the stable end point of complex formation, stable precipitation.
	CO5	Judge operate and demonstrate and perform precise operations with instrument for investigation of water pollution parameters.

PO- CO mapping

EE-110	Chemistry Lab No. of CO's:5				No. of periods : 45
Pos	Mapped with CO No.	CO periods addressing PO in Col. No. 1	%	Level 1,2,3	Remarks
PO1	CO1,CO2,CO3, CO4,CO5	12	26.66	2	>40% Level 3 (highly addressed) 25% to 40% Level2 (moderately addressed) 5% to 25% Level1 (Low addressed) < 5%(not addressed)
PO2	CO1,CO2,CO3, CO4,CO5	9	20	1	
PO3					
PO4	CO1,CO2,CO3, CO4,CO5	12	26.66	2	
PO5	CO2,CO3, CO4,CO5	12	26.66	2	
PO6	-	-	-	-	
PO7	-	-	-	-	

COs-POs mapping strength (as per given table)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	1	-	2	-	-	-	-	-	-
CO2	2	1	-	2	2	-	-	-	-	-
CO3	2	1	-	2	2	-	-	-	-	-
CO4	2	1	-	2	2	-	-	-	-	-
CO5	2	1	-	2	2	-	-	-	-	-

3=strongly mapped2= moderately mapped1= slightly mapped

Note: The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following: i) Seminars ii) Tutorials iii) Guest Lectures iv) Assignments v) Quiz competitionsvi) Industrial visit vii) Tech Fest viii) Mini project ix) Group discussions x) Virtual classes xi) Library visit for e-books

OBJECTIVES:

Upon completion of the course the student shall be able to

1.0 To identify the chemical compounds and solutions by senses.Practice volumetric measurements (using pipettes, measuring jars, volumetric flask, burettes)and gravimetric measurements (using different types of balances), making dilutions, etc.

2.0 Practice making standard solutions with pre weighed salts and to make solutions of desired dilutions using appropriate techniques.

3.0 Conduct titrations adopting standard procedures and using Std. Na_2CO_3solutionfor estimation of HCl.

4.0 Conduct titrations adopting standard procedures and using Std.HClsolution for estimation of NaOH.

5.0 Conduct titrations adopting standard procedures to determine the acidity of givensamples of water (One ground water and one surface / tap water, and rain water if available).

6.0 Conduct titrations adopting standard procedures to determine the alkalinity of given samples of water (One ground water and one surface / tap water).

7.0 Conduct titrations adopting standard procedures and using Std.$KMnO_4$ solutionfor estimation of Mohr'sSalt.

8.0 Conduct titrations adopting standard procedures and using Std.$K_2Cr_2O_7$ solutionfor estimation of Ferrous ion.

9.0 Conduct titrations adopting standard procedures to determine the total hardness of given samples of water (One ground water and one surface / tap water) using Std. EDTA solution.

10. Conduct titrations adopting standard procedures to determine the chloridespresent in the given samples of water (One ground water and one surface / tap water) using Std. $AgNO_3$ solution.

11. Conduct the test using titrimetric / electrometric method to determine. Dissolved Oxygen (D.O) in the given water samples (One sample from closed containerand one from open container / tap water) by Std. Hypo solution.

12. Conduct the test on given samples of water / solutions (like soft drinks, sewage, etc.) to determine their pH using standard pH meter.

13. Conduct the test on given samples of water / solutions.
    a) to determine conductivity.
    b) to adjust the ionic strength of the sample to the desired value.

14. Conduct the test on given samples of solutions (coloured and non-coloured)to determine their turbidity in NTU.

15. Determine the total solids present in given samples of water(One ground water and one surface / tap water).

Competencies and Key competencies to be achieved by the student

Name of the Experiment (No of Periods)	Competencies	Key competencies
Recognition of chemical substances and solutions. Familiarization of methods for Volumetric analysis.(03)	-	--
Preparation of Std.Na_2CO_3 solution and making solutions of different dilutions. (03)	▪ Weighing the salt to the accuracy of .01 mg. ▪ Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette. ▪ Making appropriate dilutions.	▪ Weighing the salt to the accuracy of 0.01 mg. ▪ Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette. ▪ Making appropriate
Estimation of HCl solution using Std. Na_2CO_3 solution. (03)	▪ Cleaning the glassware and rinsing with appropriate solutions. ▪ Making standard solutions. ▪ Measuring accurately the standard solutions and titrants. ▪ Filling the burette with titrant. ▪ Fixing the burette to the stand. ▪ Effectively Controlling the flow of the titrant. ▪ Identifying the end point. ▪ Making accurate observations. ▪ Calculating the results.	▪ Making standard solutions. ▪ Measuring accurately the standard solutions and titrants. ▪ Effectively Controlling the flow of the titrant. ▪ Identifying the end point. ▪ Making accurate observations.
Estimation of NaOH using Std. HCl solution.		
Determination of acidity of water sample. (03)		
Determination of alkalinity of water sample. (03)		
Estimation of Mohr's Salt usingStd.$KMnO_4$solution. (03)		
Estimation of Ferrous ion by using Std.$K_2Cr_2O_7$solution (03)		
Determination of total hardness of water using Std. EDTA solution. (03)		
Estimation of Chlorides present in water sample using Std. $AgNO_3$ solution (03)		
Estimation of Dissolved Oxygen(D.O) in water sample (By titration method) (03)		
Determination of pH using pH meter. (03)	▪ Familiarize with instrument.	▪ Prepare standard solutions / buffers,

Determination of conductivity of water and adjusting ionic strength to required	▪ Choose appropriate 'Mode' / 'Unit'. ▪ Prepare standard solutions / buffers, etc. ▪ Standardize the instrument with appropriate standard solutions. ▪ Plot the standard curve. ▪ Make measurements	etc. ▪ Standardize the instrument with appropriate standard solutions. ▪ Plot the standard curve. ▪ Make measurements accurately.
Determination of turbidity of water. (03)		
Estimation of total solids present in water sample. (03)	▪ Measuring the accurate volume and weight of sample. ▪ Filtering and air drying without losing any filtrate. ▪ Accurately weighing the filter paper, crucible and	▪ Measuring the accurate volume and weight of sample. ▪ Filtering and air drying without losing any filtrate. ▪ Accurately weighing the filter paper,

SCHEME OF VALUATION

A) Writing Chemicals, apparatus,principle and procedure. 5M

B) Demonstrated competencies. 20M
Making standard solutions.
Measuring accurately the standard solutions and titrants.
Effectively controlling the flow of the titrant.
Identifying the end point.
Making accurate observations.

C) Viva-voce. 5M

Total **30M**

COMPUTER FUNDAMENTALS LABORATORY

Course code	Course Title	No. of Periods/Weeks	Total No. of periods	Marks for FA	Marks for SA
EE-111	COMPUTER FUNDAMENTALS LABORATORY	3	90	40	60

Time schedule:

S.No.	Chapter/Unit Title	No.of sessions each of 3 periods duration	No. of Periods	CO's Mapped
1.	Computer hardware Basics	2	6	CO1
2.	Windows Operating System	2	6	CO1
3.	MS Word	8	24	CO2
4.	MS Excel	7	21	CO3
5.	MS PowerPoint	5	15	CO4
6	Adobe Photoshop	6	18	CO5
	Total periods	**30**	**90**	

COURSE OBJECTIVES	i) To know Hardware Basics ii) To familiarize operating systems iii) To use MS Office effectively to enable to students use these skills in future courses iv) To use Adobe Photoshop in image editing.

	At the end of the course students will be able to		
COURSE OUTCOMES	CO1	CM-111.1	Identify hardware and software components
	CO2	CM-111.2	Prepare documents with given specifications using word processing software
	CO3	CM-111.3	Use Spread sheet software to make calculation and to draw various graphs / charts.
	CO4	CM-111.4	Use Power point software to develop effective presentation for a given theme or topic.
	CO5	CM-111.5	Edit digital or scanned images using Photoshop

LEARNING OUTCOMES:

I. Computer Hardware Basics

1. a) To Familiarize with Computer system and hardware connections
   b) To Start and Shut down Computer correctly
   c) To check the software details of the computer
2. To check the hardware present in your computer

II. Windows's operating system

3. To Explore Windows Desktop
4. Working with Files and Folders
5. Windows Accessories: Calculator – Notepad – WordPad – MS Paint

III. Practice with MS-WORD

6. To familiarize with Ribbon layout of MS Word
   Home – Insert - Page layout – References – Review- View.
7. To practice Word Processing Basics
8. To practice Formatting techniques
9. To insert a table of required number of rows and columns
10. To insert Objects, Clipart and Hyperlinks
11. To use Mail Merge feature of MS Word
12. To use Equations and symbols features

IV. Practice with MS-EXCEL

13. To familiarize with MS-EXCEL layout
14. To access and enter data in the cells
15. To edit a spread sheet- Copy, Cut, Paste, and selecting Cells
16. To use built in functions and Formatting Data
17. To create Excel Functions, Filling Cells
18. To enter a Formula for automatic calculations
19. To sort and filter data in table.
20. To present data using Excel Graphs and Charts.
21. To develop lab reports of respective discipline.
22. To format a Worksheet in Excel, Page Setup and Print

V. Practice with MS-POWERPOINT

23. To familiarize with Ribbon layout features of PowerPoint 2007.
24. To create a simple PowerPoint Presentation
25. To set up a Master Slide in PowerPoint
26. To insert Text and Objects
27. To insert a Flow Charts
28. To insert a Table
29. To insert a Charts/Graphs

30. To insert video and audio
31. To practice Animating text and objects
32. To Review presentation

VI. Practice with Adobe Photoshop

33. To familiarize withstandard toolbox
34. To edit a photograph.
35. To insert Borders around photograph.
36. To change Background of a Photograph.
37. To change colors of Photograph.
38. To prepare a cover page for the book in your subject area.
39. To adjust the brightness and contrast of the picture so that it gives an elegant look.
40. To type a word and apply the shadow emboss effects.

KEY COMPETENCIES:

Expt No	Name of Experiment	Competencies	Key competencies
1 (a).	To familiarize with Computer system and hardware connections	a. Identify the parts of a Computer system: i). CPU ii). Mother Board iii) Monitor iv) CD/DVD Drive v) Power Switch vi) Start Button vii) Reset Button b. Identify and connect various peripherals c. Identify and connect the cables used with computer system d. Identify various ports on CPU and connect Keyboard & Mouse	Connect cables to external hardware and operate the computer
1 (b).	To Start and Shut down Computer correctly	a. Log in using the password b. Start and shut down the computer c. Use Mouse and Key Board	a. Login and logout as per the standard procedure b. Operate mouse &Key Board
1 (c).	To Explore Windows Desktop	a. Familiarize with Start Menu, Taskbar, Icons and Shortcuts b. Access application	a. Access application programs using Start menu b. Use taskbar and

		programs using Start menu, Task manager c. Use Help support	Task manager
2.	To check the software details of the computer	a. Find the details of Operating System being used b. Find the details of Service Pack installed	Access the properties of computer and find the details
3.	To check the hardware present in your computer	a. Find the CPU name and clock speed b. Find the details of RAM and Hard disk present c. Access Device manager using Control Panel and check the status of devices like mouse and key board d. Use My Computer to check the details of Hard drives and partitions e. Use the Taskbar	a. Access device manager and find the details b. Type /Navigate the correct path and Select icon related to the details required
4.	Working with Files and Folders	a. Create folders and organizing files in different folders b. Use copy / paste move commands to organize files and folders	a. Create files and folders Rename, arrange and search for the required folder/file
	Working with Files and Folders Continued....	c. Arrange icons – name wise, size, type, Modified d. Search a file or folder and find its path e. Create shortcut to files and folders (in other folders) on Desktop f. Familiarize with the use of My Documents g. Familiarize with the use of Recycle Bin	b. Restore deleted files from Recycle bin
5.	To use Windows Accessories:	a. Familiarize with the use of Calculator	a. Use windows accessories and

	Calculator – Notepad – WordPad – MS Paint	b. Access Calculator using Run command c. Create Text Files using Notepad and WordPad and observe the difference in file size d. Use MS paint and create .jpeg, .bmp files using MS Paint	select correct text editor based on the situation. b. Use MS paint to create /Edit pictures and save in the required format.
6.	To familiarize with Ribbon layout of MS word. – Home – Insert- page layout- References-Review-View	a. Create/Open a document b. Use Save and Save as features c. Work on two Word documents simultaneously d. Choose correct Paper size and Printing options	a. Create a Document and name appropriately and save b. Set paper size and print options
7.	To practice Word Processing Basics	a. Typing text b. Keyboard usage c. Use mouse (Left click / Right click / Scroll) d. Use Keyboard shortcuts e. Use Find and Replace features in MS- word f. Use Undo and Redo Features g. Use spell check to correct Spellings and Grammar	a. Use key board and mouse to enter/edit text in the document. b. Use shortcuts c. Use spell check/ Grammar features for auto corrections.
8.	To practice Formatting techniques	a. Formatting Text b. Formatting Paragraphs c. Setting Tabs d. Formatting Pages e. The Styles of Word f. Insert bullets and numbers g. Themes and Templates h. Insert page numbers, header and footer	a. Format Text and paragraphs and use various text styles. b. Use bullets and numbers to create lists c. Use Templates /Themes d. Insert page numbers date, headers and footers
9.	To insert a table of required number of rows and columns	a. Edit the table by adding the fields – Deleting rows and columns –inserting sub table –marking borders.	a. Insert table in the word document and edit b. Use sort option for

		Merging and splitting of cells in a Table b. Changing the background colour of the table c. Use table design tools d. Use auto fit – fixed row/ column height/length – Even distribution of rows / columns features e. Convert Text to table and Table to Text f. Use Sort feature of the Table to arrange data in ascending/descending order	arranging data.
10.	To Insert objects, clipart and Hyperlinks	a. Create a 2-page document. &Insert hyperlinks and t Bookmarks. b. Create an organization chart c. Practice examples like preparing an Examination schedule notice with a hyperlink to Exam schedule table.	a. Insert hyperlinks &Bookmarks b. Create organization charts/flow charts
11.	To Use Mail merge feature of MS Word	a. Use mail merge to prepare individually addressed letters b. Use mail merge to print envelopes.	Use Mail merge feature
12.	To use Equations and symbols features.	a. Explore various symbols available in MS Word b. Insert a symbol in the text c. Insert mathematical equations in the document	Enter Mathematical symbols and Equations in the word document
13.	To Practice with MS-EXCEL	a. Open /create an MS Excel spread sheet and familiarize with MS Excel 2007 layout like MS office Button- b. Use Quick Access Toolbar- Title Bar- Ribbon- Worksheets- Formula Bar-	a. Familiarize with excel layout and use b. Use various features available in toolbar

		Status Bar	
14.	To access and Enter data in the cells	a. Move Around a Worksheets-Quick access - Select Cells b. Enter Data-Edit a Cell-Wrap Text-Delete a Cell Entry-Save a File-Close Excel	a. Access and select the required cells by various addressing methods b. Enter data and edit
15.	To edit spread sheet Copy, Cut, Paste, and selecting cells	a. Insert and Delete Columns and Rows-Create Borders-Merge and Center b. Add Background Color-Change the Font, Font Size, and Font Color c. Format text with Bold, Italicize, and Underline-Work with Long Text-Change a Column's Width	Format the excel sheet
16.	To use built in functions and Formatting Data	a. Perform Mathematical Calculations verify - AutoSum b. Perform Automatic Calculations-Align Cell Entries	Use built in functions in Excel
17.	To enter a Formula for automatic calculations	a. Enter formula b. Use Cell References in Formulae c. Use Automatic updating function of Excel Formulae d. Use Mathematical Operators in Formulae e. Use Excel Error Message and Help	Enter formula for automatic calculations
18.	To Create Excel Functions, Filling Cells	a. Use Reference Operators b. Work with sum, Sum if, Count and CountIf Functions c. Fill Cells Automatically	a. Create Excel sheets involving cross references and equations b. Use the advanced functions for conditional calculations
19.	To sort and filter data	a. Sort data in multiple	a. Refine the data in a

	in table	columns b. Sort data in a row c. Sort data using Custom order d. Filter data in work sheet	worksheet and keep it organized b. Narrow a worksheet by selecting specific choice
20.	To Practice Excel Graphs and Charts	a. Produce an Excel Pie Chart b. Produce c. Excel Column Chart	a. Use data in Excel sheet to Create technical charts and graphs Produce Excel Line Graph b. Produce a Pictograph in Excel
21.	To develop lab reports of respective discipline	Create Lab reports using MS Word and Excel	a. Insert Practical subject name in Header and page numbers in Footer
22.	To format a Worksheet in Excel, page setup and print	a. Shade alternate rows of data b. Add currency and percentage symbols c. Change height of a row and width of a column d. Change data alignment e. Insert Headers and Footers f. Set Print Options and Print	a. Format Excel sheet b. Insert headers &footers and print
23.	To familiarize with Ribbon layout &features of PowerPoint 2007.	Use various options in PowerPoint a. Home b. Insert c. Design d. Animation e. Slideshow f. View g. Review	Access required options in the tool bar
24.	To create a simple PowerPoint Presentation	a. Insert a New Slide into PowerPoint b. Change the Title of a PowerPoint Slide c. PowerPoint Bullets d. Add an Image to a PowerPoint Slide e. Add a Textbox to a	a. Create simple PowerPoint presentation with photographs/Clip Art and text boxes b. Use bullets option

		PowerPoint slide	
25.	To Set up a Master Slide in PowerPoint and add notes	a. Create a PowerPoint Design Template b. Modify themes c. Switch between Slide master view and Normal view d. Format a Design Template Master Slide e. Add a Title Slide to a Design Template f. The Slide Show Footer in PowerPoint f. Add Notes to a PowerPoint Presentation	a. Setup Master slide and format b. Add notes
26.	To Insert Text and Objects	a. Insert Text and objects b. Set Indents and line spacing c. Insert pictures/ clipart d. Format pictures e. Insert shapes and word art f. Use 3d features g. Arrange objects	Insert Text and Objects Use 3d features
27.	To insert a Flow Chart / Organizational Charts	a. Create a Flow Chart in PowerPoint b. Group and Ungroup Shapes c. Use smart art	Create organizational charts and flow charts using smart art
28.	To insert a Table	a. PowerPoint Tables b. Format the Table Data c. Change Table Background d. Format Series Legend	Insert tables and format
29.	To insert a Charts/Graphs	a. Create 3D Bar Graphs in PowerPoint b. Work with the PowerPoint Datasheet c. Format a PowerPoint Chart Axis d. Format the Bars of a Chart e. Create PowerPoint Pie Charts f. Use Pie Chart Segments g. Create 2D Bar Charts in PowerPoint	Create charts and Bar graphs, Pie Charts and format.

		h. Format the 2D Chart e. Format a Chart Background	
30.	To Insert audio & video, Hyperlinks in a slide Add narration to the slide	a. Insert sounds in the slide and hide the audio symbol b. Adjust the volume in the settings c. Insert video file in the format supported by PowerPoint in a slide d. Use automatic and on click options e. Add narration to the slide f. Insert Hyperlinks	a. Insert Sounds and Video in appropriate format. b. Add narration to the slide c. Use hyperlinks to switch to different slides and files
31.	To Practice Animation effects	a. Apply transitions to slides b. To explore and practice special animation effects like *Entrance, Emphasis, Motion Paths &Exit*	Add animation effects
32.	Reviewing presentation	a. Checking spelling and grammar b. Previewing presentation c. Set up slide show d. Set up resolution e. Exercise with Rehearse Timings feature in PowerPoint f. Use PowerPoint Pen Tool during slide show g. Saving h. Printing presentation (a) Slides (b) Hand-out	a. Use Spell check and Grammar feature b. Setup slide show c. Add timing to the slides d. Setup automatic slide show
33	To familiarize withstandard toolbox	a. Open Adobe Photoshop b. Use various tools such as i. The Layer Tool ii. The Color& Swatches Tool iii. Custom Fonts & The Text Tool iv. Brush Tool v. The Select Tool vi. The Move Tool vii. The Zoom Tool viii. The Eraser	a photograph and save it in Photoshop

		ix. The Crop Tool x. The Fill Tool	
34	To edit a photograph	a. Use the Crop tool b. Trim edges c. Change the shape and size of a photo d. Remove the part of photograph including graphics and text	e to edit image by using corresponding tools.
35	To insert Borders around photograph	a. Start with a single background layer b. Bring the background forward c. Enlarge the canvas d. Create a border color e. Send the border color to the back f. Experiment with different colors	Able to create a border or frame around an image to add visual interest to a photo
36	To change Background of a Photograph	a. open the foreground and background image b. Use different selection tools to paint over the image c. Copy background image and paste it on the foreground. d. Resize and/or drag the background image to reposition. e. In the Layers panel, drag the background layer below the foreground image layer.	Able to swap background elements using the Select and Mask tool and layers.
37	To change colors of Photograph	a. Change colours using: i) Colour Replacement tool ii) Hue/Saturation adjustment layer tool	Able to control color saturation
38	To prepare a cover page for the book in subject area	a. open a file with height 500 and width 400 for the cover page. b. apply two different colours to work area by dividing it into two parts using Rectangle tool. c. Copy any picture and place	Able to prepare cover page for the book

		it on work area→ resize it using free transform tool. d. Type text and apply color and style e. Apply effects using blended options	
39	To adjust the brightness and contrast of picture to give an elegant look	a. open a file b. Go to image→ adjustments→ Brightness/Contrast. f. adjust the brightness and contrast g. save the image	Able to control brightness/contrast.
40	To type a word and apply the shadow emboss effects	a. open a file b. Select the text tool and type text. c. Select the typed text go to layer→ layer style→ blended option→ drop shadow, inner shadow, bevel and emboss→ contour→ satin→ gradient overlay d. Save the image.	Able to apply shadow emboss effects

Table specifying the scope of syllabus to be covered for unit tests

Unit Test	Learning outcomes to be covered
Unit test-1	From 1 to 8
Unit test-2	From 9 to 22
Unit test-3	From 23 to 40

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.0.1 Integrate various functions using different methods.

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

1.2. 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.

1.3. Solve problems involving standard functions using these properties.

1.4. 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) $\int (f(x))^n f'(x)\,dx,\ n=-1$

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

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

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

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

1.7. Evaluate integrals using decomposition method.

1.8. 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

2.2. Explain the concept of definite integral.

2.3. Solve simple problems on definite integrals.

2.4. State various properties of definite integrals.

2.5. 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.

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

3.3. 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

4.2 Find order and degree of a given differential equation.

4.3 Form a differential equation by eliminating arbitrary constants.

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

4.5 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.

4.6 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.

4.7 Define complementary function, particular integral and general solution of a non-homogeneous linear differential equation of second order with constant coefficients.

4.8 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

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

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

b) Series D. C. Motors

2.9 List the applications of the various D.C motors.

3. Speed Control and Testing of D.C Motors

-

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

3.2 Explain the different methods of speed control of series motor.

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

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

3.5 List different tests of D.C Motors.

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

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

4. Basics of Electrical measuring instruments.

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

(iii) method of measuring the value

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

instruments.

4.3 Explain the working of Permanent Magnet Moving Coil instrument.

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

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

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

4.7 Explain the working of a Dynamometer type instrument

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

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

4.11 Describe the construction and working of Megger

5. **Transducers, Sensors and Electronic & Digital Instruments**

5.1 Define Transducer

5.2 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

5.3 State the applications of Transducers.

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

5.5 Explain the working of LVDT.

5.6 Define Sensor and list its types.

5.7 List the applications of sensors.

5.8 List the basic components of analogue electronic instruments.

5.9 List the basic components of Digital instruments.

5.10 List the advantages of Digital Instruments over Analog Instruments.

5.11 Explain the Working of Digital Multi meter with block diagram.

5.12 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

1.1 State the relation between poles, speed and frequency

1.2 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.

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

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

1.5 Understand j operator

1.6 Convert polar quantities into rectangular quantities and Vice-versa.

1. Single-phase A.C circuits

2.1 Derive relationship between voltage and current in a
(i) Pure resistive circuit ii) Pure inductive circuit iii) Pure capacitive circuit.

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

2.3 Solve Problems on Series Circuits

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

2.5 Define Q-factor and state its importance,

2.6 Solve problems on Series Resonance.

2.7 State the concept of conductance, susceptance and admittance.

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

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

2. Poly Phase Circuits

3.1 Definetheterm`PolyPhase'.

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

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

3.4 State the concept of phase sequence.

3.5 Derive the relation between line and phase values of current and voltage in 3phase
(i) Star circuits and(ii)delta circuits.

3.6 Derive the equation for power in 3 phase circuit.

3.7 Solve numerical examples in balanced loads.

3.8 Derive the formulae for measurement of 3 phase power and power factor by using two watt meters.

3.9 Solve simple problems on two wattmeter method.

3. Single phase transformer

4.1 Define Transformer and Explain its working principle.

4.2 Classify the transformers basedon

(i) numberofphases (ii)construction (iii)function.

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

4. Three Phase Transformers and Autotransformers

5.1 State the advantages of 3 phase transformer over single phasetransformer.
5.2 List the different types of three phase transformers by giving theirsymbolic representation
and voltagerelationships.
5.3 State theapplicationsof (i)star-star (ii)delta-star (iii)star-delta
(iv)delta- delta connected transformers.
5.4 State the need for parallel operation of three phase transformers.
5.5 State the conditions for parallel operation of 3 phasetransformers.
5.6 List the specialtransformers.
5.7 State the advantages and disadvantages ofautotransformers
5.8 State the necessity of cooling of powertransformers.
5.9 List different methods of cooling of powertransformer.
5.10 Draw a legible sketch of a powertransformer and explain the function of each part.
5.11 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

1.1 DefinePNJunctionDiodeandexplainits formation.
1.2 ExplaintheworkingofPNJunctiondiodewithnobias,forward bias and reverse bias.
1.3 DrawtheVIcharacteristicsofPNJunctionDiode.
1.4 ExplaintheworkingofZenerdiode.
1.5 Drawthe VIcharacteristicsof Zener diode.
1.6 ExplainformationofPNPandNPNtransistors
1.7 Statethedifferentconfigurationsoftransistors.
1.8 PlottheInput/OutputcharacteristicsofatTransistorinCEconfiguration.
1.9 ExplaintheworkingandVIcharacteristicsof (a) FET (b) MOSFET (c) IGBT . Mention
their applications.

2. Power Supplies

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

3. Amplifiers

3.1 DefineAmplifier
3.2 Explaintheoperationoftransistorasanamplifier.
3.3 Listtheapplicationsofamplifiers.
3.4 Listthe differenttypesofcouplingmethods inamplifiers
3.5 Explaintheworkingof RC coupled amplifier with the circuit diagram and draw the frequencyresponsecurves.
3.6 Explain the need for power amplifier.
3.7 Distinguishbetweenvoltageamplifierandpoweramplifier.
3.8 Definetheterms(a)feedback (b)feedbackfactor
3.9 Explaintheeffectoffeedbackongain, bandwidth andnoise

4. Oscillators

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

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

4.5 Listtheapplicationsofoscillators.

5. LinearIntegratedCircuits

5.1 DefineIntegratedCircuit.

5.2 Listthe advantagesofIntegratedCircuitsoverDiscrete Circuits.

5.3 ExplaintheoperationofDifferentialAmplifier.

5.4 ListthecharacteristicsofanIdealOperationalAmplifier.

5.5 ExplaintheworkingofOperationalAmplifier.

5.6 ExplaintheworkingofOpAmp invertingAmplifier.

5.7 Statethe conceptofvirtualground.

5.8 ExplaintheOperationalAmplifieras

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

5.9 Draw the Pin Diagram of 741 IC and state its important specifications and function of 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,RohitmehtaPrinciplesofElectronics,SChand& Co.
3. G.K.MithalAppliedElectronicsKhannapublishers
4. G.K.MithalElectronicdevicesandcircuitsKhannapublishers
5. J.B.GuptaAtextbookofElectronicsEngineeringKATSONBOOKS

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

1.1 State the Importance of 'C'
1.2 Explain the basic structure of 'C' Programming
1.3 KnowtheProgrammingstylewithsample program
1.4 Executea'C' Program
1.5 Knowaboutthecharacter set
1.6 Knowaboutconstants,variables, keywords&identifiers
1.7 Listvariousdatatypeswith examples
1.8 Explain different arithmetic operators, relational operators and logical operatorswith theirprecedence
1.9 Explaintheassignment statements
1.10 Explainthe increment& decrement operators
1.11 IdentifythecompoundAssignment operators
1.12 Explaintheinputfunctionsprintfand scanf
1.13 Knowvarioustypeconversion techniques

2. Decision&LoopControl Statements

2.1 StatetheImportanceofconditional expressions
2.2 List andexplainthevariousconditional statements
2.3 Explaintheswitch statement
2.4 Listthe different iterativeloopsandexplainthem(for,do,while statements)
2.5 Definenestingandimplementwithsimple programs
2.6 Differentiate 'break' and 'continue' statements with programs
2.7 Mentionaboutthenullstatementsandcomma operator

3. Arrays& Strings

3.1 Define1-D and2-D Arrays.
3.2 Knowhow to initializeabove arraysandaccessarray elements
3.3 Explainsimpleprogramsusing arrays
3.4 Define 'string'
3.5 Knowhow todeclareandinitialize string variables
3.6 Understandvariousstringhandling functions
3.7 Implementprogramsusingstring functions

4. Userdefinedfunctions

4.1 Define 'function'
4.2 Understandtheneedfor Userdefined functions
4.3 Knowthe returnvaluesandtheir types
4.4 Listthe fourstorageclassessupportedby C
4.5 Discusstheimportanceoffunctionprototypes in programming
4.6 Differentiatelocalandexternal variables
4.7 Identifyautomatic and static variablesanddiscussthemin detail.

5. Structures,Unions&Pointers

5.1 Definea structure

5.2 Describeaboutstructure variable
5.3 Explain initialization of structures

5.4 Knowtheaccessingofmembersofa structure.
5.5 Illustrate concept ofstructure assignment
5.6 Explainhowtofindsizeofa structure.
5.7 Knowpassingofindividualmembersofa structuretoa function
5.8 DefineUnionandIllustrateuseof union
5.9 Declarepointer,assignpointer,andinitialize pointer
5.10 Discusspointer arithmetic.
5.11 Illustrate with example how pointer can be used to realize the effect ofparameter passing by reference.
5.12 Illustratewithexamplesthe relationship betweenarraysand pointers.
5.13 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℃. • 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

1.0. DC Circuits and DC Theorems

1.1. Verification of OHM's law
1.2. Verification of KCL and KVL
1.3. Verification of Super Position Theorem
1.4. Verification of Thevenin's Theorem
1.5. Verification of Maximum Power Transfer Theorem

2.0. AC Circuits

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

3.0. Performance and testing of Transformers

3.1. Determination of the polarity and voltage transformation ratio of a single phase transformer
3.2. Conduct load test on 1-phase Transformer and calculate efficiency and regulation
3.3. 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
3.4. 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

1.1 Mention the use of wires, cables, Types of Installations and wiring Accessories**.**

1.2 Explain (i) Surface conduit system (ii) Concealed wiring system.

1.3 State merits and demerits of (i) Surface conduit system (ii) Concealed wiring system.

1.4 List different types of knife switches.

1.5 List the MCB types with specifications and mention their applications (MCCB,ELCB AND RCCB)

1.6 List the different types of fuses and specify the materials used.

1.7 List different ratings of fuses and state their applications.

1.8 State the reasons for not using fuse in Neutral wire

2. Estimation of Lighting and Power Loads

2.1 Define service mains and explain different types of service mains

2.2 List the electrical material used in wiring the service mains.

2.3 List the schedule of rates used in preparing estimate for house wiring and service mains

2.4 Estimate the material requirement with cost for (i) PVC conduit wiring and (ii) PVC casing -capping wiring for the given plan of abuilding.

2.5 Draw the wiring layout for a big office building, workshop/ Electrical Laboratory

2.6 Prepare layout and draw single line wiring diagrams as per standard practice for a given
set of machines in aworkshop.

2.7 Prepare the estimate of the materials for the complete installation of machines in a work shop / laboratory as per standard practice

2.8 Select the type of wiring and service mains used for the irrigation pump set.

2.9 Prepare an estimate for electrifying the irrigation pump set scheme

2.10 Prepare estimation for submersible pump installation

3. Estimation of OH Lines and Earthingsystems

3.1 Select the type of insulators to be used for over headlines

3.2. Calculate the total number of insulators required for the givenOH Line

3.3 Select the type, size and number of cross arms required for the overheadline

3.4 Determine the size and total length of overhead conductor required for the line giving due
Consideration for the sag to be allowed

3.5 Estimate the quantity of all materials required for given 11 kV and 400V over headlines

3.6 Draw and explain plinth and Pole Mounted transformer substations

3.7 Estimate the quantity of all the electrical accessories and components required for the given
(i) Pole mounted transformer (ii) Plinth mounted transformer

3.8 State the purpose of Earthing and mention its types that are normally used.

3.9 Select the suitable type of Earthing for a given installation

3.10 Draw and explain (i) pipe earthing (ii) plateEarthing with neat sketches.

3.11 Estimate the materials required for pipe and plateearthing.

4. Departmental Tests

4.1 Describe the departmental procedure for obtaining a service connection

4.2 Specify insulation resistance desirable for a given electrical installation

4.3 Specify the value of earth resistance to be maintained for a given electrical Installations

4.4 List different tests to be conducted before energizing a newly constructed electrical installation.

4.5 Describe the test procedure for continuity of wiring in an electrical installation.

4.6 Explain the procedure for conducting insulation test of domestic wiring

4.7 Explain the Sureyof load particulars in a villagefor
(i) Domestic(ii)industrial (iii) agriculturalloads.

4.8 Calculate the capacity of a transformer required assuming suitable diversity factor

4.9 Determine the location point of transformer and calculate the tail end voltage regulations

5. Electrical Safety

5.1 State the importance of electrical safety.

5.2 State the common electrical hazards.

5.3 Define electric shock and state the effects of electric shock on human body.

5.4 State the safety precautions to be taken to avoid electric shock.

5.5 List safety equipments used while working with electricity.

5.6 Describe the procedure of first aid for shock treatment to an electrocuted person.

5.7 State the reasons for fire accidents and state the prevention techniques.

5.8 Define fire extinguisher and State fire extinguishing techniques.

5.9 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

1.1 Principle of Production of Rotating Magnetic Field in 3-phaseSystem.
1.2 Explain the construction of Induction motor- slip ring and squirrel cage
1.3 Compare Slip ring & Squirrel cage Induction motors.
1.4 State the working principle of 3 phase induction motor.
1.5 Explain working of 3 phase induction motor on(i)no-load (ii) Load.
1.6 Derive the expression relating to TORQUE, POWER and SLIP and solve simple problems.
1.7 Draw Torque – Slip curves.
1.8 Explain(i)No-load test (ii) Blocked rotor test
1.9 State the Starters used for different ratings of induction motors.
1.10 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
1.11 Explain the speed control of inductor motorsby
(i) Frequencychangingmethod(ii) Pole changingmethod (iii) Injecting voltage inrotor circuit(iv)Cascading
1.12 State the advantages of induction motors
1.13 List at least six applications of induction motors

2. 1-Phase Induction Motors.

2.1 List the types of 1- phase motors.
2.2 Explain why a Single-phase Induction motor is not a Self-starting motor.
2.3 Explain the working principle of 1 – phase Induction motorbyDouble field revolving theory.
2.4 Explain the working of the following 1-phase induction motors with legible sketch
(i) Splitphasemotor(ii) capacitor start motor (iii) shaded polemotor
2.5 Explain the working of the universal motor.
2.6 Explain the working of Stepper motor and list different types.
2.7 Listapplicationsof
(i) 1-phaseinductionmotors (ii)1-phase Commutator motors (iii)Steppermotors.

3. Alternators

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

4. Parallel operation ofAlternators

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

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

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

5. Synchronous motors

5.1 Explain the working principles of synchronous motors.

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

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

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

5.5 Explain the phenomenon ofHUNTING and how HUNTING can be prevented.

5.6 List the applications of synchronousmotor.

5.7 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

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

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

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

2.20 Explain the working of a moderate type nuclear power station with a block diagram.
2.21 Explain the need and working of coolant, reflector, and control rods. Mention the materials used for them
2.22 List the types of Reactors used in Nuclear Power Station
2.23 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.

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

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

4. Switch gear and Reactors

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

5. Protective relays, Protection of Alternators and Transformers

5.1 Define relay and State the basic requirements of relays.
5.2 Classify there lays based upon(i) Principle of operation(ii)Time of operation(iii)Duty
5.3 Define current setting and time setting.
5.4 State the applications of (i) Induction type over current relay(ii) Directional over current induction type relay(iii)Distance relay (iv)Differential Relay
5.5 List the probable faults in Stator and rotor of Alternator.
5.6 Explain the differential protection for alternator stator.
5.7 List the possible faults and their types in a transformer.
5.8 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

1.1 List different thyristors family devices and draw the circuit symbols for each device.
1.2 Describe constructional details and operation of SCR
1.3 Explain the Volt – Ampere characteristics of SCR with the help of adiagram.
1.4 Draw the Gate characteristics of SCR
1.5 Mention the ratings of SCR.
1.6 Give the advantages of SCR as a switch.
1.7 List ten applications of SCR.
1.8 Explain the Volt-ampere characteristics of Diac under forward / reverse bias.
1.9 Explain the Volt-ampere characteristics of Triac under forward / reverse bias.
1.10 State the necessity of Commutation in SCR's and list different methods of commutation

2. Power Transistors

2.1 Classify power transistor.
2.2 Describe the basic structure and operation of IGBT.
2.3 Explain the characteristics of IGBT.
2.4 Mention the applications of IGBT.
2.5 List the types of MOSFETs.
2.6 Describe the working of Power MOSFET.
2.7 Explain the characteristics of MOSFET.
2.8 Mention the applications of MOSFET.
2.9 Compare MOSFET with BJT.
2.10 Compare IGBT with MOSFET.
2.11 Describe the basic structure and operation of MOS –Controlled Thyristor (MCT).

3. Converters, AC Voltage Controllers and Inverters

3.1 Define rectifier, AC voltage controller, inverter, chopper and cyclo converter
3.2 Explain the working of single-phase half wave converter with resistive and R-L loads.
3.3 Understand need for freewheeling diode.
3.4 Explain the working of single phase full wave converter with resistive and R- L loads.
3.5 Explain the working of three-phase half wave converter with resistive load
3.6 Explain the working of three phase full wave converter with resistive load.
3.7 Explain the working of single phase AC voltage controller with resistive load.
3.8 Explain the working of three phase AC voltage controller with resistive load.
3.9 Compare AC voltage controller with transformer.
3.10 Classify inverters.
3.11 Explain the working of single-phase bridge inverter.
3.12 Explain the working of three-phase bridge inverter.
3.13 State the advantages of MOSFET based inverters over SCR based inverters.
3.14 List the applications of Inverters.

4. Applications of Power Electronic Circuits

4.1 List applications of power electronic circuits.
4.2 Mention the factors affecting the speed of DC Motors.
4.3 Explain the speed control of DC Shunt motor using converter.
4.4 Explain the speed control of PMDC motor using converter.
4.5 List the factors affecting speed of the AC Motors.
4.6 Explain the speed control of induction motor by using AC voltage controller.

4.7 Explain the speed control of induction motor by using converter and inverter (V/F control).
4.8 Devices used to suppress the spikes in supply system.
4.9 Working of UPS with block diagram.
4.10 Explain the illumination control circuit using TRIAC and DIAC with the help of a legible sketch.
4.11 Explain the anti-theft alarm circuit using SCR with the help of a diagram.
4.12 Explain the emergency lamp circuit using SCR with the help of a diagram.
4.13 Explain the battery charger circuit using SCR with the help of a diagram.
4.14 Explain the power factor improvement circuit using SCR with the help of a diagram.
4.15 Explain the DC circuit breaker using SCR with the help of a diagram.

5. PLC and SCADA

5.1 Need for automation and advantages of automation.
5.2 Define Programmable Logic Controller(PLC) and state the advantages of PLC
5.3 Explain the different parts of PLC by drawing the Block diagram and state the purpose of each part.
5.4 State the applications of PLC
5.5 Explain Ladder diagram
5.6 Explain contacts and coils used in PLC
5.7 Draw ladder diagrams for
(i)AND gate (ii)OR gate (iii) NOT gate
(iv) NAND gate (iv) NOR gate (iv) X-OR gate
5.8 Explain the following Timers and counters
(i)TON (ii)T OFF (iii) Retentive timer (iv) CTU (v) CTD
5.9 Draw ladder diagrams using Timers and counters
5.10 Explain PLC Instruction set
5.11 Explain ladder diagrams for following
(i) DOL starter and STAR-DELTA starter(ii) Stair case lighting
(iii) Traffic light control(iv) Temperature Controller
5.12 Explain the need of data acquisition.
5.13 State the advantages of supervisory control.
5.14 List the softwares used for SCADA and explain them.
5.15 State various communication methods used in SCADA.
5.16 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:

1.0. **Simple Stress and Strain**

1.1. 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
1.2. State Hooke's law
1.3. Draw stress-strain curves for ductile and brittle materials under tension
1.4. Define a) Working stress, ultimate stress, yield stress, factor of safety and Young's modulus. solve simple problems on above topics
1.5. State the factors to be considered in selecting factor of safety
1.6. Solve Simple problems on uniform bars subjected to loads

2.0 Torsion in Shafts

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

3.0 I.C.Engines

3.1 Classify I.C. Engines
3.2 Functions of main components of an I.C.Engine
3.3 Illustrate the working of four stroke petrol engine
3.4 Illustrate the working of four stroke diesel engine
3.5 Illustrate the working of two stroke petrol engine
3.6 Compare four stroke and two stroke engines
3.7 Compare petrol engine and diesel engine

4.0. Boilers and Turbines

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

5.0. Pumps

5.1. Classify hydraulic pumps
5.2. Compare between centrifugal and reciprocating pumps
5.3. 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.Thissubjectistobe taughtbyMechanical EngineeringFaculty.
2. Papersettingandpapervaluationisalso to be done by MechanicalEngineeringFaculty.

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.

1.1 Draw the standard symbols of electrical components andfixtures.

1.2 Draw sectional elevation and end views of a Protected type and Unprotected type shaft couplings.

1.3 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.

2.1 Draw the assembled sectional views of Pole and Field coils.

2.2 Draw the half sectional end view and elevation of armature of DC machine with the given data.

2.4 Draw the end view of commutator in a DCMachine with the given data.

2.5 Draw the Half sectional End view and Elevation of a D.C machine from the given data.

3. InductionMotors.

3.1 Draw the Half - sectional elevation and end views of an assembled 3-phase squirrel cage
induction motor from the givendata.

3.2 Draw the Half - sectional elevation and end views of an assembled 3-phase slip ring induction motor from the givendata.

4. Transformers.

4.1 Draw different plan and elevational views of core stepping sections (one, two, three and four
stepped cores) of aTransformer.

4.2 Draw sectional plan and elevation of a 1-phase core type transformer from the given data.

4.3 Draw sectional plan and elevation of a 3-phase core type transformer from the givendata.

5. D.C and A.C Windings.

5.1 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.

5.2 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

V SEMESTER

DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
(V 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 501	Industrial Management &Smart Technologies	4	-	60	3	20	80	100
EE-502	Electric Vehicle Technology	5	-	75	3	20	80	100
EE-503	Power Systems - II	5	-	75	3	20	80	100
EE-504	Digital Electronics & Micro Controllers	5	-	75	3	20	80	100
EE-505	Electrical Utilisation & Traction	5	-	75	3	20	80	100
PRACTICAL								
EE-506	MATLAB Practice Laboratory	-	3	45	3	40	60	100
EE-507	PLC & SCADA Laboratory	-	3	45	3	40	60	100
EE-508	Life Skills	-	3	45	3	40	60	100
EE-509	Digital Electronics & Micro Controllers Laboratory	-	3	45	3	40	60	100
EE-510	Project Work	-	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 -508 is common with all branches.

INDUSTRIAL MANAGEMENT & SMART TECHNOLOGIES

Course Code	Course Title	No of Periods/ Week	Total Number of Periods	Marks for FA	Mark s for SA
EE-501	INDUSTRIAL MANAGEMENT & SMARTTECHNOLOGIES	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	Basics of Industrial Management and Organisation structure	17	29	3	2	CO1
2	Material management and industrial safety management	17	26	2	2	CO2
3	Entrepreneurship Development	8	16	2	1	CO3
4	Total Quality Management	8	16	2	1	CO4
5	Smart Technologies	10	23	1	2	CO5
	TOTAL	**60**	**110**	**10**	**8**	

COURSE OBJECTIVES	i. To familiarise the concepts of management, ownership styles and organisation structures. Ii. To get Exposure to organisational behavioural concepts, basics of Production management and materials management in industries. Iii. To Understand the modern trends of management in industries using smart technologies and maintaining quality systems.

COURSE OUTCOMES	**CO1**	EE-501.1	Understand the concept of management, organizations applied to industry,
	C02	EE-501.2	Describe the different aspects of production, materials and safety management activities at industries.
	C03	EE-501.3	Describe the role of entrepreneur in economic development and in improving the quality of life
	CO4	EE-501.4	Analysing and maintaining the quality standards of the product
	CO5	EE-501.5	Understand and applying smart technologies

LEARNING OBJECTIVES

1. Basics of Industrial Management and Organisation Structure

1.1 Define industry, commerce (Trade) and business.
1.2 Know the need for management.
1.3 Explain the principles of scientific management.
1.4 Differentiate between supervisory, middle and Top-level management
1.5 Explain the importance of managerial skills (Technical, Human, Conceptual)
1.6 Understand the philosophy and need of organisation structure of an industry.
1.7 Understand the line, staff and Line & staff (Functional)organisations
1.8 Explain the factors of effective organisation.
1.9 Statemotivation theories.
1.10 State Maslow's Hierarchy of needs.
1.11 Explain the process of selection, recruitment, training and development
1.12 Explain types of business ownerships
1.13 Explain the meaning and definition of social responsibilities
1.14 Need for corporate social responsibility

2. Material management and industrial safety management

2.1 Define production
2.2 Explain the stages of Production, planning and control.
2.3 Know the basic methods demand forecasting
2.4 Explain Break Even Analysis
2.5 Draw PERT/CPM networks.
2.6 Solve the critical path in simple project
2.7 Know Functions of Materials Management
2.8 Explain ABC analysis.
2.9 Define safety stock and reorder level.
2.10 Explain the importance of safety at Work place.
2.11 Explain hazard and accident.

2.12 List out different hazards in the Industry.
2.13 Explain the causes of accidents.

3. Entrepreneurship Development.

3.1 Define the word entrepreneur.
3.2 Explain the requirements of an entrepreneur.
3.3 Determine the role of entrepreneurs in promoting Small Scale Industries.
3.4 Describe the details of self-employment schemes.
3.5 List out the organisations that help an entrepreneur
3.6 Understand the concept of make in India, Zero defect and zero effect
3.7 Understand the importance of startups
3.8 Explain the conduct of demand and market surveys
3.9 Prepare feasibility report of any start-up plant/processing industry

4. Total Quality Management.

4.1 Explain the concept of quality.
4.2 List the quality systems and elements of quality systems.
4.3 State the principles of qualityAssurance.
4.4 Understand the basic concepts ofTQM
4.5 Know the Pillars ofTQM
4.6 Explain ISO standards and ISO 9000 series of qualitysystems.
4.7 List the beneficiaries of ISO9000.
4.8 Explain the concepts of ISO14000

5. Smart Technologies

5.1 Get an overview ofIoT
5.2 Define the termIoT
5.3 Know how IoTwork
5.4 List the key features ofIoT
5.5 List the components of IoT : hardware, software, technology and protocols
5.6 List the advantages and disadvantages ofIoT
5.7 Smart Energy and the Smart Grid

COURSE CONTENT

1. Basics of Industrial Management and Organisation Structure

Introduction - Industry, Commerce and Business - Definition of management - Principles of scientific management – F.W.Taylor, Nature of management - levels of management - managerial skills - Organizing - Process of Organizing; Line/Staff and functional Organizations, Effective Organizing; Motivational Theories; Leadership Models and types of leadership styles Forms of Business ownerships: Types – Sole proprietorship, Partnership, Joint Stock Companies, Cooperative types of Organizations; Employee participation in management; Corporate Social responsibility

2. Material management and industrial safety management

Definition of production PPC - job, batch and mass; production Planning and Control: Demand forecasting, Break even analysis; CPM and PERT techniques; simple numerical problems-Materials in industry, ABC Analysis, Safety stock, re-order level - Importance of Safety at work places; Causes of accidents-different hazards- different emissions from industries – their effects on environment – control methods.

3. Entrepreneurship Development.

Definition of Entrepreneur - Role of Entrepreneur - Concept of Make In India, ZERO defect, Zero Effect - Concept of Start-up Company - Entrepreneurial Development- Role of SSI, MSME, DICs, Entrepreneurial development schemes - Institutional support, Market survey and Demand survey - Preparation of Feasibility study reports.

4. Total Quality Management:

Introduction to Total Quality Management (TQM)- Concept of quality discussed by B. Crosby W. Edward, Deming, Joseph M. Juran, Kooru Ishikawa, Genichi Taguchi, Shigco Shingo. Quality systems – Definitions of the terms used in quality systems like, quality policy, quality management, quality systems, Stages of development of ISO 9000 series, ISO-14000,

5. Smart Technologies:

Overview of IoT - Define IoT, how IoT work, key features of IoT, components of IoT - hardware, software, technology and protocols - advantages and disadvantages of IoT - IoT Applications - Smart Cities, Smart Energy and the Smart Grid, Smart Transportation and Mobility, Smart Home, Smart Buildings and Infrastructure, Smart Factory and Smart Manufacturing, Smart Health, Food and Water Tracking and Security, Participatory Sensing, Social Networks and IoT.

REFERENCE BOOKS

1. Industrial Engineering and Management-by O.PKhanna
2. Production Management- byBuffa.
3. Engineering Economics and Management Science - by Banga &Sharma.
4. Production and Operations Management –S.N.Chary

Unit Test	Learning Outcomes to be Covered
Unit Test-I	From 1.1 to 2.13
Unit Test-II	From 3.1 to 5.7

Syllabus to be Covered for Unit Tests

ELECTRIC VEHICLE TECHNOLOGY

Course Code	CourseTitle	No. ofperiods/ Week	Total No.of Periods	Marks for FA	Marks forSA
EE-502	ELECTRIC VEHICLE TECHNOLOGY	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	Environmental impact, History and Electric vehicle Types	17	26	2	2	CO1
2	Hybrid Electric Vehicle	13	16	2	1	CO2
3	Energy Storages	17	26	2	2	CO3
4	Charging techniques and Battery Management system	13	16	2	1	CO4
5	ElectricalDrives and Braking of electricmotors	15	26	2	2	CO5
	TOTAL	**75**	**110**	**10**	**8**	

COURSE OBJECTIVES	i).To understand the concept of electric vehicles and Hybrid Electric Vehicle.
	ii).To understand the different types of energy storage system and Charging techniques for Electric vehicles .
	iii).To understand about Electrical drives for Electric vehicles andbraking of electricmotors.

COURSE OUTCOMES	CO1	EE-502.1	Understand the Impact of Conventional Vehicles on the Society and Different Types of electric vehicles.
	CO2	EE-502.2	Understand the architecture of different hybrid vehicles
	CO3	EE-502.3	Demonstrate the concepts of energy storage and energy management in electric vehicles.
	CO4	EE-502.4	AnalyzevariousCharging techniques in electric vehicles
	CO5	EE-502.5	Analyzing the different types of electric drives and different types of electric braking

LEARNINGOUTCOMES

1. Environmental impact, History and Electric vehicle Types

1.1 List different pollutants produced by IC engine vehicle (ICEV) and state their effect on human health.
1.2 Briefly explain the historical journey of electric vehicle.
1.3 Define Electric vehicle and state the need of electric vehicle.
1.4 Briefly explain the problems encountered by humans with usage of Electric vehicles.
1.5 List the Advantages and disadvantages of electric vehicles.
1.6 Compare Battery Electric Vehicle (BEV) & conventional vehicles.
1.7 Draw the block diagram of electric vehicle and explain the major components.
1.8 Classification of electric vehicles according to the source of power as BEV, HEV , PHEV and FCEV.
1.9 Explain Battery Electric Vehicle (BEV) with a neat block diagram.
1.10 Explain Hybrid electric Vehicle (HEV) with a neat block diagram.
1.11 Explain Plug-in Hybrid Electric Vehicle (PHEV) with a neat block diagram.
1.12 Explain Fuel Cell Electric Vehicle (FCEV) with a neat block diagram.

2. Hybrid Electric Vehicle

2.1 What is hybrid electric vehicle and state its necessity.
2.2 Classification of hybrid vehicles.
2.3 Explain series hybrid electric vehicle with a neat block diagram.
2.4 State the advantages and disadvantages of series hybrid system.
2.5 Explain the different power flow control modes of a series hybrid system with the help of block diagrams
2.6 Explain parallel hybrid electric vehicle with a neat block diagram.
2.7 Advantages and disadvantages of parallel hybrid system.
2.8 Explain the different power flow control modes of a parallel hybrid system with the help of block diagrams
2.9 Explain series-parallel hybrid electric vehicle with a neat block diagram.
2.10 List the impacts of EVs/HEVs on the power grid, environment and economy.

3. Energy Storages

3.1 State cell and battery
3.2 Classify cells as Primary and Secondary cells
3.3 Classify storage cell as Lead Acid Battery, Nickel based batteries, Sodium based batteries, Lithium based batteries – Li-ion & Li-poly,
3.4 Define the terms related to batteries (i) Battery Capacity (ii) Specific Energy Density (iii) State Of Charge (iv) State Of Discharge (v) Cycle Life (vi) Efficiency.
3.5 List main Requirements of EV batteries.
3.6 Explain Nickel -Cadmium battery system with a neat sketch.
3.7 Explain Lithium-Ion (Li-Ion) battery system with a neat sketch.
3.8 List different alternative energy storage devices for EVs as Ultracapacitor, flywheel, Fuel cell.
3.9 Explain Ultracapacitor storage system with a neat sketch.
3.10 Explain flywheel storage system with a neat sketch.
3.11 Explain Fuel cell storage system with a neat sketch.
3.12 List Advantages and disadvantages of (i) Ultracapacitor (ii) flywheel (iii) Fuel cell .

4. Charging techniques and Battery Management system

4.1 List the basic requirements for charging system as Safety , Reliability , User-friendliness , Power levels and charging times , Communication , Standardization.

4.2 List the Battery charging techniques as Constant voltage, Constant current, Trickle Charging, Battery swapping techniques, Conductive DC Charging, Conductive Ac charging, Inductive charging or Wireless charging.

4.3 State the Constant voltage, Constant current and Trickle Charging methods.

4.4 Explain about Battery swapping techniques in Electric vehicles.

4.5 Explain about Conductive DC Charging in Electric vehicles.

4.6 Explain about Conductive AC charging in Electric vehicles.

4.7 Explain about Inductive charging or Wireless charging in Electric vehicles.

4.8 List the advantages and disadvantages of Wireless charging.

4.9 Explain the concept of V2G Technology (Vehicle-to-Grid).

4.10 List types of (i) AC connectors (ii) DC connectors.

4.11 Need of battery management system.

4.12 Explain the Block diagram of Battery Management system (BMS).

5. ElectricalDrives and Braking of electricmotors

5.1 Define an Electric Drive and explain the concept of electric drive.

5.2 List the advantages of Electric Drives.

5.3 Draw the block diagram of an Electric drive and state the function of each block.

5.4 List the factors governing the selection of electric drive.

5.5 Classify the drives based on (i) Operation (ii) Application

5.6 List the Major requirements of Electric vehicle motor drive.

5.7 Explain Brushless DC (BLDC) motor with a neat sketch.

5.8 Explain Switched Reluctance motor with a neat sketch.

5.9 State the advantages of electric braking over other methods of braking.

5.10 List different methods of electric braking.

5.11 Explain the methods of plugging, Rheostatic and Regenerative braking.

5.12 List the advantages of Regenerative Braking System.

HYPONATEDCOURSECONTENTS

1. **Environmental impact, History and Electric vehicle Types**
   Pollutants produced due to IC engine vehicle (ICEV) and their effect on human health, Historical journey of electric vehicle,Need of electric vehicles, Problems of Electric vehicles, major components in electric vehicles, Classification of electric vehicles Battery, Electric Vehicle (BEV) ,Hybrid electric Vehicle (HEV) Plug-in Hybrid Electric Vehicle (PHEV) ,Fuel Cell Electric Vehicle (FCEV)

2. **Hybrid Electric Vehicle**
   History of hybrid electric vehicle, Classification of hybrid vehicles, block diagram of series hybrid electric vehicle, power flow control modes of a series hybrid system , block diagram of parallel hybrid electric vehicle ,power flow control modes of a parallel hybrid system , block diagram of series parallel hybrid electric vehicle, power flow control modes for a series hybrid vehicle, impacts of EVs/HEVs on the power grid, environment and economy.

3. **Energy Storages**
   Cell and battery ,Classify cells , Battery parameters : Battery Capacity , Specific Energy Density ,State Of Charge , State Of Discharge , ,Cycle Life, Efficiency, main Requirements of EV batteries ,Nickel -Cadmium battery system ,Lithium-Ion (Li-Ion) battery system alternative energy storage devices for EVs as Ultracapacitor, flywheel, Fuel cell , Advantages and disadvantages of Ultracapacitor, flywheel, Fuel cell

4. **Charging techniques and Battery Management system**
   Basic Requirements for Charging System as Safety ,Reliability , User-friendliness , Power levels and charging times , Communication , Standardization Battery charging techniques as Constant voltage, Constant current , Trickle Charging, Battery swapping techniques, Conductive DC Charging, Conductive Ac charging , Inductive charging or Wireless charging , V2G Technology (Vehicle-to-Grid) , types of AC connectors ,types of DC connectors, Battery Management system (BMS)

5. **ElectricalDrives and Braking of electricmotors**
   Electric Drive, advantages of Electric Drives, block diagram of an Electric drive, factors governing the selection of electric drive, Classify the drives, Major requirements of Electric vehicle motor drive, (Brushless DC)BLDC motor ,Switched Reluctance motor, advantages of electric braking ,methods of electric braking, plugging, Rheostatic and Regenerative braking, Advantages of Regenerative Braking System

REFERENCE BOOKS

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.tbook / Refences.
4. Sandeep Dhameja, “Electric Vehicle Battery Systems”, Newnes, 2001
5. Prof. Ahok Jhunjhunwala, IITM – Fumdamentals of Electrical Vehicles (MPTEL VIDEOS)

Model Papers: Syllabus to be Covered for Unit Tests

Uni tTest	Learning Outcomes to be Covered
Unit Test-I	From1.1to3.4
Unit Test-II	From3.5to5.12

POWER SYSTEMS – II

Course code	Course title	No.of periods/week	Total no. of periods	Marks for FA	Marks ForSA
EE-503	POWER SYSTEMS – 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	Transmission lines	20	29	3	2	CO1
2	Line structures for transmission and Underground cables	25	29	3	2	CO2
3	Substations and Distribution	15	26	2	2	CO3
4	Protection of Transmission lines	7	13	1	1	CO4
5	Modern Trends in power systems	8	13	1	1	CO5
TOTAL		**75**	**110**	**10**	**8**	

COURSE OBJECTIVES	I) To understand the concept of transmission anddistribution ii) To Analyse different methods to solve transmission and distribution problems iii) To acquaint knowledge of substation equipment, cables and Distribution systems iv) To summarize key forces driving transformation in the power sector around the world

COURSE OUTCOMES	CO1	EE-503.1	Describe the concepts of power transmission, distribution systems and HVDC transmission systems
	CO2	EE-503.2	Explain different structures, insulators, laying of lines including calculation of Sag and evaluation of underground cables
	CO3	EE-503.3	Explain various substations and basic concepts of distribution
	CO4	EE-503.4	Understand basic concepts of transmission line protection
	CO5	EE-503.5	Enhance the knowledge of the students with the recent trends in emerging power system operation

LEARNING OUTCOMES

1. Transmission Lines

1.1 State the need of transmission lines and distribution lines
1.2 Explain A.C and D.C transmission supply systems and state its advantages and disadvantages
1.3 State the various supply systems.
1.4 Compare the supply systems based on the conductor material required for overhead lines and underground cables for the following systems:
  i) DC – 2 wire system
  ii) AC - 1 ph 2 wire system
  iii) AC - 3 ph 3 wire system
1.5 Explain the effects of supply frequency on Transmission lines
1.6 State the effects of using higher transmission voltage on
  (i) Line efficiency (ii)Voltage drop iii) Line loss
  (iv)Active &reactive Power (v)Volume of conductor material
  (vi)Cost of-transformers, insulators, switchgear, supports etc.
1.7 State the empirical formula for determining the system voltage
1.8 State the relative merits and demerits for the following conductors;
  a) Solid b) Stranded c) Hollow d) Bundled conductors
1.9 Explain the current distortion effects
  (i) Skin effect(ii) Proximity effect (iii) Spirality effect
1.10 Give expression for inductance of 1- phase system and 3-phase system
1.11 Give the expressions for capacitance of1 phase system and 3-phase system
1.12 State the need for transposition of overhead lines and explain its effects.
1.13 Define short, medium and longlines.
1.14 Define `regulation' and derive the approximate formula for percentage regulation.
1.15 Explain short transmission lines
1.16 Solve simple problems on regulation and efficiency for short line
1.17 Explain (i) Nominal T-method (ii) Nominal π –method for a medium transmission lines and solve simple problems.
1.18 State `Ferranti' effect
1.19 Define Corona, State the factors affecting it and list the methods of reducing corona
1.20 Explain the concept and applications of hot line technique
1.21 State basic concepts of HVDC transmission
1.22 List the types of HVDC transmission systems.
1.23 State the advantages and disadvantages of HVDC transmission

2. Line structures and Underground Cables

2.1 State the main components of overhead lines
2.2 State the requirements of line supports and List the types of line supports
2.3. List the common conductor spacing and ground clearances adopted for 66 kV, 33kV, 11 kV and LT line
2.4 Define 'sag' and state the factors affecting the sag
2.5 Derive an equation for the approximate method of calculating sag when the supports are at the same level (a) instiller (b) with the effect of wind and ice and solve problems.

2.6 State the disadvantages of loose spans(sag more than prescribed value)

2.7 State the purpose of insulators and its requirements.

2.8 State applications of the following insulators.
(i) Pin type (ii)Strain type (iii)Suspension type(iv)Shackle type

2.9 Compare pin type insulator and suspension type insulators.

2.10 Define the terms (i) Flashover (ii)Puncture (iii)String-efficiency

2.11 Solve problems on distribution of voltage across string and string efficiency

2.12 List the methods of improving string efficiency

2.13 State the need for arcing horns and guard rings

2.14 List causes of failure of insulators in transmission and distribution lines

2.15 Define cables and explain the general construction of cables.

2.16 Compare overhead lines with underground cables

2.17 Classify the cables based on
(i) Number of conductors (ii) Voltage (iii) Insulation and lead sheathing
(iv) The methods of improving the dielectric stress

2.18 Derive an equation for the insulation resistance of acable

2.19 Solve problems on insulation resistance.

3. Substations and Distribution

3.1 Explain the need for substations

3.2 State the merits of indoor substation and outdoor substation

3.3 State the purpose of the following equipment used in substation.
(i) Busbars (ii) Insulators (iii)Transformers
(iv) Switchgear (v) Indicating and Metering equipment (vi) Protective relays
(vii) Lightning arrestors (viii) Ca b l e s (ix) Firefighting equipment

3.5 State the need for auxiliary supply in Substations

3.6 Draw the schematic diagram of 33kV / 11kVsubstation and label the parts.

3.7 Draw the schematic diagram of 220kV / 132kVsubstation and label the parts.

3.8 Define Feeder, distributors and service mains

3.9 Explain radial and ring-main distribution systems and state their advantages and disadvantages

4. Protection of Transmission Lines

4.1 State the necessity of bus-bar protection, causes of bus-bar faults.

4.2 Describe the transmission line protection.

4.3 Explain the protection of transmission lines using distance relays.

4.4 Explain pilot wires

5. Modern trends in power systems

5.1 Define Smart Grid and state its need

5.2 Explain the working of SMARTGRID

5.3 Define Micro Grid and explain its operation

5.4 Define FACTS(Flexible AC transmission systems) and state its applications

5.5 State the Basic concept of WiTricity (wireless power transmission)

5.6 Define distributed generation (Distributed energy resources).

HYPONATEDCOURSE CONTENTS

1. **Transmission Lines**

   Need for transmission lines-Transmission supply systems, Relative advantages and disadvantages of AC & DC Transmission, Choice of frequency, Choice of voltage, Effect of voltage, Empirical formula for determining the system voltage-Types of conductor-Solid-Stranded-Hollow- Bundled conductors -Relative merits of different types of conductors-Transmission parameters: Resistance, Inductance capacitance- skin effect, proximity effect, spirality effect- inductance of Round and Parallel Conductors ,Transposition of O.H. lines-Effect of transposition on Inductance calculations in transposed lines, capacitance in round and parallel conductors - Regulation and efficiency-Approximate formula for Regulation-Short line calculation of-Efficiency-Regulation-Sending end voltage-sending end p.f. for the given receiving end conditions -Regulation-Sending end voltage-sending end p.f. for the given receiving end conditions in medium transmission lines using Nominal pie method- Nominal T method -Vector diagrams in the above methods- -Ferranti's effect- Corona in transmission lines -Effects of corona –methods of reducing corona-Hot line technique - concept and application-High voltage DC Transmission**:** Basic Concepts and Types of HVDC transmission- Advantages and disadvantages of HVDC transmission.

2. **Line structures and Cables:**

   Requirements of line supports-Types of lines supports- Conductors spacing and ground clearance -lines spaces-Approximate ground clearance- Sag, Factors affecting sag, calculating sag. Disadvantages of loose span, Insulators, Requirements of insulators, Materials used , Types of Insulators, Voltage distribution across string of suspension Insulators, Flashover, Puncture, string efficiency, improving string efficiency, , Arcing horns and guard rings, Causes for failure of insulators-Cables, Comparison between O.H. Lines and underground cables, Classification of cables, General construction of cables, Insulation resistance of cables and problems.

3. **Sub-stations and Distribution**

   Definition and classification of sub-stations, Relative merits of indoor and outdoor sub- stations equipment in sub-stations Bus-bars, Insulators, Switch gear, Transformer, Protective relays, Meters, Lightning arrestors, Cables, Fire fighting equipment-Schematic diagrams- Feeders, distributors and service mains, Classification of Distribution systems- Radial and Ring system of Distribution.

4. **Protection of Transmission Lines and Feeders,**

   Transmission line protection –Busbar protection-transmission line protection using distance relays. -Pilot wires

5. **Modern trends in power systems**

   Smart Grid – Micro Grid –FACTS(Flexible AC transmission systems) – Witricity (Wireless power Transmission), Distributed Generation

Reference Books:

1. V.K. Mehta -Principle of Power systems
2. S.L. Uppal - Electrical power
3. Sony, Gupta &Bhatnagar -Text book of Elect. Power
4. CL Wadhwa -Electrical power Systems - New Age International(P)limited.
5. KR Padiyar - HVDC Power Transmission system Technology.

Syllabus to be Covered for Unit Tests

UnitTest	Learning Outcomes to be Covered
UnitTest-I	From 1.1 to 2.14
UnitTest-II	From 2.15 to 5.6

DIGITAL ELECTRONICS AND MICROCONTROLLERS

Course Code	Course Title	No. of periods /Week	Total No. of Periods	Marks for FA	Marks for SA
EE-504	DIGITAL ELECTRONICS AND MICRO CONTROLLERS	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	Basics of Digital Electronics	10	16	2	1	CO1
2	Combinational Logic circuits	17	26	2	2	CO2
3	Sequential Logic Circuits	15	26	2	2	CO3
4	8051 Microcontroller	15	16	2	1	CO4
5	8051 instruction set and programming	18	26	2	2	CO5
TOTAL		**75**	**110**	**10**	**8**	

COURSE OBJECTIVES	i)To introduce students to the basic theory of digital electronics, their practical applications.
	ii) To familiarize students to the principle of operation, design and synthesis of different digital electronic circuits.
	iii) To provide strong foundation for further study of digital electronic circuits and systems
	iv) To understood different applications microcontrollers

COURSE OUTCOMES	CO1	EE-505.1	Understand number systems, basic operation and compare performance of various digital electronic circuits.
	CO2	EE-505.2	Design and analyse digital electronic circuits and learn to select suitable circuits by assessing the requirements of application fields.
	CO3	EE-505.3	Identify the critical areas in application levels and derive typical alternative solutions, select suitable digital electronic circuits to control industry grade apparatus.
	CO4	EE-505.4	Select 8051 microcontroller for given

			application and develop assembly program for a given application
	CO5	EE-505.5	Describe 8051 microcontrollers as per requirement and develop a simple real time application.

LEARNING OUTCOMES

1. Basics of Digital Electronics

1.1 Explain Binary, Octal, Hexadecimal number systems and compare them with Decimal system.
1.2 Perform binary addition, subtraction, Multiplication and Division.
1.3 Explain about BCD.
1.4 Write 1‘s complement and 2‘s complement numbers for a given binary number
1.5 Perform subtraction of binary numbers in 2‘s complement method.
1.6 Explain the importance of parity Bit.
1.7 State different postulates and De-Morgan ‘s theorems in Boolean algebra.
1.8 Explain AND, OR, NOT, NAND, NOR and EX-OR gates with truth table.
1.9 Realize AND, OR, NOT operations using NAND, NOR gates.
1.10 Classify digital logic families.
1.11 Give IC numbers for different digital Logic gates.

2. Combinational Logic Circuits

2.1 Give the concept of combinational logic circuits.
2.2 Draw the Half adder circuit and verify its functionality using truth table.
2.3 Realize a Half-adder using NAND gates only.
2.4 Draw the full adder circuit and explain its operation with truth table.
2.5 Realize full-adder using two Half-adders and an OR – gate and write truth table
2.6 Draw and explain a 4 Bit parallel adder using full – adders.
2.7 Explain the working of a serial adder with a Block diagram.
2.8 Draw and explain the operation of 4 X 1 Multiplexers
2.9 Draw and explain the operation of 1 to 4 demultiplexer.
2.10 Draw and explain 3 X 8 decoder.
2.11 List any three applications of multiplexers and decoders.
2.12 Draw and explain One-bit digital comparator.

3. Sequential Logic Circuits

3.1 Give the idea of Sequential logic circuits.
3.2 Explain NAND and NOR latches with truth tables
3.3 State the necessity of clock and give the concept of level clocking and edge triggering,
3.4 Draw and explain clocked SR flip flop with preset and clear inputs.
3.5 Construct level clocked JK flip flop using S-R flip-flop and explain with truth table
3.6 Write the truth tables of edge triggered D and T flip flops and draw their symbols.
3.7 List the applications of flip flops.
3.8 Define modulus of a counter
3.9 Explain with block diagrams and timing diagrams

(i) 4-bit asynchronous counter (ii) 4-bit synchronous counter.

3.10 State the need for a Register and list the types of registers.

3.11 Draw and explain the working of 4 bit shift left and shift right registers

3.12 Explain the working of ring counter and list its applications

3.13 State memory read operation, write operation, access time, memory capacity, address lines and word length.

3.14 Distinguish between (a) EEPROM and UVEPROM (b) static RAM and dynamic RAM

4. Micro controller

4.1 Explain the concept of Micro controllers.

4.2 Compare Embedded with External memory devices.

4.3 List the three commonly used Commercial Microcontroller Device families.

4.4 Draw the block diagram of a microcontroller and explain the function of each block.

4.5 Explain the register structure of 8051.

4.6 Explain the functions of various special function registers.

4.7 Draw the pin diagram of 8051 micro controller and specify the purpose of each pin.

4.8 Explain internal memory, external memory and ports of 8051.

4.9 List interrupts in 8051

5. Instruction set and Programming

5.1 State the need for an instruction set.

5.2 Explain the instruction format of 8051.

5.3 Explain fetch cycle, execution cycle and instruction cycle.

5.4 Define the terms machine language, assembly language, and mnemonics.

5.5 Differentiate between machine level and assembly level programming.

5.6 List the major groups in the instruction set along with examples.

5.7 Explain the terms operation code, operand and illustrate these terms by writing an instruction.

5.8 Explain the data manipulation functions data transfer, arithmetic, logic and branching.

5.9 Explain the addressing modes of 8051.

5.10 Explain data transfer instructions of 8051.

5.11 Explain the arithmetic instructions and recognize the flags that are set or reset for given data conditions.

5.12 Explain the logic instructions and recognize the flags that are set or reset for given data conditions.

5.13 Explain unconditional and conditional jump and how flags are used to change the sequence of program.

5.14 Define subroutine and explain its use.

5.15 Write program to perform

(i) Single byte & Multi byte addition

(ii) Summing-up of given N numbers

(iii) Multiplication of two 8-bit numbers using MUL instruction

Note :1. This Subject is to be taught 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. **Basics Of Digital Electronics**
   Binary, Octal. Hexadecimal number systems- Logic gates : AND, OR, NOT, NAND, NOR, Exclusive-OR-Boolean algebra, Boolean expressions – De-Morgan's Theorems - Characteristics of digital circuits .
2. **Combinational Logic Circuits**
   Implementation of arithmetic circuits, Half adder, Full adder, Serial and parallel Binary adder. Parallel adder/subtractor, Multiplexer, demultiplexer, decoder
3. **Sequential Logic Circuits**
   Principle of flip-flops operation, Concept of edge triggering, level triggering, RS, D, JK, T, flip-flops - Applications of flip flops,. Binary counter- ripple counter, synchronous counter, up-down counter-Shift Registers – ring counter and its applications- Memories-terminology related to memories, RAM, ROM, EEPROM, UVEPROM, static RAM, dynamic RAM
4. **Micro Controllers**
   Block diagram of 8051- Pin out diagram of 8051, registers, interrupts.
5. **Instruction Set And Programming**
   Instruction set of 8051, instruction format, fetch cycle, execution cycle, instruction cycle, machine cycle, timing diagrams, classification of instructions, addressing modes- Groups of instructions, Opcode, operand - Data transfer, subroutines– Assembly level programming.

REFERENCE BOOKS

1. Digital Computer Electronics by Malvino and leach TMH
2. Modern Digital Electronics By RP Jain TMH
3. Digital Electronics Tokhem TMH
4. Digital Design by Morris Mano, PHI
5. Kenneth J.Ayala. - 8051 Micro controller

Unit Test	Learning Outcomes to be Covered
Unit Test-I	From 1.1 to 3.9
Unit Test-II	From 3.10 to 5.17

Syllabus to be Covered for Unit Tests

ELECTRICAL UTILIZATION AND TRACTION

Course code	Course Title	No. of periods /week	Total No. of periods	Marks for FA	Marks for SA
EE-505	**ELECTRICAL UTILIZATION AND TRACTION**	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	Electric Lighting	17	26	2	2	CO1
2	Electric Heating	14	24	3	1.5	CO2
3	Energy saving devices	12	13	1	1	CO3
4	Electric Traction	22	29	3	2	CO4
5	Traction Supply Systems	10	18	1	1.5	CO5
TOTAL		**75**	**110**	**10**	**8**	

COURSE OBJECTIVES	i) Understand about terminology regarding illumination, understand about various lamps, Able to design simple lighting schemes.
	ii) Understand about different Electric Heating Methods, Ability to identify a heating scheme for a given application.
	iii) Understand different schemes of traction, its main equipments

COURSE OUTCOMES	CO1	EE-505-1	Design lighting schemes for a given application
	CO2	EE-505-2	Ability to identify the type of Electric heating suitable for any specific application
	CO3	EE-505-3	Ability to draw Automatic Temperature and Illumination control circuits.
	CO4	EE-505-4	Understand the basic principle of electric tractionincluding speed– time curves of different traction services and traction equipment
	CO5	EE-505-5	Analyzethe operation of traction supply systems and train lighting systems

LEARNING OBJECTIVES

1. Electric Lighting

1.1. Define the following terms related to electric lighting.

a) Plane and solid angles, b) luminous flux, c) Luminous intensity,
d) Lumen Illumination e) Candle power, f) Polar curve,
g) Brightness, h) MHCP, i) MSCP,
j) MHSCP k) Wave length, l) Glare

1.2. Explain the production of light by

a) Excitation b) Ionisation c) Fluorescence and d) Phosphorescence

1.3. List the types of lamps used for illumination at different situations such as

a) Domestic) Industrial) Decoration) Advertisements) Street lighting schemes

1.4. State the requirements of good lighting

1.5. List the lamp fittings used in domestic and industrial applications

1.6. State and explain the laws of Illumination

1.7. Solve problems on Illumination

1.8. Define the following terms

a) Utilisation factor b) Depreciation factor c) Waste light factor
d) Reflection factor e) Reduction factor f) Absorption factor
g) Luminous efficiency h) Space height ratio i) Specific energy consumption

1.9. Design a simple lighting scheme for drawing hall

2. Electric Heating

2.1. State the advantages of electric heating

2.2. List the requirements of good heating material and state the materials employed for heating

2.3. Explain the following with legible sketch and state its industrial applications

a) Direct resistance heating b) Indirect resistance heating

2.4. Explain the following with legible sketch and state its industrial applications

a) Direct arc furnace b) Indirect arc furnace

2.5. Explain the following with legible sketch and state its industrial applications

a) Core type Induction furnace b) Coreless type Induction furnace

2.6. State the principle of dielectric heating and list the industrial applications of the dielectric heating

3. Energy saving Devices

3.1 State the need of power saving devices

3.2 Draw Automatic temperature control circuits for (coolers, geysers, air conditioners and iron boxes)

3.3 Draw Automatic illumination control circuits using LDR's

3.4 List the advantages of Compact Fluorescent Lamps (CFL)

3.5 Explain the operating principle of Light Emitting Diode (LED)

3.6 List the advantages of LED lamps over other types of lamps

3.7 Compare LED lamps with Tungsten filament lamps

4. Electric Traction

4.1 Describe different methods of track electrification

4.2. List the types of traction services and sketch the speed-time curves
4.3. State each stage of the speed-time curve with appropriate speeds
4.4. Define Maximum speed, average speed and scheduled speed
4.5. List the factors affecting the scheduled speed
4.6. Sketch the simplified speed-time curves and state their practical importance
4.7. Derive the expression for maximum speed, acceleration and retardation for the following speed time curves and solve simple problems on it
a) Trapezoidal speed time curve b) Quadrilateral speed time curve
4.8. Explain the tractive effort
4.9. Derive the expression for tractive effort for acceleration to overcome gravity pull and train resistance and solve problems.
4.10. Explain the mechanics of transfer of power from motor to driving wheel
4.11. Define `Coefficient of adhesion' and list the factors affecting the coefficient of adhesion
4.12. Solve problems on calculation of number of axels required
4.13. State the methods of improving the coefficient of adhesion
4.14. Define specific energy consumption and list the factors affecting it
4.15. List the important Overhead Equipment's (OHE) used in Traction
4.16. State the important requirements of traction motor
4.17. Explain the suitability of different motors (D.C., 1-Ø A.C, 3-Ø A.C., Composite &Kando systems) for traction
4.18. State the need for Booster Transformer in Traction

5. Traction Supply Systems

5.1. Describe the following major Equipment at traction Substation
a) Transformer b) Circuit Breaker c) Interrupter
5.2. State the importance of location and spacing of Substation
5.3. Explain End on Generation
5.4. Explain Mid on Generation
5.5. Explain Head on Generation
5.6. State the requirements of Train lighting
5.7. Mention the requirements of railway coach air conditioning

HYPONATED COURSE CONTENT

1. Electric Lighting

Important terms and definitions of lighting - Plane and solid angles, luminous flux, Luminous intensity, Lumen Illumination, Candle power, Polar curve, Brightness, MHCP, MSCP, MHSCP, Wave length and Glare – Principle of production of light by Excitation, Ionisation, Fluorescence and Phosphorescence – Types of lamps – Requirements of good lighting – Different types of lamp fittings – Laws of Illumination – important terms used in designing of simple lighting scheme – Problems.

2. Electric Heating

Advantages of electric heating - requirements of good heating material - materials

generally employed for Electric Heating, resistance heating - direct and indirect types - applications - Electric arc furnaces - direct and indirect types - applications - Induction furnace heating - core andcoreless type - applications - Dielectric heating - principle – applications

3. Energy saving Devices

Need of power saving devices - Automatic temperature control circuits- Automatic illumination control circuits using LDR's- Advantages of CF Lamps –Operating Principle of LED lamp - Advantages of LED lamps over other types of lamps- Compare LED lamps with tungsten filament lamps.

4. **Electric Traction**

Single-phase A.C. and Composite systems -Types of services (main line, suburban , Metro and urban) - speed-time curves for the above services - Maximum speed, average speed and scheduled speed - Factors affecting the scheduled speed - Simplified speed-time curves & its practical importance - Expression for maximum speed, acceleration and retardation for Trapezoidal & Quadrilateral speed time curves - numerical examples - Tractive effort & its derivation – Mechanism of transfer of power from motor to driving wheel - Coefficient of adhesion - factors affecting the coefficient of adhesion - problems on calculation of number of axles required - methods of improving the coefficient of adhesion - specific energy consumption - factors affecting specific energy consumption - Overhead Equipments (OHE) - State the important requirements of traction motor - suitability of different motors (D.C., 1-Ø A.C, 3-Ø A.C., Composite &Kando systems for traction – Need of Booster Transformer.

5. Traction Supply Systems

Major Equipment at traction Substation – Importance of Location and Spacing of Substations - End on Generation - Mid on Generation - Head on Generation - Requirements of Train lighting - requirements of railway coach air conditioning.

REFERENCES

1. J B Gupta – Utilisation of Electric Power and Electric Traction – Katson Books

2. R.K.Gang - Utilisation ofElectricenergy
3. H.Partab - Art and Science ofelectricpower – Dhanpat Rai & Co
4. K.B.Bhatia – Study of electrical Appliances and devices – Khanna Publications
5. R.K.Rajput - Utilisation of Electric Power – Parag Enterprises

Syllabus to be covered for Unit Tests

Unit Test	Learning Outcomes to be Covered
Unit Test - 1	From 1.1 to 3.4
Unit Test – 2	From 3.5 to 5.7

MATLAB PRACTRICE LABORATORY

Course code	Course Title	No. of periods /week	Total No. of periods	Marks for FA	Marks for SA
EE-506	MATLAB PRACTRICE LABORATORY	3	45	20	80

Chapter No.	Title	No. of periods	CO's Mapped
1	Familiarization with MATLAB	09	CO1
2	Simulation of DC Circuits	06	CO2
3	Simulation of AC Circuits	09	CO3
4	Simulation of Power Electronic Converter circuits	12	CO4
5	Simulation of DC and AC motor Drives	09	CO5
	Total	**45**	

COURSE OBJECTIVES	i) Familiarize with the MATLAB software
	ii)Simulate the responses in DC, AC and Power Electronic Converter Circuits
	iii) Simulate the responses in DC and AC motor Drives

COURSE OUTCOMES	CO1	EE-506-1	Ability to use command window and save files. Understands various blocks available in Sims cape/SIM Power systems
	CO2	EE-506-2	Ability to find desired response in DC Circuits through MATLAB software
	CO3	EE-506-3	Ability to find desired response in AC Circuits through MATLAB software
	CO4	EE-506-4	Ability to find desired response in power electronics Circuits through MATLAB software
	CO5	EE-506-5	Understand the Voltage control method in speed control of DC and AC motor Drives through software simulation

LEARNING OUTCOMES

1. Familiarization with MATLAB software

1.1. Introduction to command window and perform simple math calculations
1.2. Introduction to Sims cape/SIM Power systems
1.3. Working with different blocks of Sims cape/SIM Power systems

2. Simulation of DC Circuits

2.1. Verify Thevenin's Theorem in a simple DC Circuit using SIMULINK
2.2. Verify Norton's Theorem in a simple DC Circuit using SIMULINK

3. Simulation of AC Circuits

3.1. Verify Thevenin's Theorem in a simple AC Circuit using SIMULINK
3.2. Verify Norton's Theorem in a simple AC Circuit using SIMULINK

4. Simulation of Power Electronic Converter circuits

4.1. Simulation of Single-phase full wave converter circuit with R and RL loads
4.2. Simulation of Three phase full wave converter circuit with R load
4.3. Simulation of single-phase bridge inverter circuit

5. Simulation of DC and AC motor Drives

5.1. Simulation of speed control of BLDC motor using single phase full wave rectifier
5.2. Simulation of speed control of PMSM motor using single phase full wave rectifier
5.3. Simulation of speed control of Induction Motor using Three phase AC Voltage controller.

HYPONATED COURSE CONTENT

1. Familiarization with MATLAB software
Introduction to command window - perform simple math calculations (addition, multiplication, matrix formation) – Procedure to save MATLAB files - Sims cape/SIM Power systems – Introduction – Familiarization with different blocks available in Sims cape/SIM Power systems

2. Simulation of DC Circuits
Verification of Thevenin's and Norton's Theorem in a simple DC Circuit using SIMULINK

3. Simulation of AC Circuits
Verification of Thevenin's and Norton's Theorem in a simple AC Circuit using SIMULINK

4. Simulation of Power Electronic Converter circuits
Simulation - Single phase full wave converter circuit with R and RL loads - Three phase full wave converter circuit with R load - single phase bridge inverter circuit

5. Simulation of DC and AC motor Drives
Simulation of speed control - BLDC motor using single phase full wave rectifier - PMSM motor using single phase full wave rectifier - Induction Motor using Three phase AC Voltage controller.

Competencies & Key competencies to be achieved by the student

Sl.No.	Experiment Title	Competencies	Key Competencies
1	Familiarization with MATLAB software	• Opening of new command window • Understand about command window and workspace • Able to perform simple mathematical calculations • Able to perform matrix operations • Understanding the procedure to save mat lab files • Procedure to open new file in Simulink • Understand about different tabs in Simulink • To know about different blocks in Simulink library browser • To draw simple circuits by using different blocks in Simulink library browser • understand the functional block 'scope' and able to use it • able to save the work done in simulink	• perform simple math calculations by using command window • Familiarization with different blocks available in Simscape/SIM Power systems
2	Simulation of DC Circuits	• Opening of new file in Simulink • Adding of all electrical components required from Simulink library browser to form a desired DC circuit to verify Thevenin's & Norton's theorems • Give appropriate values to all electric components • Adding 'scope' to view response • Press the run icon to process the circuit and the response will be viewed in scope • Save the work done in simulink	• Identification of required DC electrical components from Simulink library browser • Drawing the desired circuit in Simulink • Interpreting the results obtained through scope
3	Simulation of AC Circuits	• Opening of new file in Simulink • Adding of all electrical components required from Simulink library browser to form a desired AC circuit to verify Thevenin's & Norton's theorems • Give appropriate values to all electric components • Adding 'scope' to view response	• Identification of required DC electrical components from Simulink library browser • Drawing the desired circuit in Simulink • Interpreting the results obtained through scope

		• Press the run icon to process the circuit and the response will be viewed in scope • Save the work done in simulink	
4	Simulation of Power Electronic Converter circuits	• Opening of new file in Simulink • Adding the components required for single phase and three phase full wave rectifier for R load. • Adding the components for gate triggering pulses • Able to change the firing angle • Press the run icon to process the circuit and the response will be viewed in scope • Save the work done in simulink	• Identification of required Power electronic devices from Simulink library browser • Drawing of Single phase and three phase full wave converter circuit with R and RL loads. • Analyze the waveforms for different triggering angles
5	Simulation of DC and AC motor Drives	• Opening of new file in Simulink • Adding the components required for single phase full wave rectifier and three phase AC Voltage controller. • Identifying the BLDC, PMSM and Induction motors in simulink library browser and adding to simulink • Press the run icon to process the circuit and the response will be viewed in scope • Save the work done in simulink	• Identification of required Power electronic devices and motors from Simulink library browser • Drawing of speed control circuit to BLDC, PMSM and Induction motors in simulink • Analyze the response for different triggering angles

PLC AND SCADA LABORATORY

Course code	Course title	No. Of periods/week	Total No. of periods	Marks for FA	Marks for SA
EE-507	PLC and SCADA LABORATORY	3	45	40	60

S.No.	Unit Title	No. of Periods	CO'S Mapped
1.	Basics of PLC	6	CO1
2.	Ladder Diagrams for logic gates, timers and counters	6	CO2
3.	Ladder Diagrams for domestic applications	12	CO3
4.	Ladder Diagrams for industrial applications	12	CO4
5.	Supervisory Control and Data Acquisition(SCADA)	9	CO5
Total		**45**	

COURSE OBJECTIVES	i) To acquire the knowledge for PLC programming and operating. ii) To develop ladder diagrams for domestic and industrial applications. iii) Apply PLC Timers and Counters for the control of industrial processes and to develop a coil and contact control to operate analog PLC operations. iv) To understand the fundamentals of SCADA and to design programs of automated applications.

COURSE OUTCOMES	CO1	EE-507.1	Familiarise automation, its importance, expectations from automation andapplications in industry. Analyze the working of PLC, I/O modules of PLC, Programming languages and instructions of PLC.
	CO2	EE-507.2	Design and writing ladder diagrams for logic gates, timers and counters.
	CO3	EE-507.3	Designing a small automated ladder diagrams for domestic applications.
	CO4	EE-507.4	Designing a small automated ladder diagrams for industrial applications.
	CO5	EE-507.5	Understand the fundamental of SCADA systems, design of ON andOFF switch in SCADA,design programs of automated applications in SCADA.

LEARNING OUTCOMES

1. Basics of PLC

1. Demonstrate PLC architecture
2. Working with various tools available in PLC software
3. Preparation of ladder diagram, uploading of code to PLC and running the code on PLC
4. Ladder diagram for ON/OFF inputs to produce ON/OFF outputs.

2. Ladder Diagrams for logic gates, timers and counters

1. Execute ladder diagram for Logical Gates – AND gate, OR gate, NOT gate, NAND gate, NOR gate, EX-OR gate and EX-NOR gate
2. Execute the following Boolean expressions
   - $\bar{A}$ BC + $A\bar{B}$
   - $A\bar{B}\bar{C}$ + $\bar{C}$B + $\bar{A}$ CB
3. Execute ladder diagram to run the motor for a specified time using timers.
4. Execute the ladder diagram for blinking the LED until a key is pressed using timer.
5. Execute the ladder diagram for starting the motor after pressing the push button for three times using counters.

3. Ladder Diagrams for domestic applications

1 Execute ladder diagram for interfacing of lamp and button for ON / OFF operation
2 Execute ladder diagram for delayed operation of lamp by using PUSH button.
3 Execute ladder diagram by multiple push button operation with delayed lamp for ON/OFF operation.
4 Execute ladder diagram for Stair Case Lighting
5 Execute ladder diagram for sensing of temperature of the given liquid.

4. Ladder Diagrams for industrial applications

1 Execute ladder diagram for DOL starter
2 Execute ladder diagram for Star-Delta starter
3 Execute ladder diagram for PMDC Motor Speed Controller
4 Execute ladder diagram for Traffic Light Controller
5 Execute ladder diagram for rotating stepper motor in forward and reverse direction at constant speed.

5. Supervisory Control and Data Acquisition(SCADA)

1. Interface SCADA with PLC and perform read/ command transfer operation.
2. Design of ON and OFF switch in SCADA
3. Execute Parameter reading of PLC in SCADA.
4. Operate the PLC inputs through the switch symbol from the computer screen and view the
5. status of the outputs using lamp and motor graphics symbols in the screen.
6. Perform Alarm annunciation using SCADA.
7. Perform Reporting and Trending in SCADA System.
8. Perform temperature sensing using SCADA.

HYPONATED COURSE CONTENTS

1. **Basics of PLC**

   Demonstrate PLC architecture - Working with various tools available in PLC software - Preparation of ladder diagram - uploading of code to PLC and running the code on PLC

2. **Ladder Diagrams for logic gates, timers and counters**

   Execute ladder diagram for different Logical Gates - ladder diagram using timers & counters

3. **Ladder Diagrams for domestic applications**

   Execute ladder diagram for interfacing of lamp and button for ON / OFF operation - ladder diagram for delayed operation of lamp by using Push button - ladder diagram by multiple push button operation with delayed lamp for ON/OFF operation - ladder diagram with combination of counter and timer for lamp ON/OFF operation - ladder diagram for Stair Case Lighting - ladder diagram for Temperature Controller.

4. **Ladder Diagrams for industrial applications**

   Execute ladder diagram for DOL starter - ladder diagram for Star-Delta starter - ladder diagram for PMDC Motor Speed Controller - ladder diagram for Traffic Light Controller - ladder diagram for rotating stepper motor in forward and reverse direction at constant speed.

5. **Supervisory Control and Data Acquisition(SCADA)**

   Interface SCADA with PLC and perform read/ command transfer operation - Design of ON and OFF switch in SCADA - Execute Parameter reading of PLC in SCADA - Operate the PLC inputsthrough the switch symbol from the computer screen and view the status of the outputs using lamp and motor graphics symbols in the screen - Perform Alarm annunciation using SCADA - Perform Reporting and Trending in SCADA System - Perform temperature sensing using SCADA

Competencies & Key competencies to be achieved by the student

S. NO.	Experiment Title	Competencies	Key competencies
1	(i) Demonstrate PLC architecture and Ladder diagram (ii) Execute Ladder diagrams for different Logical Gates(iii) Execute Ladder diagrams using timers & counters	Identify the PLC trainer kit, the Personal Computer and Load PLC software	i) Test the ladder logic with logic gate examples ii) Test the ladder logic with Timer/Counter instructions in ladder diagrams
		Observe the input and output ports of the PLC	
		Make the interfacing between the PC and the PLC.	
		Prepare the appropriate ladder diagrams for different logic gates(AND, OR, NOT, NOR,NAND)	
		Save the ladder diagram with relevant file names	
		Execute each ladder diagram program and check for errors	
		Rectify errors if any then save and again execute the program	
		Download the Ladder Diagram program into the PLC	
		Run each program and check its output logic with relevant inputs.	
		Prepare simple ladder diagrams using timers and counters instructions	
		Execute ,Run and check the output logic for each program	
2	Execute Ladder diagrams with model applications (i) ladder diagram for interfacing of lamp and button for ON / OFF operation (ii) ladder diagram for delayed operation of lamp by using Push button (iii) ladder diagram by multiple push button operation with delayed lamp for ON/OFF operation(iv) ladder diagram with combination of counter and timer for lamp ON/OFF operation(v) ladder diagram for Stair	Identify the PLC trainer kit, the Personal Computer and Load PLC software	Execute the Ladder Diagram programs and observe the performance
		Observe the input and output ports of the PLC	
		Make the interfacing between the PC and the PLC.	
		Prepare the appropriate ladder diagrams for lamp ON/OFF operation	
		Save the ladder diagram with relevant file names	
		Execute each ladder diagram program and check for errors	
		Rectify errors if any then save and again execute the program	

	case Lighting vi) ladder diagram for sensing of temperature of the given liquid	Download the Ladder Diagram program into the PLC	
		Run each program and check its output logic with relevant inputs.	
3	Execute Ladder diagrams with model applications (i) ladder diagram for DOL starter (ii) ladder diagram for Star-Delta starter (iii) ladder diagram for PMDC Motor Speed Controller(iv) ladder diagram for Traffic Light Controller (v) ladder diagram for rotating stepper motor in forward and reverse direction at constant speed.	Identify the different available model application kits in the lab	Execute the ladder diagram programs and observe the performance
		Draw the ladder diagrams for the given program	
		Prepare the ladder diagrams in the Computer, save and execute the program	
		Make proper connections of the model application at the output port of PLC and download its relevant ladder diagram program in PLC	
		Run the ladder diagram program and observe the outputs with the model applications	
4	(i) Execute Parameter reading of PLC in SCADA (ii) the PLC inputs through the switch symbol from the computer screen and view the status of the outputs using lamp and motor graphics symbols in the screen (iii) Alarm annunciation using SCADA (iv) Reporting and Trending in SCADA System (v) temperature sensing using SCADA	Make the Interfacing between SCADA and PLC, perform read/ command transfer operation	Operate the buttons in SCADA and observe the outputs on the computer screen
		Develop switch symbols from the computer screen in SCADA to operate the PLC inputs	
		Observe the output in the computer screen	

LIFE SKILLS

Course code	Course title	No. Of periods/week	Total No. of periods	Marks for FA	Marks for SA
EE-508	LIFE SKILLS	3	45	40	60

Chapter No.	Title	No. of Periods
1	Attitude	4
2	Adaptability	4
3	Goal Setting	4
4	Motivation	4
5	Time Management	4
6	Critical Thinking	4
7	Creativity	4
8	Problem Solving	5
9	Team work	4
10	Leadership	4
11	Stress Management	4
	TOTAL	**45**

COURSE OBJECTIVES	understand the relevance of life skills in both personal and professional lives
	practice life skills complementarily in life-management to lead a happy and successful life

COURSE OUTCOMES	**CO1**	exhibit right attitude and be adaptable in adverse and diverse situations
	CO2	set appropriate goals and achieve them through proper planning, time management and self-motivation
	CO3	solve diverse real-life and professional problems with critical thinking and creativity for a stress-free life
	CO4	be an ideal team player and manifest as a leader

Course Delivery:

Text book: **"Life Skills" –** by State Board of Technical Education and Training, AP

COURSE CONTENT:

UNIT I:Attitude matters!
Preparatory activity-Role play; Generating word bank; Types of attitude. Read the passage and answer the related questions, read the story and discuss issues raised; Express opinions on the given topic and fill the grid with relevant words.

UNIT 2: **Adaptability… makes life easy!**
Pair work-Study the given pictures and understand adaptability -read the anecdote and discuss, read the story and answer the questions, role play

UNIT 3: Goal Setting… life without a goal is a rudderless boat!
Short term goals and long-term goals-SMART features, observe the pictures and answer questions - matching- read the passage and answer questions-filling the grid.

UNIT 4: Motivation… triggers success!
Types of motivation-difference between motivation and inspiration- matching different personalities with traits - dialogue followed by questions - writing a paragraph based on the passage.

UNIT 5: Time Management … the need of the hour!

Effective Time Management- Time quadrant - Group task on management of time- Time wasters-fill in the grid, read the story and answer the questions- prioritising tasks.

UNIT 6: Critical Thinking… Logic is the key!

Preparatory activity-read the passage and answer the questions- differentiate between facts and assumptions- components of critical thinking- complete the sets of analogies- choose the odd one out- true or false statements- decide which of the conclusions are logical.

UNIT 7: Creativity…. The essential YOU!!

Definition- Pre-activity-read the anecdote and answer the questions- matching celebrities with their fields of specialization - think of creative uses of objects- think creatively in the given situations.

UNIT 8: Problem Solving… there is always a way out!

Preparatory activity-read the story and answer the questions- discuss the given problem and come out with three alternative solutions- group activity to select the best solution among available alternatives- discuss the problem and plan to analyze it.

UNIT 9: Team Work… Together we are better!

Advantages of team work- Characteristics of a team player- Activity-Observe the pictures and classify them into two groups- team game - read the story and answer the questions- fill in the grid.

UNIT 10 : Leadership… the making of a leader!

Characteristics of effective leadership- styles of leadership- Activity-read the dialogue and answer the questions- identify the people in the picture and describe them- discuss leadership qualities of the given leaders- filling the grid- read the quotes and write the name of the leader.

UNIT 11: Stress Management … live life to the full !!

Types of stress- Strategies for Stress Management- Activity-read the passage and answer the questions, read the situation and write a paragraph about how to manage stress.

Mapping COs with POs

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**
COs	**POs 1 to 5 are applications of Engineering Principles, can't directly be mapped with Life Skills**					**1,2,3,4**	**1,2,3,4**

Unit wise Mapping of COs- POs

CO	**Course Outcome**	**CO Unit Mapped**	**PO mapped**	**Cognitive levels as per Bloom's Taxonomy** **R/U/Ap/An/Ev/Cr** **(Remembering / Understanding/ Applying/Analysing/ Evaluating/ Creating)**
CO 1	To exhibit right attitude and be adaptable to adverse and diverse situations	All Units (1 to 11)	6,7	U/Ap/ An
CO2	To set appropriate goals and achieve them through proper planning, time management and self-motivation	Units 3,4,5	6,7	U/Ap/An
CO3	To solve diverse real-life and professional problems with critical thinking and creativity	Units 6,7,8,11	6,7	U/Ap/An/ Ev/ Cr.

	for a stress-free life			
CO4	To be an ideal team player and manifest as a leader	Units 9,10	6,7	U/Ap/An/ Ev

DIGITAL ELECTRONICS AND MICROCONTROLLERS LABORATORY

Course Code	Course Title	No. of periods / Week	Total No. of Periods	Marks for FA	Marks for SA
EE-509	DIGITAL ELECTRONICS AND MICROCONTROLLERS LABORATORY	3	45	40	60

Chapter No.	Title	No. of periods	CO's Mapped
1.	Logic Gates	6	CO1
2.	Combinational Logic Circuits	6	CO2
3.	Sequential Logic Circuits	9	CO3
4	Basics of Microcontrollers	6	CO4
5	Programming on Microcontrollers	9	CO5

COURSE OBJECTIVES	i. To understand number representation and conversion between different representation in digital electronic circuits.
	ii. To analyze logic processes and implement logical operations using combinational logic circuits.
	iii. To know the importance of different peripheral devices and their interfacing to microcontrollers.
	iv.To know the design aspects of microcontrollers and to write assembly language programs of microcontrollers for various applications.

COURSE OUTCOMES	CO1	EE-509.1	Understand theory of Boolean Algebra & the underlying features of various number systems.
	CO2	EE-509.2	Apply the concepts of Boolean Algebra for the analysis & design of various combinational & sequential logic circuits.
	CO3	EE-509.3	Analyse the sequential logic circuits design both in synchronous and asynchronous modes for various complex logic and switching devices.
	CO4	EE-509.4	Interpret various peripheral devices to the microcontrollers.
	CO5	EE-509.5	Write assembly language program for microcontrollers and Design microcontroller-based system for various applications.

LEARNING OUTCOMES

1. Logic Gates

1.1 Verify the truth tables of basic gates and universal gates.
1.2 Show NAND gate and NOR gate as Universal gates.

2. Combinational Logic Circuits

2.1 Realize a given boolean function and obtain its truth table.
2.2 Construct half adder and full adder and verify the truth tables.
2.3 Verify the function of 74138 decoder IC.
2.4 Verify the working of Multiplexer (Using IC 74153)
2.5 Verify the functional table of 4-bit magnitude comparator 7485 IC.

3. Sequential Logic Circuits

3.1 Construct and verify the truth tables of NAND & NOR latches
3.2 Construct clocked RS FF using NAND gates and Verify its truth table.
3.3 Verify the truth table of JK FF using 7476 IC.
3.4 Construct D and T flip flops using 7476 and verify the truth tables.

4. Basics of Microcontrollers

4.1 Familiarization of 8051 Microcontroller Kit
4.2 Familiarization of 8051 simulator EDSIM 51 (or similar)

5. Programming on Microcontrollers

5.1 Write a program to demonstrate different register addressing techniques on 8051

5.2 Write a program to demonstrate Addition, subtraction, division and multiplication of 8 bit

numbers using immediate data access on 8051.

5.3 Write a program to Add and Subtract 16-bit numbers on 8051.

5.4 Control a RGB led with Arduino.

5.5 Interface an LCD display with Arduino.

5.6 Control a small pump using moisture sensor and Arduino

Note: 1. This subject is to be taught 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. **Logic Gates**
   Verify the truth tables of basic gates and universal gates - Show NAND gate and NOR gate as Universal gates.
2. **Combinational Logic Circuits**
   Realize a given boolean function and obtain its truth table - Construct half adder and full adder and verify the truth tables - Verify the function of 74138 decoder IC - Verify the working of Multiplexer (Using IC 74153) - Verify the functional table of 4-bit magnitude comparator 7485 IC.
3. **Sequential Logic Circuits**
   Construct and verify the truth tables of NAND & NOR latches - Construct clocked RS FF using NAND gates and Verify its truth table - Verify the truth table of JK FF using 7476 IC - Construct D and T flip flops using 7476 and verify the truth tables.
4. **Basics of Microcontrollers**
   Familiarization of 8051 Microcontroller Kit - Familiarization of 8051 simulator EDSIM 51 (or) similar
5. **Programming on Microcontrollers**
   Write small ALP to demonstrate different register addressing techniques - Write an ALP to demonstrate Addition, subtraction, division and multiplication of 8 bit numbers using immediate data access - Write an ALP to Add and Subtract 16 bit numbers – Arduino Programming

Competencies & Key competencies to be achieved by the student

Sl.No.	Experiment Title	Competencies	Key Competencies
1	Logic Gates	• Understand the connection patterns in bread board • Identifying and constructing circuits using the basic logic gates (NOT, OR, AND, NOR, NAND) and their truth tables. • Identifying and constructing circuits using the compound logic gates (EXOR, EXNOR) and their truth tables.	• Connection of devices with exact ratings as per circuit diagram in bread board • Ability to verify truth table
2	Combinational Logic Circuits	• Applying fundamental theorems, associative laws, distributive laws, commutative laws, and De Morgan's theorems to solve problems. • . Applying Boolean principles to perform logic circuit evaluation by using truth tables, simplification by fundamental theorems, and simplification by the Karnaugh map technique. • Minimizing logic circuits into sum of products (SOP) and product of sums (POS) form. • . Identifying types of encoding, decoding, multiplexer and de-multiplexer devices and describing their functions and uses.	• Ability to verify truth table • Ability to build half adder and full adder and verify the truth tables
3	Sequential Logic Circuits	• Ability to detect and respond to clock signals • Connection of circuit diagram on kit with proper input sources • Using CRO to observe frequency response waveform patterns	• Ability to detect and respond to changes in input signals • Ability to generate output signals based on input signals • Ability to detect and respond to enable

			signals
4	Basics of Microcontrollers	• Knowledge of microcontroller architecture and its components • Ability to write and debug assembly language programs • Knowledge of communication protocols	• Ability to write and debug assemblylanguage programs
5	Programming on Microcontrollers	• Understanding of the microcontroller's instruction set • Knowledge of embedded system design principles • Ability to interface with external devices	• Ability to write and debug C and assembly language programs • Ability to interface with external devices

PROJECT WORK

Course Code	Course Title	No. of periods / Week	Total No. of Periods	Marks for FA	Marks for SA
EE-510	PROJECT WORK	3	45	40	60

COURSE OBJECTIVES	• Enhance the knowledge by field visits • Provide with the opportunity to synthesize knowledge from various areas of learning • Critically and creatively apply it to real life situations

COURSE OUTCOMES	CO1	Organising teamwork.
	CO2	Innovative learning.
	CO3	Apply theoretical knowledge to practical work situations.
	CO4	Practice technical project reports preparation and presentation.

LEARNING OUTCOMES

Upon completion of the course the student shall be able to

1. Problem solving and Critical Thinking

1.1. Generate Ideas from electrical courses and develop the ideas.
1.2. Gather relevant Information.
1.3. Evaluate Ideas.
1.4. Apply these ideas to a specific task.
1.5. Execute appropriate Laboratory skills
1.6. Draw Appropriate Conclusions

2. Communication

2.1 Communicate effectively.
2.2 Present Ideas Clearly.
2.3 Present Ideas Coherently.
2.4 Report writing.

3. Collaboration

3.1 Discuss the ideas.
3.2 Coordinate with team members
3.3 Team work in accomplishing the task.

4. Independent Learning

4.1 Involves in the group task.

4.2 Analyze the appropriate actions.

4.3 Compares merits and demerits

4.4 Analyze the activities for sustain.

4.5 Analyze the activities to ensure ethics

5. Ethics

5.1 Give respect and value to all classmates, educators, colleagues, and others

5.2 Understand the health, safety, and environmental impacts of their work

5.3 Recognize the constraints of limited resources

5.4 Develop sustainable products and processes that protect the health, safety, and prosperity of future generations

5.5 Maintain integrity in all conduct and publications and give due credit to the contributions of others

COURSE CONTENT

1.0 Design/Assembling/Analysis/CaseStudy Projects in the areas of Electrical & Electronics Engineering

Weightage of marks for Assessment of Learning Outcomes of Project work

S.No	Item	Marks
1	**Internal Marks** Completion of Assigned task in the group/individual to complete the project	**40**
	End Exam Marks: i) Demonstration of skill relevant to the project (30) ii) Project Report (20) iii) Viva Voce (10)	**60**
Total marks		**100**

- End Examination assessment shall be done by HEEES, external examiners and faculty members who guided the students during project work.
- The external examiner shall be from an industry/organisation/Head of EEE of other polytechnic/Senior faculty of other polytechnic.

VI SEMESTER

DIPLOMA IN ELECTRIAL AND ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
VI SEMESTER
INDUSTRIAL TRAINING

<table>
<tr><th rowspan="2">SI. No.</th><th rowspan="2">Course Title</th><th rowspan="2">Duration</th><th colspan="3">Scheme of evaluation</th><th>Remarks</th></tr>
<tr><th>Item</th><th>Nature</th><th>Max. Marks</th><th></th></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Industrial Training</td><td rowspan="5">6 months</td><td>1.First Assessment at training place/ Industry (After 12 Weeks)</td><td>Assessment of Learning outcomes by both the faculty and training Mentor of the industry</td><td>120</td><td rowspan="2">Pass marks is 50% in assessment at training place/industry (first and second assessment put together)</td></tr>
<tr><td>2.Second Assessment at training place/Industry (After 20 weeks)</td><td>Assessment of Learning outcomes by both the faculty and training Mentor of the industry</td><td>120</td></tr>
<tr><td rowspan="3">Final Summative assessment at institution level after completion of training.</td><td>Training Report</td><td>20</td><td rowspan="3">Pass marks is 50% in final summative assessment</td></tr>
<tr><td>Demonstration of any one of the skills listed in learning outcomes</td><td>30</td></tr>
<tr><td>Viva Voce</td><td>10</td></tr>
<tr><td colspan="5">TOTAL MARKS</td><td>300</td><td></td></tr>
</table>

INDUSTRIAL TRAINING

Subject Title	Subject Code	Duration
Industrial Training	EE-601	6 months

Time schedule

S.NO	Code	TOPICS	Duration
1	EE-601	• Practical training in Industry • Training Report Preparation Report Preparation: Title Page, Certificate, Acknowledgements, Abstract, Contents(introduction of Industry, Organization Chart, List of Major Equipments, List of Processes: Skills Acquired; Conclusions; Bibliography	Six Months

Upon completion of the course the student shall be able to	
COURSE OBJECTIVES	1. Expose to real time working environment 2. Enhance knowledge and skill already learnt in the institution. 3. Acquire the required skills of assembling, dismantling, testing, trouble shooting, observing and supervising in electrical engineering fields.

COURSE OUTCOMES	CO1	Apply theory to practical work situations
	CO2	Cultivate sense of responsibility and good work habits
	CO3	Exhibit the strength, teamwork spirit and self-confidence
	CO4	Gaining knowledge in installations, manufacturing, operations and maintaining various electrical goods and appliances.
	CO5	Writing reports and auditing in electrical projects.

LEARNING OUTCOMES

The student shall be able to display the following skill sets

1) Demonstration Skills
2) Reading drawings and analysing Specifications
3) Handling Tools/Instruments/Materials/Machines
4) Assembling, dismantling, testing, trouble shooting and maintenance skills.
5) Assess and Control of quality parameters
6) Planning, Organizing, recording and report submission Skills

SCHEME OF EVALUATION

Sl .No.	**Course Title**	**Duration**	**Scheme of evaluation**		
			Item	**Nature**	**Max. Marks**
1	Industrial Training	6 months	1.First Assessment at Industry (After 12 Weeks)	Assessment of Learning outcomes by both the faculty and training Mentor of the industry	120
			2.Second Assessment at the Industry (After 20 weeks))	Assessment of Learning outcomes by both the faculty and training Mentor of the industry	120
			Final Summative assessment at institution level	Training Report	20
				Demonstration of any one of the skills listed in learning outcomes	30
				Viva Voce	10
TOTAL MARKS					**300**

Weightage of marks for Assessment of Learning Outcomes during first and second assessment

Sl.No	Learning Outcome	Max Marks Allotted For each parameter	Marks secured for each parameter
1	Demonstration Skills	20	
2	Reading drawings and analysing Specifications	20	
3	Handling Tools/Instruments/Materials/machines	20	
4	Assembling, dismantling, testing, trouble shooting and maintenance skills.	20	
5	Assess and Control of quality parameters	15	
6	Planning, Organizing, recording and report submission Skills	25	
	Total	**120**	

During assessment the performance of the students shall be assessed in those skills in which the student has been trained and be awarded the marks as per the weightage assigned as above. In case the student has undergone training in a few skill sets then the total marks obtained shall be raised to 120 marks for the given assessment i.e. either assessment 1 or 2. However the performance of the student shall be assessed at the most skill sets listed above but not less than three skill sets.

Illustration

If the student has undergone training in only 4 skill sets (namely serial number 1, 3, 4, 5 of above skill sets) and marks awarded during assessment is 50 out of 80 marks, then the marks of 50 shall be enhanced to 120 proportionately as (50/80)*120=75.

GUIDELINES FOR INDUSTRIAL TRAINING OF DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING PROGRAMME:

1. Duration of the training: 6 months.
2. Eligibility: As per SBTET norms
3. Training Area: Students can be trained in APGENCO/APTRANSCO/APDISCOM/Captive Power plants/Wind power plants,/Solar power plants/Milk factories/Railways/Roadways/Communication sectors/Television sectors/Public and private Organizations or industries or companies etc., related to electrical & electronics fields.
4. The Industrial Training shall carry 300 marks and pass marks is 50% in assessment at industry (first and second assessment put together) and also 50% in final summative assessment at institution level.
5. Formative assessment at industry level shall be carried out by the representative of the industry, where the student is undergoing training and the faculty from the concerned section in the institution.
6. If the student fails to secure 50% marks in industrial assessments put together, the student should reappear for 6 months industrial training at his/her own expenses.
7. If the student fails to secure 50% marks in final summative assessment at institution level, the student should reappear for final summative assessment in the subsequent board examination.
8. Final Summative assessment at institution level is done by a committee including **1. Head of the section (of concerned discipline ONLY), 2. External examiner from an industry and 3. Faculty member who assessed he student during industrial training as member.**
9. During Industrial Training the candidate shall put a minimum of 90% attendance.
10. If the student fails to secure 90% attendance during industrial training, the student should reappear for 6 months industrial training at his/her own expenses.

Guidelines and responsibilities of the faculty members who are assessing the students performance during industrial training:

- Shall guide the students in all aspects regarding training.
- Shall create awareness regarding safety measures to be followed in the industry during the training period, and shall check it scrupulously.
- Shall check the logbook of the students during the time of their visit for the assessment.
- Shall monitor progress at regular intervals and make appropriate suggestions for improvement.
- Shall visit the industry and make first and second assessments as per stipulated schedules.
- Shall assess the skill sets acquired by the students during their assessment.
- Shall award the marks for each skill set as per the marks allotted for that skill set during 1st and 2nd assessments
- Shall voluntarily supplement students learning through appropriate materials like photographs, articles, videos etc.
- Shall act as co-examiner along with other examiners in the final assessment at institution.
- Shall act as liaison between the student and mentor.

- Shall maintain a diary indicating his observation with respect to the progress of students learning in all three domains (Cognitive, Psychomotor and Affective).

Guidelines to the Training Mentor in the industry:

- Shall train the students in all the skill sets as far as possible.
- Shall assess and award the marks in both the assessments along with the faculty member.
- Shall check and approve the log books of the students.
- Shall approve the attendance of each student at the end of the training period.
- Shall report to the guide about student's progress, personality development or any misbehavior as the case may be.
- ✓ **Every Teacher (including HoD if not holding any FAC) shall be assigned a batch of students of 10 to 15 for industrial training irrespective of student's placements for training.**

Rubrics for assessment
Department of Technical Education
Industrial training assessment

PROFORMA

1. Name of the institution :
2. PIN :
3. Name of the student :
4. Assessment Period (I / II) : FROM: TO:

Skill Set Sl. No	*SKILL SET*	Max Marks Allotted For each parameter	Precisely completes the task	Completes the task, mistakes are absent, but not Precise	Completes the task, Mistakes are a few	Makes attempt, Mistakes are many
1	**Technical Skills (Manufacturing/Service/ Name plate details /Identification of Tools components etc.,) (20)**					
	(i) Identification of components and tools.	*5*	*5*	*3*	*2*	*1*
	(ii) Identification of name plate details of machine/equipment. (iii) Explaining manufacturing procedure.	*5*	*5*	*3*	*2*	*1*
		5	*5*	*3*	*2*	*1*
	(iv) Identification of service requirement.	*5*	*5*	*3*	*2*	*1*
2	**Reading, Observing, drawing and analysing Specifications. (15)**					
	(i) Analysing specifications of machine/ equipment.	*5*	*5*	*3*	*2*	*1*
	(ii) Drawing circuit diagram/schematic diagram of the manufacturing process. (iii) Observing readings of various parameters.	*5*	*5*	*3*	*2*	*1*
		5	*5*	*3*	*2*	*1*

3	**Using of Tools/Instruments /Materials/Machines (20)** *(i) Use of proper Tools/Instruments* *(ii) Materials/Machinery required for the process*	*10* *10*	*10* *10*	*7* *7*	*6* *6*	*3* *3*
4	**Assembling, dismantling, testing, repair and maintenance skills (20)** *(i) Assembling and Dismantling (ii) Testing* *(iii) Repair and maintenance*	*10* *5* *5*	*10* *5* *5*	*7* *3* *3*	*6* *2* *3*	*3* *1* *2*
5	**Assess and Control of quality parameters, Practice of Safety measures and Precautions while handling the Electrical equipment (20)** *(i) Assess and control of quality parameters.* *(ii) Safety and precautions for handling the equipment.*	*10* *10*	*10* *10*	*7* *7*	*6* *6*	*3* *3*
6	**Planning, Organizing, Recording, Communicating, Supervising and report submission Skills** *(25)* *(i) Planning and organizing. (ii) Maintenance of records in the work place.* *(iii) Communication and Supervising skill.* *(iv) Reporting technical issues.*	*10* *5* *5* *5*	*10* *5* *5* *5*	*7* *3* *4* *3*	*6* *3* *3* *3*	*4* *2* *2* *2*

TOTAL MARKS OBTAINED FOR 120	

NOTE: Mistakes are with reference to Technique, Procedure & precautions, while precision refers to technique, procedure, precautions, time & result.

(Marks awarded in words: **)**

Signature of the Training In-charge (Mentor) Name Designation	Signature of the faculty incharge (Guide) Name Designation

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