

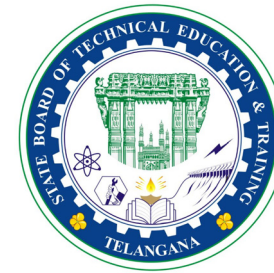
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**CURRICULUM – 2014**

**(C-14)**

**DIPLOMA IN  
ELECTRICAL & ELECTRONICS  
ENGINEERING**

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**State Board of Technical Education & Training  
Telangana State  
HYDERABAD**

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## CURRICULUM ( C-14 ) FOR DIPLOMA COURSES IN Telangana

**I. PREAMBLE**

The State Board of Technical Education and Training, **Telangana** under the aegis of the Department of Technical Education, Telangana generally reviews the Curricula once in every five years. However, recognizing the changing needs as stated by the user industries, the Board has decided to bring forward the revision of curriculum. Consequently, the Board with the assistance of NITTTR, Chennai under the guidance of Prof. C. Nagendra Rao, performed the evaluation of C-09 Curriculum in force. On finding the merits and demerits of C-09 Curriculum the faculty have made a thorough assessment of the curricular changes that have to be brought in. It was felt that there is an urgent need to improve hands-on experience among the students pursuing diploma courses. Further, the urgency of enhancing communication skills in English was also highlighted in the feedback and suggestions made by the user industries. Keeping these in view, a number of meetings and deliberations were held at district and state level, with experts from industry, academia and senior faculty of the department. The new Curricula for the different diploma courses have been designed with the active participation of the members of the faculty teaching in the Polytechnics of Telangana, besides reviewed by Expert Committee constituted with eminent academicians.

The primary objective of the curricular change is to produce best technicians in the country by correlating growing needs of the industries with the academic input.

The revised New Curriculum i.e., Curriculum – 2014 or C-14 is vetted by NITTTR, Chennai followed by BoG approval of SBTET for its implementation with effect from 2014-15.

**Salient Features:**

1. Duration of course is either 3 years / 3½ years duration of Regular Academic Instruction.
2. The Curriculum is prepared in Semester Pattern. However, First Year is maintained as Year-wise pattern.
3. 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.

4. 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 introduced in IV and V semesters respectively for all the branches except Chemical Engineering and Chemical Engineering (Sugar Technology) for which life skills is introduced at 3<sup>rd</sup> semester level..
5. In addition to Engineering Mathematics in I year (Mathematics -102) and III semester (Mathematics-301), Mathematics-401 has been introduced in the IV semester of present syllabus.
6. Modern topics relevant to the needs of the industry and global scenario suitable to be taught at Diploma level are also incorporated in the curriculum.
7. CAD specific to the branch has been given more emphasis in the curriculum. Preparing drawings using CAD software has been given more importance.
8. Every student is exposed to the computer lab at the 1<sup>st</sup> year itself in order to familiarize himself with skills required for keyboard/mouse operation, internet usage and e-mailing.
9. The number of teaching hours allotted to a particular topic/chapter has been rationalized keeping in view the past experience
10. Upon reviewing the existing C-09 curriculum, it is found that the theory content is found to have more weightage than the Practical content. In the revised C-14 curriculum, more emphasis is given to the practical content of Laboratories and Workshops, thus strengthening the practical skills.
11. 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. While the course content in certain subjects is reduced, in rest of the subjects the content has been enhanced as per the need.
12. A new subject "**Field Practices**" is introduced in 5<sup>th</sup> Semester. In Field Practices, the students will perform all the industry oriented activities for all types of Field tastings and make use of the machinery, equipment and tools actually used in the industry. By this, the student will get first-

hand experience of performing various practical procedures and field experiments to enhance their skills.

13. All Practical subjects are independent of each other and the practice of grouping two or more practical subjects is dispensed with.
14. Curriculae 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 at the Polytechnics. The experiments /exercises that are chosen for the practical sessions are identified to conform to the field requirements of industry.
15. The Members of the working group are grateful to Sri Ajay Jain, I.A.S., Commissioner of Technical Education & Chairman, S.B.T.E.T. and Smt.Sailaja Ramaiyer, I.A.S., for their guidance and valuable inputs in revising, modifying and updating the curriculum.
16. The Members acknowledge with thanks the cooperation and guidance provided by the Sri. D. Venkateswarlu, Secretary, SBTET, Telangana and Dr. CN Rao, Professor and Head, NITTTR, ECH and other officials of Directorate of Technical Education and the State Board of Technical Education, Telangana, experts from industry, academia from the universities and higher learning institutions and all teaching fraternity from the Polytechnics who are directly and indirectly involved in preparation of the curricula.

## II. RULES AND REGULATIONS

### 1. ADMISSION PROCEDURES :

#### 1.1 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 Electronics with specialization in CP/ CN/ IE/ TV/ BM/ Embedded systems, the training will be in the seventh semester.

#### 1.2 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.

- i) Candidates who wish to seek admission in any of the Diploma courses will have to appear for Common Entrance Test for admissions into Polytechnics (POLYCET) conducted by the State Board of Technical Education and Training, Telangana, Hyderabad.

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 the X class examination, conducted by the Board of Secondary Examination, Telangana or equivalent examination thereto, at the time of making application to the Common Entrance Test for Polytechnics for admissions into Polytechnics (POLYCET). In case of candidates who apply pending results of their qualifying examinations, their selection shall be subject to production of proof of their passing the qualifying examination in one attempt or compartmentally at the time of interview for 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 Telangana 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.

1). D.H.M.C.T. 2). D.Pharmacy

### 1.3 MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

### 1.4 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 candidate so as to facilitate this work and avoid errors in tabulation of results.

### 1.5 NUMBER OF WORKING DAYS PER SEMESTER / YEAR:

- a). The Academic year for all the Courses usually shall be from Fifteenth June of the year of admission to the 31<sup>st</sup> March of the succeeding year.
- b). The Working days in a week shall be from Monday to Saturday
- c). There shall be 7 periods of 50 minutes duration 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 cover the syllabus.

### 1.6 ELIGIBILITY OF 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 upto 10% (65% and above and below 75%) in each semester or 1<sup>st</sup> year may be granted on medical grounds.
- c). Candidates having less than 65% attendance shall be detained.
- d). Students whose shortage of attendance is not condoned in any semester / 1<sup>st</sup> year 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 / 1<sup>st</sup> year when offered next.
- e). A stipulated fee shall be payable towards condonation for shortage of attendance.

**1.7 READMISSION**

Readmission shall be granted to eligible candidates by the respective RJD / Principal.

- 1) Within 15 days after commencement of class work in any semester (Except industrial Training).
- 2) 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.

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, after readmission is granted.

**2. SCHEME OF EXAMINATION****2.1 a) First Year**

**THEORY EXAMINATION:** Each Subject carries 80% marks with examination of 3 hours duration, along with 20% marks for internal evaluation. (Sessional marks). However, there are no minimum marks prescribed for sessionals.

**PRACTICAL EXAMINATION:** There shall be 40% Marks for regular practical work done, i.e. sessional marks for each practical subject with an end examination of 3 hours duration carrying 60% marks. However, there are no minimum marks prescribed for sessionals.

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

**THEORY EXAMINATION:** Each subject carries usually 80 marks and 40 marks in respect of specified subjects of 3hours duration, along with 20/ 10 marks for internal evaluation (sessional marks) respectively.

**PRACTICAL EXAMINATION:** Each subject carry 30/60 marks of 3hours duration 20/40 sessional marks.

**2.2 INTERNAL ASSESSMENT SCHEME**

- a) Theory Subjects: Theory Subjects carry 20 % sessional marks, Internal examinations will be conducted for awarding sessional marks on the dates specified. **Three unit tests will be conducted for I year students**

**and two Unit Tests for semesters.** Average of marks obtained in all the prescribed tests will be considered for awarding the sessional marks.

- b) Practicals: Student's performance in Laboratories / Workshop shall be assessed during the year of study for 40% marks in each practical subject. Allotment of marks should be discrete taking into consideration of the students skills, accuracy, recording and performance of the task assigned to him / her. Each student has to write a record / log book for assessment purpose. In the subject of Drawing, which is also considered as a practical paper, the same rules hold good. Drawing exercises are to be filed in seriatum.
- c) Internal assessment in Labs / workshops / Survey field etc., during the course of study shall be done and sessional marks shall be awarded by the concerned Lecturer / Senior Lecturer / Workshop superintendent as the case may be.
- 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 the department preferably choosing a person from an Industry. 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 all the experiments / exercise prescribed.
- f) Records pertaining to internal assessment marks of both theory and practical subjects are to be maintained for official inspection.
- g) **In case of Diploma courses having Industrial Training**, the training assessment shall be done and marks be awarded in the following manner.

Industrial assessment	:	200 marks (in two spells of 100 marks each)
Maintenance of log book	:	30 marks
Record Work	:	30 marks
Seminar / viva-voce	:	40 marks
		_____
TOTAL	:	300 marks
		_____

The assessment at the institute level will be done by a minimum of three members Internal Faculty, Industrial Experts and H.O.D. and be averaged.

- h) In case of Diploma courses **not having Industrial Training** in the curriculum, the students shall make **Industrial visits** as per the schedule given below:

S.No	Semester	Nature of Training/Exposure	Duration
1	III Semester	Industrial Visits	5 no. (One week)
2	IV Semester	Industrial Visits	5 no. (One week)
3	End of Semester Vacation of IV Semester	Industrial Training	4 Weeks
4	V Semester	Industrial Visits	5 no. (one Week)
		Simulated Industrial Training (Field Practices)	3 Weeks
5	VI Semester	Industrial Visits	5 no. (one Week)
<b>Total</b>			<b>11 Weeks</b>

**NOTE:** No Marks shall be awarded for the above industrial visits. However, it will be evaluated as satisfactory/unsatisfactory.

### 2.3 MINIMUM PASS MARKS

#### THEORY EXAMINATION:

For passing a theory subject, 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.

#### PRACTICAL EXAMINATION:

For passing a practical subject, a candidate has to secure, a minimum of 50% in end examination and a combined minimum of 50% of both sessional and practical 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 subjects of D.C.C.P course.

### 2.4 PROVISION FOR IMPROVEMENT

- Improvement is allowed only after he / she has completed all the subjects from First Year to Final semester of the Diploma.
- Improvement is allowed in any 4 (Four) subjects of the Diploma.
- The student can avail of this improvement chance only once, that too within the succeeding two examinations after the completion of Diploma, with the condition that the duration including Improvement examination shall not exceed FIVE years from the first admission.

- No improvement is allowed in Practical / Lab subjects or Project work or Industrial Training assessment. However, improvement is allowed in drawing subject.
- If improvement is not achieved, the marks obtained in previous Examinations hold good.
- Improvement is not allowed in respect of the candidates who are punished under Mal-practice in any Examination.
- Examination fee for improvement shall be paid as per the notification issued by State Board of Technical Education and Training from time to time.
- 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.

### 3 RULES OF PROMOTION TO NEXT LEVEL :

#### 3.1 For Diploma Courses (Except HMCT, Architecture, Chemical-Sugar & Auto mobile Engineering) From 1<sup>ST</sup> YEAR TO 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup> Semesters:

- A candidate shall be permitted to appear for first year examination provided he / she puts in 75% attendance and pays the examination fee. However, he/she can be condoned on Medical grounds upto 10% ( i.e. attendance after condonation on Medical grounds should not be less than 65%) and he/she has to pay the condonation fee along with examination fee.
- A candidate shall be promoted to 3<sup>rd</sup> 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 3<sup>rd</sup> semester.
- A candidate shall be promoted to 4<sup>th</sup> semester provided he/she puts the required percentage of attendance in the 3<sup>rd</sup> semester and pays the examination fee. A candidate who could not pay the 3<sup>rd</sup> 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 4<sup>th</sup> semester.

A candidate is eligible to appear for the 4<sup>th</sup> semester exam if he/she

- i) Puts the required percentage of attendance in the 4<sup>th</sup> semester
- ii) Should not have failed in more than Four backlog subjects of 1<sup>st</sup> year
4. A candidate shall be promoted to 5<sup>th</sup> semester provided he / she puts the required percentage of attendance in the 4<sup>th</sup> semester and pays the examination fee on fulfilment of 3(i)(ii) clauses stated above. A candidate, who could not pay the 4<sup>th</sup> 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 5<sup>th</sup> semester.

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

- i) Puts the required percentage of attendance in the 5<sup>th</sup> semester
- ii) Should have obtained eligibility to appear for 4<sup>th</sup> Semester examination.

**For IVC students.**

- i) Puts the required percentage of attendance in the 5<sup>th</sup> semester
- ii) Should have appeared for 4<sup>th</sup> Semester examination.
- iii) Should not have failed in more than Four backlog subjects of III Semester
5. A candidate shall be promoted to 6<sup>th</sup> semester provided he/she has puts the required percentage of attendance in the 5<sup>th</sup> semester and pay the examination fee, a candidate who could not pay the 5<sup>th</sup> 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 6<sup>th</sup> semester.
- A candidate is eligible to appear for 6<sup>th</sup> semester examination if he/she
- i) Puts the required percentage of attendance in 6<sup>th</sup> semester and
- ii) Should not have failed in more than six backlogs subjects of 1<sup>st</sup> year, 3<sup>rd</sup> & 4<sup>th</sup> semesters put together.

**For IVC students.**

- i) Puts the required percentage of attendance in the 6<sup>th</sup> semester
- ii) Should have obtained eligibility to appear for V semester examination.
- iii) Should not have failed in more than Six backlog subjects of III & IV Semester put together.

**3.2 For HMCT, Architecture and Chemical - Sugar courses**

- 1) The same rules are applicable on par with other diploma courses with the exception that the Industrial Training is in the 5<sup>th</sup> semester.
- 2) A candidate shall be promoted to 5<sup>th</sup> semester (Industrial Training) provided he/she puts the required percentage of attendance in the 4<sup>th</sup> semester and pay the examination fee. A candidate, who could not pay the 4<sup>th</sup> semester examination fee, has to pay the promotion fee as prescribed by the SBTET from time to time before commencement of 5<sup>th</sup> semester (Industrial Training).
- 3) A candidate shall be promoted to 6<sup>th</sup> semester of the course provided he/she has successfully completed the Industrial Training (Passed).
- A candidate is eligible to appear for the 6<sup>th</sup> semester examination if he/she
- (i) Puts the required percentage of attendance in 6<sup>th</sup> semester.
- (ii) Should not have failed in more than six backlog subjects of 1<sup>st</sup> Year, 3<sup>rd</sup> & 4<sup>th</sup> semesters put together.

**For IVC students**

- i) Puts the required percentage of attendance in the 6<sup>th</sup> semester
- ii) Should have completed the Industrial Training.
- iii) Should not have failed in more than Six backlog subjects of III & IV Semester put together.

**3.3 For Automobile Engineering Course**

The same rules are applicable on par with other diploma courses with the exception that the Industrial Training is in the 6<sup>th</sup> semester. A Candidate shall be promoted to 6<sup>th</sup> semester provided he/she puts the required percentage of attendance in 5<sup>th</sup> semester and pay the examination fee. A candidate, who could not pay the 5<sup>th</sup> semester examination fee, has to pay the promotion fee prescribed by SBTET from time to time before commencement of 6<sup>th</sup> semester (Industrial Training).

Or

The Automobile Engineering Industrial Training may be shifted to 5<sup>th</sup> semester on par with **HMCT/ARCH/CH (ST)**



### 3.4 For Diploma Courses of 3 ½ Years duration:

#### 3.4.1 MET/ CH/ CHPP/ CHPC/ CHOT/ TT

1. A candidate shall be permitted to appear for 1<sup>st</sup> 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.
2. A candidate shall be promoted to 3<sup>rd</sup> semester if he/she puts the required percentage of attendance in the 1<sup>st</sup> year and pays the examination fee. A candidate who could not pay the 1<sup>st</sup> 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 3<sup>rd</sup> semester.
3. A candidate shall be promoted to 4<sup>th</sup> semester provided he/she puts the required percentage of attendance in the 3<sup>rd</sup> semester and pay the examination fee. A candidate, who could not pay the 3<sup>rd</sup> 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 4<sup>th</sup> semester.  
A candidate is eligible to appear for the 4<sup>th</sup> semester exam if he/she
  - i) Puts the required percentage of attendance in the 4<sup>th</sup> semester
  - ii) Should not have failed in more than Four backlog subjects of 1<sup>st</sup> year.
4. A candidate shall be promoted to 5<sup>th</sup> semester provided he / she puts the required percentage of attendance in the 4<sup>th</sup> semester and pays the examination fee. A candidate, who could not pay the 4<sup>th</sup> 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 5<sup>th</sup> semester.
5. Promotion from 5<sup>th</sup> to 6<sup>th</sup> semester is automatic (i.e., from 1<sup>st</sup> spell of Industrial Training to 2<sup>nd</sup> spell) provided he/she puts the required percentage of attendance, which in this case would be 90 % attendance and attends for the VIVA-VOCE examination at the end of training.
6. A candidate shall be promoted to 7<sup>th</sup> semester of the course provided he/she has successfully completed both the spells of Industrial Training (Passed).  
A candidate is eligible to appear for 7<sup>th</sup> semester examination if he/she
  - i) Puts the required percentage of attendance in the 7<sup>th</sup> semester and
  - ii) Should not have failed in more than 6 backlog subjects of 1<sup>st</sup> year, 3<sup>rd</sup> and 4<sup>th</sup> semesters put together.

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- iii) Should not have failed in more than six backlog subjects of 3<sup>rd</sup> and 4<sup>th</sup> semester put together for IVC students.

#### 3.4.2 For Diploma Courses of 3 ½ Years duration:

##### FW

- i) In respect of Diploma in Footwear Technology, the Industrial training is offered in two spells, the 1<sup>st</sup> spell of Industrial training after the First Year (i.e. III semester of the course) and the second spell of industrial training after the V semester (i.e VI Semester of the course). The promotion rules for this course are on par with the other sandwich Diploma courses except that there is no restriction on number of backlog subjects to get eligibility to appear for the 4<sup>th</sup> semester examination and ,  
A candidate is eligible to appear for 5<sup>th</sup> semester examination if he/she
  1. Puts the required percentage of attendance in the 5<sup>th</sup> semester and
  2. Should not have failed in more than four subjects of 1<sup>st</sup> year.
- ii) A candidate shall be promoted to 7<sup>th</sup> semester of the course provided he/she has successfully completed second spell of Industrial Training (Passed).  
A candidate is eligible to appear for 7<sup>th</sup> semester examination if he/she
  1. Puts the required percentage of attendance in the 7<sup>th</sup> semester and
  2. Should not have failed in more than 6 backlog subjects of 1<sup>st</sup> year and 4<sup>th</sup> semesters put together.
  3. Should not have failed in more than six backlog subjects of 4<sup>th</sup> and 5<sup>th</sup> semester  
put together for IVC students.

#### 3.4.3 For Diploma Courses of 3 ½ Years duration:

##### BM

- The same rules as are applicable for conventional courses also apply for these courses. Since the industrial training in respect of these courses is restricted to one semester (6 months) after the 6<sup>th</sup> semester (3 years) of the course.
- A candidate shall be promoted to 7<sup>th</sup> semester provided he/she puts the required percentage of attendance in 6<sup>th</sup> semester and pay the examination fee. A candidate, who could not pay the 6<sup>th</sup> semester examination fee, has to pay the promotion fee prescribed by SBTET

from time to time before commencement of the 7<sup>th</sup> semester (Industrial Training).

**OR**

Run through system for 1<sup>st</sup> Year and 3<sup>rd</sup> semester to 6/7<sup>th</sup> semester provided that the student puts in 75% of attendance (which can be condoned on medical grounds upto 10%) i.e. attendance after condonation on medical grounds should not be less than 65%.

### 3.5 OTHER DETAILS

- In case a candidate does not successfully complete the Industrial training, he / she will have to repeat the training at his / her own cost.
- The I spell of Industrial training shall commence 10 days after the completion of the last theory examination of 4<sup>th</sup> Semester.
- The Second spell of Industrial training shall commence within 10 days after the completion of I spell of Industrial training.
- Each Semester of Institutional study shall be a minimum of 90 working days. (With 6 working days in a week i.e. from Monday to Saturday, with 7 periods of 50 minutes, duration per day.

## 4 STUDENTS PERFORMANCE EVALUATION

### 4.1 AWARD OF DIPLOMA

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

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

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

With respect to the intermediate vocational candidates who are admitted directly into diploma course at the 3<sup>rd</sup> semester (i.e., second year) level the aggregate of (100%) marks secured at the 3<sup>rd</sup> and subsequent semesters of study shall alone be taken into consideration for

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

- Second Class shall be awarded to all students, who fail to complete the Diploma in the regular three years and four subsequent examinations, from the first admission.

### 4.2 EXAMINATION FEE SCHEDULE:

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

### 4.3 STRUCTURE OF END EXAMINATION QUESTION PAPER:

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 subject be considered.

Examination paper is of 3/6/9 hour's duration.

- Each theory paper consists of Section 'A' and Section 'B'. Section 'A' contains 10 short answer questions. All questions are to be answered and each carries 3 marks Max. Marks: 10 x 3 = 30.

Section B contains 8 essay type questions including Numerical questions, out of which 5 questions each carrying 10 marks are to be answered.

Max.Marks: 5 x 10 = 50.

Total Maximum Marks: 80.

- For Engineering Drawing Subject (107) consist of section 'A' and section 'B'. Section 'A' contains four (4) questions. All questions in section 'A' are to be answered and each carries 5 marks. Max. Marks: 4 x 5=20. Section 'B' contains six (6) questions. Out of which four (4) questions to be answered and each question carries 10 Marks. Max. Marks 4 x 10 = 40.

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 : 60%

In case of practical examinations with 50 marks, the marks will be worked out basing on the above ratio.

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

#### 4.4 ISSUE OF MEMORANDUM 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, Telangana. for each duplicate memo.

#### 4.5 MAXIMUM PERIOD FOR COMPLETION OF DIPLOMA COURSES:

Maximum period for completion of the course 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.

#### 4.6 ELIGIBILITY FOR AWARD OF DIPLOMA

A candidate is eligible for award of Diploma Certificate if he / she fulfils 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 has completed all the subjects.

Students who fail to fulfill 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.

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

- 4.7.1 a) A candidate desirous of applying for Recounting/ issue of Photo copy of valued answer scripts/ Reverification should submit the application to the Secretary, State Board of Technical Education and Training, Telangana., Hyderabad – 500 063 within 15 days from the date

of receipt of Tabulated Marks Statement by the Principal of concerned Polytechnic or the date specified.

Recounting shall be done for any TWO theory subjects per Year/Semester only, including drawing subjects. No request for recounting shall be entertained from any candidate who is reported to have resorted to Malpractice in that examination. The fee prescribed for Recounting should be paid by way of Demand Draft drawn on any Scheduled Bank payable at Hyderabad in favour of the Secretary, State Board of Technical Education and Training, Telangana., Hyderabad. The verification of the totaling will be done by an Officer of the Board and will be intimated to the candidate by post only.

The following documents should be invariably be enclosed with the application failing which the application will not be considered.

1. Marks secured as per Tabulated Marks Sheet certified by the Principal.
2. Demand draft towards the payment of fee
3. Self – addressed and stamped envelopes of 11" X 5" size.

The applications received after the prescribed date will not be accepted and any correspondence in this regard will not be entertained.

#### 4.7.2 FOR ISSUE OF PHOTO COPIES OF VALUED ANSWER SCRIPTS

1. A candidate desirous of applying for Photo copy of valued answer script/ scripts should submit the application to the Secretary, State Board of Technical Education and Training, Telangana., Hyderabad – 500 063 along with the required fee in the form of Demand Draft within 07 days from the date of receipt of Tabulated Marks Statement by the Principal of concerned Polytechnic or the date specified in the covering letter whichever is earlier.
2. Photo copies of valued answer scripts will be issued to all theory subjects including drawing subjects.
3. The following documents should invariably be enclosed with the application
  - (1) Marks secured as per Tabulated Marks Sheets certified by the Principal
  - (2) Self-addressed Stamped Envelope/Cloth-line cover of size 10" x 14".
  - (3) Fee in the form of Demand Draft

#### 4.7.3 FOR RE-VERIFICATION OF THE VALUED ANSWER SCRIPT

1. A candidate desirous of applying for Re-verification of valued answer script should submit the application to the Secretary, State Board of Technical Education and Training, Telangana., Hyderabad – 500 063 along with the required fee in the form of Demand Draft, within 15 days from declaration of result.
2. Re-verification of valued answer script shall be done for all theory subjects including drawing subjects.
3. The following documents should invariably be enclosed with the application failing which the application will not be considered.
  - (i) Marks secured as per Tabulated Marks Sheets certified by the Principal.
  - (ii) Fee in the form of Demand Draft.

#### 4.7.4 MALPRACTICE CASES:

If any candidate resorts to any Mal Practice during examinations, he / she shall be booked and the Punishment shall be awarded as per rules and regulations framed by SBTET from time to time.

#### 4.7.5 DISCREPANCIES/ PLEAS:

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

## 5 ISSUE OF CERTIFICATES AND VETO

### 5.1. 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, Telangana 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.

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 from time to time.

### 5.2 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.

### 5.3 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 are within the jurisdiction of Hyderabad.
- iii. In case of any ambiguity in the interpretation of the above rules, the decision of the Secretary, SBTET is final.

**DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING**  
**SCHEME OF INSTRUCTIONS AND EXAMINATIONS**  
**V Semester**

Subject Code	Name of the Subject	Instruction period / week		Total Period / Sem	Scheme of Examination			
		Theor y	Practical /Tutorial		Duration (hours)	Session al Marks	End Exam Marks	Total Marks
THEORY:								
EE-501	Electrical Utilization	4	-	60	3	20	80	100
EE-502	A.C.Machines - II	4	-	60	3	20	80	100
EE-503	Power Systems – II (T&D)	5	-	75	3	20	80	100
EE-504	Industrial Drives	3	-	45	3	20	80	100
EE-505	Digital Electronics	4	-	60	3	20	80	100
EE-506	Maintenance of Electrical Systems	4	-	60	3	20	80	100
PRACTICAL:								
EE-507	Matlab Lab Practice	-	6	90	3	40	60	100
EE-508	Life skills	-	3	45	3	40	60	100
EE-509	A.C.Machines – II Lab Practice	-	3	45	3	40	60	100
EE-510	Field Practices	-	6	90	3	40	60	100
TOTAL		24	18	630		280	720	1000

## V SEMESTER

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**Note:** 1. Five no local industrial visits / Interaction, one from each of the courses listed from EE 502 to EE 506 may be arranged to enable the students to have industry exposure.

2. **Duration:** Total of all the visits not exceeding one week

- The students need to submit 2-3 page write up mentioning all salient learning experiences like advance in technology, its evaluation, application, advantages & disadvantages, expected changes in future etc.,.

3. Three weeks simulated industrial training (Field practices) may be arranged to enable the students to have hands on practice.

- The students need to prepare a model/working drawing/substation T&D network and submit 2-3 page write up mentioning all salient learning experiences.

4. **Industries:** Exposure on reading and interpretation of work / Trouble shooting of various electrical systems in a workshop etc.

**ELECTRICAL UTILISATION**

**Subject Title** : **ELECTRICAL UTILISATION**  
**Subject Code** : **EE-501**  
**Periods/Week** : **04**  
**Periods/semester** : **60**

**TIME SCHEDULE**

Sl. No.	Major Topics	Periods	Weightage of marks	Short questions	Essay questions
1.	Electric Lighting	16	29	3	2
2.	Electric heating	14	26	2	2
3.	Electric welding	10	23	1	2
4.	Refrigeration, Air conditioning and Auto Wiring	10	16	2	1
5	Energy saving devices	10	16	2	1
	<b>Total</b>	<b>60</b>	<b>110</b>	<b>10</b>	<b>8</b>

**OBJECTIVES**

**Upon completion of the course the student shall be able to**

**1.0 Understand the principles of lightings**

- 1.1 Explain the nature of light and of its propagation
- 1.2 State the units of wave length
- 1.3 Define
- |                           |                   |
|---------------------------|-------------------|
| i) Plane and solid angles | ii) luminous flux |
| iii) Luminous intensity   | iv) Lumen         |
| v) Candle power           | vi) Illumination  |
| vii) Brightness           | viii) Polar curve |
| ix) MHCP                  | x) MSCP           |
| xi) MHSCP                 |                   |
- 1.4 Explain the production of light by
- |               |                |
|---------------|----------------|
| i) Excitation | ii) Ionisation |
|---------------|----------------|

- iii) Fluorescence and phosphorescence
- 1.5 List the types of lamps used for illumination for different situations such as
- |                            |                   |
|----------------------------|-------------------|
| i) Domestic                | ii) Industrial    |
| iii) Decoration            | iv) Advertisement |
| v) Street lighting schemes |                   |
- 1.6 Define glare
- 1.7 State the requirements of good lighting
- 1.8 List the lamp fittings used in domestic and Industrial applications
- 1.9 Draw different lamp fittings
- 1.10 State the uses and advantages of each type of Lamp fittings.
- 1.11 State the laws of illumination.
- 1.12 Explain the laws of illumination.
- 1.13 Solve Problems on Illumination
- 1.14 Define the terms:
- |                                   |                         |
|-----------------------------------|-------------------------|
| i) Utilisation factor             | ii) Depreciation factor |
| iii) Waste light factor           |                         |
| iv) Reflection factor             | v) Reduction factor     |
| vi) Absorption factor             |                         |
| vii) Luminous efficiency          |                         |
| viii) Specific energy consumption | ix) Space -height ratio |
- 1.15 Design a simple lighting scheme for
- |   |  |
|---|--|
| i) Indoor,                              |  |
| a) Drawing Halls                        |  |
| b) Assembly Halls.                      |  |
| c) Factory                              |  |
| ii) Out door                            |  |
| a) Flood lights for open area.          |  |
| b) Street lighting by light flux method |  |
- 2.0 Understand the principle of electric heating and its industrial applications**
- 2.1 State the advantages of electric heating
- 2.2 List the requirements of good heating material
- |   |  |
|---|--|
| i) State the materials employed for heating |  |
|---|--|

- ii) Design of heater element and problems
- 2.3 Explain with legible sketch
- i) Direct resistance heating
- ii) Indirect resistance heating
- 2.4 State the industrial application of
- i) Direct resistance heating
- ii) Indirect resistance heating
- 2.5 Explain the different methods of temperature controls with legible sketch
- 2.6 Explain the different types of electric arc furnaces with legible sketch:
- i) Direct arc furnace
- ii) Indirect arc furnace
- 2.7 Explain the basic circuit for electric arc furnace showing the arrangement of OCB Control panels, CTs through relays, furnace transformer and arrangement of electrode movement
- 2.8 Explain the application of direct arc furnaces in industry
- 2.9 Explain the application of indirect arc furnaces in industry
- 2.10 Explain the principle of operations of induction furnaces with legible sketches (low and high frequency, core type and core less type)
- 2.11 List the industrial application of the following Furnaces.
- i) core type                      ii) coreless type
- iii) high frequency type
- 2.12 State the principle of dielectric heating
- 2.13 List the industrial applications of the dielectric heating
- 2.14 Solve problems on Dielectric heating.
- 3.0 Explain the types, applications and equipments of electric welding**
- 3.1 State different types of electric welding
- 3.2 Explain the principles of
- i) Resistance Welding                      ii) Spot Welding
- iii) Seam Welding                              iv) Butt Welding
- v) Arc Welding                                      vi) Metal Arc Welding
- vii) Carbon Arc Welding
- 3.3 List the conditions for Successful Welding
- 3.4 Explain the characteristics of a welding generator
- 3.5 Explain with legible sketch the principle of operation of welding transformer with a reactance coil
- 3.6 Explain the different types of electrodes used for welding

- 3.7 Explain electronic circuits used for welding
- 3.8 Explain the 'Sequence Weld' with a block diagram
- 4.0 Understand the Electrical equipment of a refrigerator, Air conditioner, Two wheeler, Four wheeler and Car Stereo wiring**
- 4.1 Draw the block diagram and electric circuit of Refrigerator
- 4.2 State the function of each component in the electric circuit of a Refrigerator
- 4.3 Draw the block diagram and electric circuit of Air conditioner
- 4.4 State the function of each component in the electric circuit of a Air conditioner
- 4.5 Draw the Circuit diagram of Lighting, Ignition, self starting and Battery charging of two wheeler.
- 4.6 Draw the Circuit diagram of Lighting, Ignition, self starting and Battery charging of four wheeler.
- 4.7 Draw the Circuit diagram of Car stereo wiring.
- 5.0 Appreciate the Concept of Electric Power saving Devices**
- 5.1 State the need of power saving devices.
- 5.2 Draw Automatic temperature control circuits for (coolers, greasers, air conditioners, and iron boxes)
- 5.3 Draw Automatic illumination control circuits using LDR's.
- 5.4 List the advantages of CF Lamps.
- 5.5 List the advantages of LED lamps over other types of lamps.
- 5.6 Compare CF lamps with tungsten filament lamps.
- 5.7 Explain the working of magnetic Induction lamps.
- 5.8 List the advantages of Remote operated Power utility devices like TV, Fan and lamps.
- 5.9 State the principles of Energy efficient systems.
- 5.10 List the advantages of using energy efficient systems for Electric motors, transformers and Power factor improvement devices.
- 5.11 Explain the concept of energy auditing and Management.

## COURSE CONTENT

### 1. Electric Lighting

Nature of light and its production, electro magnetic spectrum physical spectrum - units of wave length - Terms and definitions plane and solid angle, luminous flux, Lumen, C.P. Illumination, brightness, polar curve, MHCP, MSCP, MHSCP, 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. Terms and factors used in design of lighting schemes for indoor, factory, outdoor and street lighting schemes - problems

## 2. Heating

Advantages of electric heating - requirements of good heating material and materials generally employed, direct resistance heating - principle and application design of heating element - Indirect resistance heating - Principle and applications - Temperature control of resistance furnaces - Electric arc furnaces - direct and indirect types - applications - Induction heating core type and coreless type - Applications - Dielectric heating - principle advantages and applications - problems on dielectric Heating.

## 3. Welding

Types of welding - Principle and applications of Resistance welding - spot welding - seam welding - butt welding - Arc welding - Metal Arc welding - Carbon Arc welding - use of coated electrode power supply - Welding generator, welding transformer - welding control circuits. Sequence welding circuits

## 4. Refrigerator, Air conditioner and Auto Electric Circuits-

Block diagram and Electric circuit of Refrigerator - function of each component- Block diagram and electric circuit of Air conditioner- function of each component- Electrical circuit diagram of Lighting, Ignition, self starting and Battery charging of two wheeler and four wheelers.- Circuit diagram of Car stereo wiring - functions of various components.

## 5. Power saving Devices :

Need of power saving devices.- Automatic temperature control circuits- Automatic illumination control circuits using LDR's- Advantages of CF Lamps- Advantages of LED lamps over other types of lamps- Compare CF lamps with tungsten filament lamps-Advantages of Remote operated Power utility devices -Principles of Energy efficient systems- Advantages of using energy efficient systems for Electric motors, transformers and Power factor improvement devices- Concept of energy auditing and Management.

### REFERENCES

1. Electrical power by S.L. Uppal
2. Electrical Utilisation by Gupta
3. Utilisation of Electric Power by Openshaw Taylor
4. Utilisation of Electric energy by R.K. Gang
5. Art and Science of electric power by H. Partab
6. Electric Traction by H. Partab
7. Study of Electrical Appliances and devices K.B.Bhatia.

## A.C. MACHINES - II

Subject Title	:	A.C. MACHINES -II
Subject Code	:	EE-502
Periods/ Week	:	04
Periods /Semester	:	60

### TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of marks	Short questions	Essay questions
1.	Synchronous motors.	14	26	2	2
2.	3- Phase Induction Motors	22	49	3	4
3.	1- Phase Induction Motors	12	19	3	1
4.	1- Phase Commutator Motors	12	16	2	1
	<b>Total</b>	<b>60</b>	<b>110</b>	<b>10</b>	<b>8</b>

### OBJECTIVES

Upon completion of the course the student shall be able to

- 1.0 **Comprehend the working of synchronous motors.**
  - 1.1 Principle of Production of Rotating Magnetic Field in 3-phase System.
  - 1.2 Explain the construction of synchronous motor and it's parts with legible sketch.
  - 1.3 Explain the principles of working of synchronous motors.
  - 1.4 Explain the performance of synchronous motor on no load & Load with phasor diagrams.
  - 1.5 Explain the effects of varying excitation at constant load with phasor diagrams,
  - 1.6 Explain the significance and account for the shape of 'V' curves, Inverted V curve,
  - 1.7 Explain how a Synchronous motor can be used as a Synchronous condenser.
  - 1.8 Explain the phenomenon of HUNTING.
  - 1.9 State how HUNTING is prevented.



- 1.10 Explain the starting methods of synchronous motor by  
(i).Auxiliary motor and (ii).Damper winding
- 1.11 List the applications of synchronous motor.
- 2.0 Comprehend the working of 3 phase Induction Motors,**
- 2.1 Explain the construction of Induction motor- slip ring and squirrel cage
- 2.2 Compare Slip ring & Squirrel cage Induction motors.
- 2.3 State the principle of working of 3 phase induction motor.
- 2.4 Explain working of 3 phase induction motor on  
i)no-load and ii) Load.
- 2.5 Derive the equation relating TORQUE, POWER and SLIP.
- 2.6 Draw Torque - Slip curves.
- 2.7 Explain how an induction motor is treated as a generalized transformer.
- 2.8 Explain : (i) No-load test  
(ii) Blocked rotor test and  
Draw circle diagram with the help of above tests.
- 2.9 Solve problems on evaluation of the performance of induction motors.
- 2.10 Explain methods of starting of induction motors.
- 2.11 Explain the working of the following starters with the help of circuit diagram.  
(i) D.O.L. starter. (ii) Star/Delta Starter.  
(iii) Auto - Transformer starter. (iv) Rotor resistance starter.
- 2.12 Explain construction features of double cage rotor motor.
- 2.13 Explain the speed control of inductor motors by  
(i). Frequency changing method  
(ii). Pole changing method.  
(iii) Injecting voltage in rotor circuit. (iv).Cascading
- 2.14 State the advantages of inductor motors
- 2.15 List at least six applications of inductor motors
- 2.15 Compare synchronous motors with induction motors.
- 3.0 Comprehend the working of 1- Phase induction motors.**
- 3.1 List the types of 1- phase induction motors.
- 3.2 Describe the parts and construction of 1 phase Induction Motor with legible sketch.
- 3.3 Explain the working principle of 1 - phase Induction motor by  
i) Cross field theory ii) Double field revolving theory.

- 3.4 Explain why a Single-phase Induction motor is not a Self starting motor.
- 3.5 Describe the Construction of the following motors with legible sketch.  
i)split phase motor ii)capacitor start motor  
iii) shaded pole motor.
- 3.6 Explain the working of the following motors with legible sketch.  
i) split phase motor ii)capacitor start motor  
iii) shaded pole motor
- 4.0 Comprehend the working of single phase Commutator motors .**
- 4.1 Describe the construction of the following types of single phase Motors  
i) Commutator motors ii) A.C.Series motors  
iii) universal motors.
- 4.2 Explain the working of the following types of single phase Motors  
i) Commutator motors ii) A.C.Series motors  
iii) universal motors.
- 4.3 List the types of Stepper motors.
- 4.4 Explain the Principle and working of Stepper motor.
- 4.5 Explain the working of the following Stepper motors  
i) Permanent magnet ii) variable reluctance I  
ii) hybrid stepper motors  
iv) Permanent magnet brushless motor with a legible sketch.
- 4.6 List atleast three applications of above Stepper motors.

#### COURSE CONTENT

##### 1. Synchronous Motors

- Introduction - Rotating Magnetic field, synchronous speed, parts of synchronous Motor - Excitation of rotor working Principle - Back EMF - Resistance and synchronous Reactance - Effects of no load & Load, Vector diagrams - Load Angle, power relation, Effects of change of Excitation at constant Load, Vector diagrams for:(a). Normal,  
(b). Under and c) Over excitation conditions, Effects of Excitation on Armature current and power factor, Relation between Back EMF, applied voltage, Simple problems - V - Curves and inverted V - curves ,constant power lines - Hunting and its undesirable Effects - prevention of Hunting-Methods of Countering hunting, starting Device necessity - Methods of starting , Applications of synchronous motor.

##### 2. Three Phase Induction Motors

Introduction - Constructional features and differences in respect of cage and wound rotor types. Principle of working & self starting features, actual rotor speed and synchronous speed, slip. Effect of loading on slip - frequency and magnitude of rotor EMF and reactance - Expression for rotor current on no load and on Load - problems. Induction motor as a generalized transformer. Losses and Power transfer stage by stage from stator to rotor - Derive the relation between rotor copper losses - Rotor output and rotor input and problems. Torque equation derivation - Starting torque, condition for maximum torque - Relation Between full load torque, starting Torque and maximum torque - Torque slip curves effects and variation rotor resistance and reactance on starting, full load and maximum torque. Effect of supply voltage on torque and speed, problems. Losses and efficiency - No load and blocked rotor tests, circle diagram from test data - Evaluation of torque - efficiency, problems on circle diagram. Starters for Induction motor - necessity, Direct Switching, D.O.L starter, Star / Delta starter, Auto Transformer starter and rotor resistance starters, Double cage rotor motor - Improvement in performance features. Speed variation of induction motors ,Advantages- Application of induction motors. Comparison of Synchronous and induction motors.

### 3. Single phase Induction Motors

Essential parts and constructional features of single phase motors - self starting -split phase, capacitors start, capacitor run and shaded pole types and Principles of working -Applications and relative merits.

### 4. Commutator Motors (Single phase)

Essential parts and Constructional features of A.C series motor - principles of working -Applications - Universal motor- parts, constructional features, principle of working- Applications- Stepper motors - essential features , principle of working and Applications- permanent magnet brushless motor -Applications.

#### REFERENCES

1. B.L. Theraja Electrical Technology- S.Chand &Co.
2. J.B. Gupta -Electrical Technology
3. H. Cotton -Electrical Technology
4. T.K.Naga Sankar, M.S.Sukhija -Basic Electrical Engineering- Oxford publications.
5. Langsdorf-Performance of A.C. Machines
6. M.V. Deshpande-Electrical motors applications and control
7. DP Kothari, IJNagrath- Electrical machines-McGrawHill.

## POWER SYSTEMS - II (Transmission & Distribution)

<b>Subject Title</b>	:	<b>POWER SYSTEMS - II</b>
<b>Subject Code</b>	:	<b>EE- 503</b>
<b>periods / week</b>	:	<b>05</b>
<b>Periods / Semester</b>	:	<b>75</b>

#### TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of marks	Short questions	Essay questions
1.	Transmission lines	30	34	3	2 & 1/2
2.	HVDC transmission	04	3	1	
3.	Line structures for transmission and Distribution	21	26	2	2
4.	Cables	6	13	1	1
5.	Substations	6	13	1	1
6.	Distribution	8	21	2	1&1/2
	<b>Total</b>	<b>75</b>	<b>110</b>	<b>10</b>	<b>8</b>

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#### OBJECTIVES

Upon completion of the course the student shall be able to

- 1.0 **Comprehend the need for transmission and choice of supply systems**
  - 1.1 State the need of transmission lines and distribution lines
  - 1.2 Explain the transmission supply systems
    - i) D.C
    - ii)A.C
  - 1.3 State the advantages of D.C and A.C. transmission systems..
  - 1.4 State the supply systems based on the conductor material required for overhead lines and underground cables
    - i) AC - 1 ph 2 wire system
    - ii) AC - 3 ph 3 wire system
    - iii) DC - 2 wire system
  - 1.5 Explain the effects of the following on Transmission lines.

- i)Supply frequency      ii)Supply voltage
- 1.6 Explain the effect of 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 type of transmission line conductors  
a) Solid      b) Stranded      c) Hollow  
d) Bundled conductors
- 1.9 State the relative merits of different types of above conductors
- 1.10 Explain the current distortion effects  
i)Skin effect      ii)Proximity effect  
iii)Spirality effect      iv)Kelvin's law
- 1.11 State the different types of conductors used in transmission lines.
- 1.12 Derive expression for inductance of 1 phase system
- 1.13 Give the expression for the inductance of 3 phase symmetrical and asymmetrically spaced round conductors ( No derivation)
- 1.14 State the need for transposition of overhead lines
- 1.15 Explain the effects of transposition of overhead lines
- 1.16 Compute inductance in transposed lines
- 1.17 Define capacitance
- 1.18 Derive the expressions for capacitance of 1 phase system.
- 1.19 Give the expressions for capacitance of 3 phase symmetrically spaced, asymmetrically spaced and transposed lines round conductors (No-Derivation)
- 1.20 Use the conductors tables for determining the inductance and capacitance of overhead lines of different voltage
- 1.21 Define short, medium and long lines.
- 1.22 State the reasons for the constants lumped in short lines and medium transmission lines.
- 1.23 Define 'regulation' and percentage regulation.
- 1.24 Derive the approximate formula for percentage regulation.
- 1.25 Compute the following for short line  
i) Sending end voltage  
ii) Sending end P.F

- iii) percentage regulation  
iv) Efficiency for the given receiving end condition
- 1.26 Solve problems on short lines
- 1.27 Compute the percentage regulation, efficiency of medium transmission lines with given receiving end conditions and line parameters using  
i) Nominal ( pie ) method  
ii) Nominal T- method
- 1.28 Draw the phasor diagram in the above methods
- 1.29 Solve problems in medium transmission lines
- 1.30 Explain the charging current in lines and power loss due to it
- 1.31 State 'Ferranti' effect
- 1.32 Compute the rise in voltage at the receiving end
- 1.33 State the factors affecting corona
- 1.34 Explain corona in transmission lines
- 1.35 State the disruptive critical voltage and give its formula
- 1.36 State the empirical formula for power loss due to corona
- 1.37 State the effect of corona
- 1.38 Explain the methods of reducing corona
- 1.39 Explain the concept and applications of hot line technique
- 2.0 Appreciate HVDC transmission**
- 2.1 Discuss basic concepts of HVDC transmission
- 2.2 List the types of HVDC.
- 2.3 Know the location of Projects in India.
- 2.4 Discuss the advantages and disadvantages of HVDC transmission
- 2.5 Discuss the protective measures to be adopted for HVDC system
- 3.0 Comprehend Line structures for transmission and Distribution**
- 3.1 State the main components of overhead lines
- 3.2 State the requirements of line supports
- 3.3 List the factors influencing the selection of the line supports
- 3.4 List the types of line supports
- 3.5 State the advantages and disadvantages of the above line supports
- 3.6 State the need for cross arms
- 3.7 Give the formula for economical spacing of conductors
- 3.8 State the necessity for pole guys

- 3.9 Describe the methods of fixing of guys  
i) Bow ii) Fly guys iii) Strut pole
- 3.10 State the factors on which the conductor spacing and ground clearance depend
- 3.11 List the common conductor spacing and ground clearances adopted for  
i) 66 KV ii) 33 KV iii) 11 KV iv) L.T. lines
- 3.12 List the Maximum earth resistance value together with the size of pipe or plate used for Earthing.
- 3.13 State the minimum ground clearances adopted for  
i) 66 KV ii) 132 KV iii) 220 KV
- 3.14 Explain a method of laying foundation to towers
- 3.15 Define 'sag'
- 3.16 State the factors affecting the sag
- 3.17 Derive an equation for the approximate method of calculating sag.  
i) when the supports are at the same level  
(a) in still air and  
(b) with the effect of wind and ice  
ii) when the supports are at different levels
- 3.18 solve the problems on above.
- 3.19 State the disadvantages of loose spans(sag more than prescribed value)
- 3.20 State the purpose of insulators in transmission and distribution lines
- 3.21 State the requirements of insulators
- 3.22 State applications of the following insulators.  
i) Pin type ii) Strain type iii) Suspension type  
iv) Shackle type
- 3.23 Tabulate the relative merits of pin type insulator over suspension type insulators
- 3.24 Show that the voltage across a string does not distribute uniformly across the individual discs
- 3.25 Define the terms i) Flashover ii) Puncture iii) String-efficiency
- 3.26 Solve problems on distribution of voltage across string
- 3.27 State the methods of improving string efficiency  
i) By eliminating ground capacitance  
ii) By grading of the units

- iii) Static shielding(guard ring)
- 3.28 Solve problems on equalisation of potential across a string
- 3.29 State the need for arcing horns and guard rings
- 3.30 List causes of failure of insulators in transmission and distribution lines
- 4.0 Comprehend Underground Cables**
- 4.1 Define cables
- 4.2 Compare overhead lines with underground cables
- 4.3 State the classification of cables based on  
i) Number of conductors  
ii) Voltage  
iii) Insulation and lead sheathing  
iv) The methods of improving the dielectric stress
- 4.4 Describe the construction of different types of cables  
i) Low voltage cables ii) H.T cables  
iii) Super tension cables iv) EHV cables
- 4.5 Derive an equation for the insulation resistance of a cable
- 4.6 Solve problems on insulation resistance
- 5.0 Comprehend substations**
- 5.1 Explain the need for substations
- 5.2 State the relative merits of indoor substation ,outdoor substation and Gas insulated Substations over others.
- 5.3 List the equipment used in substation.  
i) Bus bars ii) Insulators iii) Transformers  
iv) Switch gear v) Indicating and Metering equipment  
vi) Protective relays vii) Lightning arrestors  
viii) Cables ix) Fire fighting equipment
- 5.4 State the purpose of each of the above equipment.
- 5.5 Explain Substation auxiliary supply
- 6.0 Understand the Different Distribution Systems**
- 6.1 Distinguish between primary distribution and secondary distribution
- 6.2 Explain Feeder, distributors and service mains
- 6.3 Classify the type of distribution systems according to  
i) Type of current ii) Construction

- iii) Service
- iv) Number of wire
- v) Scheme of connections
- 6.4 List the type of distribution systems
  - i) Radial and
  - ii) Ring main systems
- 6.5 State the advantages and disadvantages of the following systems
  - i) radial and
  - ii) ring main systems
- 6.6 List the steps involved in the voltage drop calculations in A.C. distributors
- 6.7 Solve problems on voltage drop calculations in D.C & A.C. Distributors.

### COURSE CONTENTS

1. Transmission Lines-Need for transmission lines-Transmission supply systems, Relative advantages of AC & DC Transmission, Choice of frequency, Choice of voltage, Effect of voltage, Empirical formula for determining the system voltage, H.V.D.C. power Transmission, Operational techniques of H.V.D.C, Requirements of conductor material - Types of conductor-Solid-Stranded-Hollow- Bundled conductors - Relative merits of different types of conductors-Kelvin law -Transmission parameters: Resistance, Inductance capacitance-skin effect, proximity effect, spirality effect-Determination of resistance of solid, ACSR and AAAC conductors using conductor tables-Determination of inductance of Round and Parallel Conductors ,Transposition of O.H. lines-Effect of transposition on Inductance calculations in transposed lines, Calculation of capacitance in round and parallel conductors -Use of conductor tables of determination of inductance and capacitance of transmission lines-Regulation and % Regulation-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-Charging current in lines-Ferranti's effect-Corona in transmission lines-Power loss due to corona-Effects of corona-Methods of reducing corona - Hot line technique - concept and application
2. High voltage DC Transmission: Basic Concepts and Types of HVDC transmission- HVDC projects in India - Advantages and disadvantages of HVDC transmission. Basics of protection of HVDC systems.
3. Line structure for Transmission and Distribution: Requirements of line supports, Factors influencing the selection of line support-Types of lines supports-Foundation for poles Descriptive treatment- Cross arms for L.T and H.T lines upto 33 KV- Pole guys- Conductors spacing and ground clearance-Methods of earthing- L.T., 11 KV and 33 KV lines-Max. earth

resistance-Types of towers used for 66 KV and 132 KV and 220 KV / 400kv lines spaces-Approximate ground clearance-Foundation to towers Earthing of towers Sag, Factors affecting sag, calculating sag. Disadvantages of loose span, stringing charts, Insulators, Requirements of insulators , Materials used , Types of Insulators, Voltage distribution across string of suspension Insulators, string efficiency, Flashover, Puncture, string efficiency, improving string efficiency, eliminating the ground capacitance, grading, static shielding , Arcing horns and guard rings, Causes for failure of insulators

### 4. Cables

Cables, Comparison between O.H. Lines and underground cables, Classification of cables, General construction of cables,Types of cables, Insulation resistance of cables, Specifications of cables

### 5. Sub-stations

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, Bus bar arrangements - Typical sketches Typical layouts and sketches of 33/11KV SS, 66/11 KV, 132/11 KV, Earthing adopted in 132/11KV, 66/11 KV, 33/11 KV and pole mounted and plinth mounted SS, Substation Earthing

### 6. Distribution

Primary and secondary distribution, Feeders, distribution and service mains, Classification of Distribution systems, Radial and Ring system of Distribution,D.C & A.C. Distribution(single phase), Steps in voltage drop calculation

### 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. JB Gupta -Electrical Power
5. CL Wadhwa -Electrical power Systems - New Age International(P) limited.
6. KR Padiyar - HVDC Power Transmission system Technology
7. S.N. Singh -Electrical Power generation, transmission and distribution, PHI,2003

**INDUSTRIAL DRIVES**

<b>Subject Title</b>	:	<b>Industrial Drives</b>
<b>Subject code</b>	:	<b>EE- 504</b>
<b>Periods/Week</b>	:	<b>03</b>
<b>Periods/Semester</b>	:	<b>45</b>

**TIME SCHEDULE**

Sl. No	Major Topics	Periods	Weightage of marks	Short questions	Essay questions
1.	Electrical Drives	12	39	3	3
2.	Electric Braking	12	39	3	3
3.	Domestic applications of Drives	9	11	2	½
4.	Industrial applications of Drives	12	21	2	1½
	<b>Total</b>	<b>45</b>	<b>110</b>	<b>10</b>	<b>8</b>

**OBJECTIVES**

Upon completion of the course the student shall be able to

**1.0 Appreciate the different types of Electrical Drives.**

- 1.1 Define an Electric Drive.
- 1.2 Explain the concept of Electric Drive.
- 1.3 List the advantages of Electric Drives.
- 1.4 Draw the block diagram of an Electric drive.
- 1.5 State the function of each block in the block diagram of an Electric drive
- 1.6 List the factors governing the selection of electric drive.
- 1.7 Classify the drives.
  - i) Based on their operation
  - ii) Based on their application
- 1.8 State the advantages and disadvantages of different types of drives.
- 1.9 Distinguish between an AC Drive and a DC Drive.
- 1.10 State the types of loads for which drives are needed.
- 1.11 Draw the Load curves for different ratings of motors.

- 1.12 Solve the Problems on the motor Ratings.
- 1.13 State the need of load equalization
- 1.14 State the use of fly wheels
- 1.15 List the different types of enclosures and bearings
- 1.16 State the methods employed for reduction of noise
- 2.0 Understand braking of electric motors.**
- 2.1 State different systems of braking of electric motors.
  - (i) Mechanical
  - (ii) Compressed air
  - (iii) Vacuum brake
  - (iv) Magnetic Brake
  - (v) Electric Braking.
- 2.2 State advantages of electric braking over other forms of brake
- 2.3 Explain different methods of electric braking
- 2.4 Discuss the methods of plugging of the following motors.
  - i) D.C. shunt motors
  - ii) D.C. series motors
  - iii) Induction Motor.
- 2.5 Solve the Problems on the above
- 2.6 Explain the method of Rheostatic braking of the following motors.
  - i) D.C. shunt motors
  - ii) D.C. series motors.
- 2.7 Describe the method of Regenerative braking of the following motors.
  - i) D.C. shunt motor
  - ii) D.C series motor
  - iii) T hree-phase induction motor.
- 2.8 Solve the Problems on the above.
- 3.0 Understand the Domestic applications of Drives**
- 3.1 List at least eight domestic applications of drives.
- 3.2 Select the suitable motors for the following drives
  - i) Domestic
  - ii) refrigeration
  - iii) Vacuum cleaner
  - iv) Washing machine
  - (v) Mixies
  - vi) Grinders
  - vii) Air conditioners
  - viii) Pumps.
- 3.3 Explain the working of the drives for the above applications.
- 4.0 Industrial applications of Drives**
- 4.1 List atleast twelve industrial applications of drives.
- 4.2 Select the suitable motors for the following drives
  - (i) Steel mills
  - (ii) sugar mills
  - (iii) flour mills
  - (iv) Cranes
  - (v) Lifts & Hoists
  - (vi) Lathes
  - (vii) Drilling and Grinding machines
  - (viii) Pump sets
  - (ix) Punches & Presses
  - (x) Wood working machines
  - (xi) Printing
  - (xii) Belt conveyor
  - (xiii) Textile mills
  - (xiv) Paper mills
  - (xv) Rolling mills

- (xvi) Ship propulsion (xvii) Mines (xviii) Cement works.
- 4.3 Explain the working of the drives for the above applications.
- 4.4 Select a suitable motor and drive system for  
i) Hard Disc ii) Computer Printer
- 4.5 Select a suitable motor and drive system for  
i) Robot Arm ii) C.N.C.Machine

## COURSE CONTENT

### 1. Electrical drives

Definition and concept of Electric Drives -Advantages- factors governing selection of motors -nature of electric supply- DC & AC - Nature of Drives - Group drives- Individual drives their merits and demerits - Nature of load - analysis of type of load- Operations required -matching of motors with given loads - Rating of motors basing on temperature rise and load equalization - purpose of load equalization- use of Flywheel - types of enclosures and bearings - Reduction of noise.

### 2. Electric Braking

Braking - Types of Braking - Merits & de-merits of Electrical braking - Plugging applied to Shunt, Series and Induction Motor - Simple Problems - Rheostatic braking applied to Shunt, Series and Induction motors - Regenerative braking applied to shunt, series and Induction motor.

### 3. Domestic applications of Drives

Electric motors used in Domestic applications , Refrigeration, Vacuum cleaners, Washing machines, Mixies, Grinders, Air conditioners, Pumps.

### 4. Industrial applications of Drives

Electric motors used in - Steel mills- Sugar mills - Flour mills- Cranes - Lifts -Hoists - Lathes -Drilling and Grinding machines - Pump sets - Punches & Presses - Wood working machines - Printing - Belt conveyor -Textile mills -Paper mills - Rolling mills - Ship propulsion -Mines -Cement works.

## REFERENCES

- 1.Hand book of process control - Lyptak
- 2.A first course on Electric Drives- S.K.Pillai.
- 3.Electrical motors applications and control by M.V.Deshpande
- 4.Electrical power by S.L.Uppal
- 5.Electrical power by J.B.Gupta

## DIGITAL ELECTRONICS

<b>Subject Title</b>	:	<b>DIGITAL ELECTRONICS</b>
<b>Subject Code</b>	:	<b>505</b>
<b>Periods/Week</b>	:	<b>4</b>
<b>Periods/Semester</b>	:	<b>60</b>

## TIME SCHEDULE

Sl	Major topics	No. of periods	Weightage of marks	Short Answer Questions	Essay Questions
1	Basics of Digital Electronics	12	16	2	1
2	Logic Families	15	29	3	2
3	Combinational Logic circuits	15	26	2	2
4	Sequential Logic Circuits	10	26	2	2
5	Registers and Semiconductor Memories	8	13	1	1
	Total	<b>60</b>	<b>110</b>	<b>10</b>	<b>8</b>

## OBJECTIVES

**On completion of the course the student shall be able to**

### 1.0 Understand the basics of Digital Electronics

- 1.1 Explain Binary, Octal, Hexadecimal number systems and compare with Decimal system.
- 1.2 Convert a given decimal number into Binary, Octal, and Hexadecimal numbers and vice versa.
- 1.3 Convert a given binary number into octal and hexadecimal number system and vice versa.
- 1.4 Perform binary addition, subtraction, Multiplication and Division.
- 1.5 Write 1's complement and 2's complement numbers for a given binary number.
- 1.6 Perform subtraction of binary numbers in 2's complement method.
- 1.7 Explain the use of weighted and Un-weighted codes.
- 1.8 Write Binary equivalent number for a number in 8421, Excess-3 and Gray Code and vice-versa.
- 1.9 Explain the use of alphanumeric codes (ASCII & EBCDIC)
- 1.10 Explain the importance of parity Bit.
- 1.11 State different postulates in Boolean algebra.

- 1.12 Explain the basic logic gates AND, OR, NOT gates with truth table.
- 1.13 Explain the working of universal logic gates (NAND, NOR gates) using truth tables.
- 1.14 Explain the working of an exclusive - OR gate with truth table.
- 1.15 State and explain De-Morgan's theorems.
- 1.16 Realize AND, OR, NOT operations using NAND, NOR gates.
- 1.17 Apply De-Morgan's theorems related postulates to simplify Boolean expressions (up to three variables).
- 1.18 Explain standard representations for logical functions (SOP and POS form)
- 1.19 Write Boolean expressions from the given truth table.
- 1.20 Use Karnaugh map to simplify Boolean Expression (up to 4 variables only)
- 2.0 Understand different logic families.**
- 2.1 Give the classification of digital logic families.
- 2.2 Explain the characteristics of digital ICs such as logic levels, propagation delay, Noise margin, Fan-in, Fan-out, and Power dissipation.
- 2.3 Draw and explain TTL NAND gate with open collector.
- 2.4 Draw and explain TTL NAND gate with Totem pole output.
- 2.5 Draw CMOS NAND gate circuit and explain its operation.
- 2.6 Draw and explain the basic emitter coupled logic OR/NOR gate.
- 2.7 Compare the TTL, CMOS and ECL logic families.
- 2.8 Give IC numbers of two input Digital IC Logic gates.
- 3.0 Understand the working of combinational logic circuits**
- 3.1 Give the concept of combinational logic circuits.
- 3.2 Draw the Half adder circuit and verify its functionality using truth table.
- 3.3 Realize a Half-adder using NAND gates only and NOR gates only.
- 3.4 Draw the full adder circuit and explain its operation with truth table.
- 3.5 Realize full-adder using two Half-adders and an OR - gate and write truth table
- 3.6 Draw and explain a 4 Bit parallel adder using full - adders.
- 3.7 Draw and Explain 2's compliment parallel adder/ subtractor circuit.
- 3.8 Explain the working of a serial adder with a Block diagram.
- 3.9 Compare the performance of serial and parallel adder.
- 3.10 Draw and explain the operation of 4 X 1 Multiplexers

- 3.11 Draw and explain the operation of 1 to 4 demultiplexer.
- 3.12 Draw and explain 3 X 8 decoder.
- 3.13 Draw and explain BCD to decimal decoder.
- 3.14 List any three applications of multiplexers and decoders.
- 3.15 Draw and explain Decimal to BCD encoder.
- 3.16 State the need for a tri-state buffer and list the four types of tri-state buffers.
- 3.17 Draw and explain One bit digital comparator.
- 4.0 Understand the working of Sequential logic circuits**
- 4.1 Give the idea of Sequential logic circuits.
- 4.2 Explain NAND and NOR latches with truth tables
- 4.3 State the necessity of clock and give the concept of level clocking and edge triggering,
- 4.4 Draw and explain clocked SR flip flop using NAND gates.
- 4.5 Study the need for preset and clear inputs .
- 4.6 Construct level clocked JK flip flop using S-R flip-flop and explain with truth table
- 4.7 Analyze the race around condition.
- 4.8 Draw and explain master slave JK flip flop.
- 4.9 Explain the level clocked D and T flip flops with the help of truth table and circuit diagram.
- 4.10 Give the truth tables of edge triggered D and T flip flops and draw their symbols.
- 4.11 List any four applications of flip flops.
- 4.12 Define modulus of a counter
- 4.13 Draw and explain 4-bit asynchronous counter and also draw its timing diagram.
- 4.14 Draw and explain asynchronous decade counter.
- 4.15 Draw and explain 4-bit synchronous counter.
- 4.16 Distinguish between synchronous and asynchronous counters.
- 4.17 Draw and explain asynchronous 3 bit up-down counter.
- 4.18 List any six commonly used IC numbers of flip flops, registers and counters.
- 5.0 Understand working of Registers and memories**
- 5.1 State the need for a Register and list the four types of registers.



- 5.2 Draw and explain the working of 4 bit shift left and shift right registers
- 5.3 Draw and explain the working of 4-bit bi-directional shift register.
- 5.4 Draw and explain parallel in parallel out shift register
- 5.5 Explain the working of Universal shift register (74194 )
- 5.6 Explain the working of ring counter and list its applications
- 5.7 List the four common applications of shift registers.
- 5.8 State memory read operation, writes operation, access time, memory capacity, address lines and word length.
- 5.9 Classify various types of memories based on principle of operation, physical characteristics, accessing modes and fabrication technology..
- 5.10 Differentiate between ROM and RAM
- 5.11 Explain basic principle of working of diode ROM
- 5.12 Distinguish between EEPROM and UVPROM.
- 5.13 List six types of ROM and RAM ICs
- 5.14 Explain the working of basic dynamic MOS RAM cell.
- 5.15 Compare static RAM and dynamic RAM
- 5.16 Explain the working principle of NVRAM
- 5.17 State the difference between Flash ROM and NV RAM

## COURSE CONTENT

### 1 Basics of Digital Electronics

Binary, Octal. Hexadecimal number systems. Conversion from one number system to another number system. Binary codes, excess-3 and gray codes. Logic gates :AND, OR, NOT, NAND, NOR, Exclusive-OR. Logic symbols. Boolean algebra, Boolean expressions. Demorgan's Theorems. Implementation of logic expressions, SOP and POS forms, Karnaugh map application.

### 2. Logic families

Characteristics of digital circuits: logic levels, propagation delay, Noise margin, Fan-in, Fan-Out, power dissipation, TTL NAND gate: open collector, totem pole output, CMOS NAND gate, ECL OR/NOR gate , comparison of TTL,CMOS and ECL logic families.

### 3. Combinational logic circuits

Implementation of arithmetic circuits, Half adder, Full adder, Serial and parallel Binary adder. Parallel adder/subtractor, Multiplexer, demultiplexer, decoder, encoder, tri-state buffer, 2-bit Digital comparator.

### 4. Sequential logic circuits

Principle of flip-flops operation, Concept of edge triggering, level triggering, RS, D, JK, T, JK Master Slave flip-flops., synchronous and asynchronous inputs and their use. Applications of flip flops,. Binary counter- ripple counter, synchronous counter, up-down counter.

### 5. Registers and Memories

Shift Registers- Types, shift left ,shift right, bidirectional, Parallel in parallel out ,universal shift registers, ring counter and its applications, Memories-terminology related to memories, RAM, ROM, EEPROM, UVEPROM, static RAM, dynamic RAM, Flash ROM, NVRAM,

## 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 Electronics Puri TMH
5. Digital Computer Fundamentals by Thomas Bartee.
6. Digital Electronics by GK Kharate, Oxford University Press.



- 4.9 List the various applications of different fire extinguishers.

### COURSE CONTENTS

#### 1.0 Testing of Electrical Domestic Appliances

Tools & meters required for testing and repair of Domestic appliances- Principle, construction & working with fault finding, dismantling, assembling and testing after repair of the Domestic appliances.

**Note:** Suitable tests to be conducted on the above Electrical Domestic appliances are Open circuit, Short circuit, Earth fault and Leakage tests.

#### 2.0 U.P.S and SMPS

Commercial power supply-Disturbances and Spikes in supply voltages- UPS - SMPS

#### 3.0 Maintenance of Electrical Power devices

Preventive and periodical maintenance schedule of the following electrical power devices. i.e Batteries (Dry / Wet ), UPS / Inverters, DC & AC Motors, Motor starters ( AC & DC), Air conditioners, Power transformers, Pole mounted & Plinth mounted transformer yards, Circuit breakers

#### 4.0 Safety

Need of safety - Equipment used in Electrical and general safety - Different types of Electrical hazards / accidents - Causes of different Electrical hazards / accidents - Methods to avoid Electrical hazards / accidents - First-Aid methods followed to rescue a person met with Electric shock - Do's & Don't's of Electrical supervisor at Electrical substations - Different fire extinguishers- operation and application of different fire extinguishers.

### References:

1. K.B.Bhatia Study of Electrical Appliances and, devices  
Khanna publication
2. B. L. Theraja Electrical Technology Vol I To IV  
S. Chand & Co., New Delhi
3. B. V. S. Rao Operation & Maintenance of Electrical Machines Vol - I  
Media Promoters & PublisherLtd. Mumbai
4. B. V. S. Rao Operation & Maintenance of Electrical Machines Vol - II  
Media Promoters & PublisherLtd. Mumbai
5. C.J. Hubert Preventive Maintenance  
Hand Books & Journals

### MATLAB LAB PRACTICE

Subject Title	:	MATLAB LAB PRACTICE
Subject code	:	EE- 507
Periods/Week	:	06
Periods/Semester	:	90

### TIME SCHEDULE

Sl. No	Major Topics	Periods
1.	C Programming Basics	6
2.	Decision & Loop Control Statements	12
3.	Exercises on functions	15
4.	Arrays, Strings and Pointers in C	15
5.	Structures, Unions & Preprocessor Directives	12
6.	MAT Lab Practice	30
	Total	60

### OBJECTIVES (LIST OF EXPERIMENTS)

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**Upon the completion of this lab practice, the student shall be able to perform**

1. Editing, compiling and executing simple programs
2. Exercises on printf and scanf functions
3. Exercises on Selective Structures
4. Exercises on Repetitive Structures
5. Exercises on functions to demonstrate prototyping, parameter passing, function returning values.
6. Exercises on recursion
7. Exercises on global variables.
8. Exercises on arrays and Strings
9. Exercises to demonstrate use of Pointers, pointers as function arguments, functions returning pointers
10. Exercise on structures.
11. Exercises on C preprocessor Directives.

**MATLAB- Simulink Practicals**

1. Generate square, sine, sawtooth and triangular waveform using Function generator.
2. Step response of RL and RC circuit
3. Op-amp applications (Inverting, Non inverting, Integrator & Differentiator )
4. Verification of Superposition theorem
5. Verification of Thevenins theorem
6. Verification of Nortons theorem
7. Simulate the UJT relaxation oscillator and draw the waveform across the load
8. Simulation of Half wave controlled rectifier with R and RL load
9. Simulation of full wave rectifier mid point configuration with R load
10. Simulation of single phase half controlled bridge rectifier with R and RL load
11. Simulation of single phase fully controlled bridge rectifier with R and RL load
12. Simulation of AC voltage regulator
13. Simulation of Cycloconverter.
14. Simulation of single phase multiple pulse inverter

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**LIFE SKILLS****(Common to all Branches)**

<b>Subject Title</b>	:	<b>Life skills</b>
<b>Subject Code</b>	:	<b>EE - 508</b>
<b>Periods per week</b>	:	<b>03</b>
<b>Period per semester</b>	:	<b>45</b>

**TIME SCHEDULE**

Sl No.	Major Topics	No. of periods
1.	Concept of life skills	03
2.	Enhancing self esteem	03
3.	Goal setting	03
4.	Positive attitude	03
5.	Managing emotions	06
6.	Stress management	06
7.	Time management	03
8.	Interpersonal skills	03
9.	Creativity	03
10.	Problem solving and Decision making skills	03
11.	Assertiveness	06
12.	Leadership skills & Team spirit	03
TOTAL		45

**Note: No Written Examination**

The students may be asked to demonstrate 1 or 2 skills from unit 2 to unit 12.

**Marks:** Internal – 40; External - 60

**OBJECTIVES**

On the completion of the course the students shall be able to

**1.0 Understand the concept of Life Skills**

- 1.1 Define Life Skills
- 1.2 Explain need and impact of Life Skills Programme
- 1.3 List the elements of Life Skills
- 1.4 Identify the sources of Life Skills

**2.0 Understand the concept of Self esteem**

- 2.1 Define the term self esteem
- 2.2 Explain the concept of Self esteem
- 2.3 List the characteristics of High Self esteem
- 2.4 List the characteristics of Low Self esteem
- 2.5 Explain the advantages of High Self esteem
- 2.6 Explain the behaviour patterns of Low self esteem
- 2.7 Explain the causes of Low self esteem
- 2.8 List the steps to build a positive Self esteem

**Practicals**

Exp No	Exercise	Activity (Questionnaire / Game and Role play)
1.	Identifying the Behaviour	<ul style="list-style-type: none"> <li>• Identifying the behavior patterns of low self-esteem people.</li> </ul>
2.	Practice Positive Self Esteem	<ul style="list-style-type: none"> <li>• Steps to build a positive self esteem</li> </ul>

**3.0 Understand the concept of Goal setting**

- 3.1 Define the term Goal
- 3.2 Explain the significance of Goal setting
- 3.3 Explain the following concepts
  - a) Wish b) Dream c) Goal
- 3.4 Explain the reasons for not setting goals
- 3.5 Explain effective goal setting process
- 3.6 List the barriers to reach goals

**Practicals**

Exp No	Exercise	Activity
1.	Differentiate among Wish, Dream and Goal	<ul style="list-style-type: none"> <li>• Draw a picture of Your Self/ Your Country/ Your Society after 10yrs.</li> <li>• Discussion: Setting Personal Goals</li> <li>• Story Telling</li> <li>• Identifying of barriers</li> <li>• Analysis barriers</li> <li>• Overcoming barriers</li> </ul>

**4.0 Practise positive attitude**

- 4.1 Define Attitude
- 4.2 Explain the concept of positive attitude
- 4.3 Explain the concept of negative attitude
- 4.4 Explain the effects of negative attitude
- 4.5 Identify the attitude of self and peers
- 4.6 Explain the effect of peers on self and vice-versa.
- 4.7 List the steps to enhance positive attitude
- 4.8 Explain the strategies to enhance positive attitude

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**Practicals**

Exp No	Exercise	Activity (Psychological Instrument/ Game & Role play)
1.	Identify Positive attitude	<ul style="list-style-type: none"> <li>• To study &amp; to identify the attitude of self and peer</li> <li>• List &amp; practise the strategies to enhance positive attitude.</li> </ul>
2.	Observe	<ul style="list-style-type: none"> <li>• Positive attitudes of self and Peers</li> <li>• Negative attitudes of self and Peers</li> </ul>
3.	Practice Strategies to enhance Positive attitude	<ul style="list-style-type: none"> <li>• Celebrating success</li> <li>• Listing successes</li> </ul>

**5.0 Practise managing emotions****5.1 Explain the concept of emotion**

- 5.2 List the different types of emotions
- 5.3 Differentiate between positive and negative emotions
- 5.4 Identify the type of emotion

- 5.5 Explain the causes of different types of emotions.
- 5.6 Implement methods to manage major emotions ( anger / depression )
- 5.7 Define Emotional Intelligence.
- 5.8 Explain the method to enhance Emotional Intelligence.

### Practicals

Exp No	Exercise	Activity (Story / simulated situational act /GD & Role play)
1.	Identify the Type of Emotion	<ul style="list-style-type: none"> <li>To identify the type and to study the cause of the emotion.</li> </ul>
2	Managing Emotions	<ul style="list-style-type: none"> <li>Managing major emotions -Anger and Depression</li> </ul>

### 6.0 Practise stress management skills

- 6.1 Define Stress
- 6.2 Explain the concept of stress
- 6.3 List the types of stress
- 6.4 Explain the causes of stress
- 6.5 Comprehend the reactions to stress
- a) Physical      b) Cognitive      c) Emotional      d) Behavioural
- 6.6 Explain the steps involved in coping with stress by
- a) Relaxation      b) Meditation      c) Yoga
- 6.7 Practice stress relaxing techniques by 3 methods.
- a) Relaxation      b) Meditation      c) Yoga
- 6.8 Comprehend changing personality and cognitive patterns.
- 6.9 Observe changing personality and cognitive patterns.

### Practicals

Exp No	Exercise	Activity(Questionnaire /Interview and practice)
1	Identify the type of stress	<ul style="list-style-type: none"> <li>To study &amp; to identify the type and causes of stress.</li> </ul>
2	Stress –Relaxation Techniques	<ul style="list-style-type: none"> <li>Practice some simple Stress –Relaxation Techniques, Meditation, Yoga.</li> </ul>

Practise some simple Stress –Relaxation Techniques, Meditation, Yoga.

### 7.0 Practice Time Management Skills

- 7.1 Define Time management.
- 7.2 Comprehend the significance of Time management.
- 7.3 Explain the strategies to set priorities.
- 7.4 List the steps to overcome barriers to effective Time management.
- 7.5 Identify various Time stealers.
- 7.6 Explain Time-Management skills.
- 7.7 List different Time-Management skills.
- 7.8 Comprehend the advantages of Time-Management skills.

### Practicals

Exp No	Exercise	Activity ( Group work and Games)
1	Identify Time stealers	<ul style="list-style-type: none"> <li>Assign a activity to different Groups –Observe the time of accomplishing the task, Identify the time stealers.</li> </ul>
2.	Practice Time-Management skills	<ul style="list-style-type: none"> <li>Perform the given tasks- Games</li> </ul>

### 8.0 Practise Interpersonal skills

- 8.1 Explain the significance of Interpersonal skills.
- 8.2 List the factors that prevent building and maintaining positive relationships.
- 8.3 Advantages of positive relationships.
- 8.4 Disadvantages of negative relationships

### Practicals

Exp No	Exercise	Activity
1.	Identify Relationships	<ul style="list-style-type: none"> <li>Positive Relationships, Negative Relationships – Factors that affect them- Through a story</li> </ul>
2.	Practise Rapport building	<ul style="list-style-type: none"> <li>Exercises on Rapport building</li> <li>Developing Correct Body Language</li> </ul>

**9.0 Understand Creativity skills**

- 9.1 Define Creativity
- 9.2 List the synonyms like Invention, Innovation and Novelty
- 9.3 Distinguish between Creativity , Invention, Innovation, and Novelty
- 9.4 Discuss the factors that lead to creative thinking like observation and imitation , improvement etc.
- 9.5 Distinguish between Convergent Thinking and Divergent Thinking
- 9.6 Explain various steps involved in Scientific approach to creative thinking namely
- a) Idea generation b) Curiosity c) Imagination d) Elaboration e) Complexity  
f) Abstraction and simplification g) Divergent Thinking h) Fluency  
i) Flexibility j) Persistence k) Intrinsic Motivation l) Risk taking  
m) Projection/empathy n) Originality o) Story telling p) Flow.
- 9.7 List the Factors affecting the creativity in Individuals.
- 9.8 Give the concept of Vertical thinking and Lateral thinking.
- 9.9 Explain the importance of Lateral thinking.
- 9.10 Compare Lateral thinking and Vertical thinking

**Practicals**

Exp No	Exercise	Activity (Games and Group work)
1	Observe any given object	• Identifying finer details in an object
2.	Imagine	• Imagining a scene • Modifying a story (introduce a twist) • Improving a product • Finding different uses for a product
3	Skills	• Making paper craft
4	Product development	• Brain storming session
5	Developing originality	• Come up with original solutions for a given problem

**10.0 Understand Problem Solving and Decision Making Skills**

- 10.1 Define a Problem
- 10.2 Analyze the performance problems
- 10.3 Categorize the problems
- 10.4 List the barriers to the solutions to problems.

**Practicals**

Exp No	Exercise	Activity (Brainstorming – checklist technique free association, attribute listing)
1	Gathering the facts and Data and Organizing the information.	• Information gathering and organizing • Identifying the solutions to the problem • Identifying the barriers to the solutions • Zeroing on Optimum solution
2.	Problem solving	• Games on Problem solving

**11.0 Understand Assertive and Non Assertive behaviour**

- 11.1 List the 3 types of Behaviours 1. Assertive 2. Non assertive (passive) 3. Aggressive Behaviour 4. Submissive behaviours
- 11.2 Discuss the personality of a person having above behaviours
- 11.3 Explain the usefulness of assertive behaviour in practical situations.
- 11.4 Explain the role of effective communication in reflecting assertive attitude
- 11.5 Give examples of Assertive statements a) Assertive request b) assertive NO
- 11.6 Explain the importance of goal setting
- 11.7 Explain the method of Conflict resolution.
- 11.8 Discuss the methods of controlling fear and coping with criticism.

**Practicals**

Exp No	Exercise	Activity ( Simulated situational act)
1	Observation of behavior	<ul style="list-style-type: none"> <li>Identifying different personality traits from the body language</li> </ul>
2.	Practicing assertiveness	<ul style="list-style-type: none"> <li>Write statements</li> <li>Reaction of individuals in a tricky situation</li> <li>Facing a Mock interview</li> <li>Detailing the characteristics of peers</li> <li>setting goals – Games like throwing a coin in a circle</li> <li>Giving a feedback on a )Successful program</li> <li>Failed project</li> <li>Self disclosure</li> </ul>
3	Skills	<ul style="list-style-type: none"> <li>Dealing with a critic</li> <li>Saying NO</li> <li>Dealing with an aggressive person</li> </ul>
4	Simulation	<ul style="list-style-type: none"> <li>Role play- skit</li> <li>1. Assertive statements</li> <li>2. goal setting</li> <li>3. self disclosure</li> </ul>

## 12.0 Practise Leadership Skills

- 12.1 Explain the concept of leadership
- 12.2 List the traits of an effective leader
- 12.3 Distinguish between Managing and leading
- 12.4 List the 3 leadership styles
- 12.5 Compare the above styles of leadership styles
- 12.6 Discuss choice of leadership style
- 12.7 Explain the strategies to develop effective leadership.
- 12.8 Explain the importance of Decision making
- 12.9 Explain the procedure for making effective decisions.

### Practicals

Exp No	Exercise	Activity ( Games and Group work)
1	Observation	<ul style="list-style-type: none"> <li>Questionnaire</li> </ul>
2.	Identification of a Leader	<ul style="list-style-type: none"> <li>Give a task and observe the leader</li> <li>Discuss the qualities and his /her leadership style</li> <li>Ask the other members to identify the leadership qualities</li> <li>Reflection on the self</li> </ul>
3	Skills	<ul style="list-style-type: none"> <li>Decision making – followed by discussion</li> </ul>
4	Building Team spirit	<ul style="list-style-type: none"> <li>Motivation – Intrinsic and Extrinsic</li> </ul> Training- Communication- Challenge

## Competencies for Practical Exercises

S.No	Title	Competency	Key competencies
1.	Concept of life skills	<ul style="list-style-type: none"> <li>Explain need and impact of Life skills</li> </ul>	
2.	Enhancing self esteem	<ul style="list-style-type: none"> <li>Follow the steps to build a positive self esteem</li> </ul>	
3.	Goal setting	<ul style="list-style-type: none"> <li>Practise the effective goal setting process</li> </ul>	
4.	Positive attitude	<ul style="list-style-type: none"> <li>Practise the steps to enhance positive attitude.</li> <li>Observe the effects of peers on self and vice-versa.</li> </ul>	Practise the steps to enhance positive attitude
5.	Managing emotions	<ul style="list-style-type: none"> <li>Practise the steps to manage emotional intelligence</li> <li>Identify different types of emotions</li> <li>Exercise control over Emotions</li> </ul>	<ul style="list-style-type: none"> <li>Identify different types of emotions</li> </ul>
6.	Stress management	<ul style="list-style-type: none"> <li>Practise stress management techniques</li> </ul>	
7.	Time management	<ul style="list-style-type: none"> <li>Practise Time management techniques</li> </ul>	
8.	Interpersonal skills	<ul style="list-style-type: none"> <li>Identify positive and Negative Relations</li> </ul>	
9.	Creativity	<ul style="list-style-type: none"> <li>Lead a small group for accomplishment of a given task.</li> <li>Build positive relationships.</li> </ul>	<ul style="list-style-type: none"> <li>Build positive relationships.</li> </ul>
10.	Problem solving and Decision making skills	<ul style="list-style-type: none"> <li>Identify the various Problem solving and Decision making skills</li> <li>Make appropriate decision</li> </ul>	<ul style="list-style-type: none"> <li>Identify the various Problem solving and Decision making skills</li> </ul>
11.	Assertive and non Assertive behaviour	<ul style="list-style-type: none"> <li>Practise Assertive and non Assertive behavior</li> </ul>	
12.	Leadership skills	<ul style="list-style-type: none"> <li>Exhibit Leadership skills</li> </ul>	<ul style="list-style-type: none"> <li>Exhibit Leadership skills</li> </ul>



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**COURSE CONTENT****1.0 Concept of life skills**

Definition of life skills, Need and impact of life skills programme

**2.0 Enhancing self esteem**

Concept, Characteristics of high and low self esteem people, Advantages of high self esteem, Causes of low self esteem- Identification of behaviour patterns of low self esteem – Practice session of Questionnaire / Game -Steps to build positive self esteem – Practice session of Role play

**3.0 Goal setting**

Significance of goal setting, Concepts of Wish, Dream, and Goal Identify Wish, Dream, and Goal and differentiate among them. Reasons for not setting the goals, Barriers to reach goals, Identify Barriers, Effective goal setting process & Practise Effective goal setting

**4.0 Positive attitude**

concept effects of negative attitude, attitude of self and peers, effect of peers on self and vice-versa, steps to enhance positive attitude, strategies to enhance positive attitude

**5.0 Managing emotions**

Problem-definition, performance problems, Categorize the problems, barriers to the solutions to problems.

**6.0 Stress management**

concept of stress, Types of stress, causes of stress, reactions of stress, coping with stress, stress relaxing techniques, changing personality and cognitive patterns

**7.0 Time management**

Definition, significance of various Time stealers, Time management, strategies to set priorities, steps to overcome barriers, Time-Management skills- its advantages.

**8.0 Interpersonal skills**

Significance of Interpersonal skills, positive relationships- Advantages, negative relationships- Disadvantages

**9.0 Creativity**

Definition, Invention, Innovation, Novelty, Creative Thinking, observation and imitation, improvement, Expertise, skill, and motivation, components of Creativity, Convergent Thinking and Divergent Thinking, various steps involved in Scientific approach to creative thinking namely, Factors

affecting the creativity in Individuals, Vertical Thinking and Lateral Thinking.

**10.0 Problem solving and Decision making skills**

Definition, performance problems –analysis, categorizing, barriers to the solutions to problems.

**11.0 Assertive and non Assertive behaviour**

Types of Behaviours – their characteristics, need for controlling and avoiding aggressive behaviours, making and refusing an assertive request – their evaluation, importance of goal setting, method of giving feed back.

**12.0 Leadership skills**

Concept, importance, Role of a Leader in an Organization, Traits of an effective leader, Managing and leading, leadership styles-their comparison, theories of leadership, strategies to develop effective leadership, importance of Decision making, concept of ethical leadership and moral development.

**REFERENCE**

1. Robert Nlussier, Christopher F. Achua Leadership: Theory, Application, & Skill development: Theory, Application.

## AC MACHINES LAB PRACTICE - II

**Subject Title** : AC Machines Lab Practice - II  
**Subject Code** : EE-509  
**Periods/Week** : 03  
**Periods/Year** : 45

### TIME SCHEDULE

S. No.	MAJOR TOPICS	NO OF PERIODS
1.	Tests on 1-phase and 3-phase AC Motors	15
2.	Drawing circle diagram on AC Motors	18
3.	Identify and rectify faults in AC motors and starters	12
	Total	45

### OBJECTIVES

**Upon completion of the practice the student shall be able to**

1. Conduct brake test on 3-phase squirrel cage induction motor.
2. Conduct Brake test on 3-phase slip ring induction motor.
3. Perform Load test on Single phase split type induction motor.
4. Perform Load test on single phase capacitor type induction motor
5. Perform Load test on a single phase Universal motor
6. Conduct suitable tests and draw circle diagram of squirrel cage induction motor.
7. Conduct suitable tests and draw circle diagram of slip ring induction motor
8. Conduct load test on synchronous motor and draw V and inverted V curves.
9. Identify and rectify faults in AC motors.
10. Identify and rectify faults in AC starters

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S.No	Experiment Title	Competencies	Key competency
1	Brake test on 3-phase squirrel cage induction motor.	<ul style="list-style-type: none"> <li>▪ Draw the circuit diagram</li> <li>▪ Identify the different terminals of 3-ph induction motor</li> <li>▪ Select the suitable starter.</li> <li>▪ Identify the terminals of the starter.</li> <li>▪ Select the range and type of the meters</li> <li>▪ Make the connections as per the circuit diagram</li> <li>▪ Start the motor using a starter Apply the load up to full load in steps</li> <li>▪ Pour water in the brake drum</li> <li>▪ Note down the readings of ammeter and voltmeter for each load.</li> <li>▪ Calculate the output, torque and efficiency etc</li> <li>▪ Plot the performance characteristics</li> <li>▪ Verify the performance of the machine.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Apply the load up to full load in steps</li> <li>▪ Pour water in the brake drum</li> <li>▪ Before Switching off the motor remove the load</li> </ul>
2	Brake test on 3-phase slip ring induction motor.	<ul style="list-style-type: none"> <li>▪ Draw the circuit diagram</li> <li>▪ Interpret the name plate details</li> <li>▪ Identify the different terminals of the 3-ph induction motor</li> <li>▪ Select the suitable starter.</li> <li>▪ Identify the terminals of the starter.</li> <li>▪ Select the range and type of the meters</li> <li>▪ Make the connections as per the circuit diagram</li> <li>▪ Start the motor using a starter</li> <li>▪ Verify the performance of the machine.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Before giving supply Slip rings must be short circuited</li> <li>▪ Speed should be measured accurately</li> </ul>
3,4	Load test on a) split phase induction motor. b) capacitor type induction motor	<ul style="list-style-type: none"> <li>▪ Draw the circuit diagram</li> <li>▪ Identify the different terminals of the 1-ph split phase induction motor /1-ph capacitor type induction motor and the starter</li> <li>▪ Select the ranges and type of the meters</li> <li>▪ Make the connections as per circuit diagram</li> <li>▪ Start the motor using a starter</li> <li>▪ Apply the load in steps</li> <li>▪ Record the meter readings</li> <li>▪ Verify the performance of the machine.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Start the motor using a starter without load</li> <li>▪ Apply the load up to full load in steps</li> </ul>
5	Load test on single-phase Universal motor.	<ul style="list-style-type: none"> <li>▪ Draw the circuit diagram</li> <li>▪ Identify the different terminals of the 1-ph universal motor</li> <li>▪ Select the range and type of the meters</li> <li>▪ Make the connections as per the circuit diagram</li> <li>▪ Start the motor using a starter</li> <li>▪ Apply the brake load lightly</li> <li>▪ Verify the performance of the machine</li> </ul>	<ul style="list-style-type: none"> <li>▪ Apply the brake load lightly</li> <li>▪ Take the readings properly</li> </ul>

**Competencies & Key competencies to be achieved by the student**

6,7	Conduct suitable tests and draw circle diagram of a) squirrel cage induction motor b) slip ring induction motor	<ul style="list-style-type: none"> <li>▪ Draw the circuit diagram for No-load test and Blocked rotor test</li> <li>▪ Make the connections for no-load test and Blocked rotor test as per the circuit diagram</li> <li>▪ Start the motor without load</li> <li>▪ Apply the rated voltage to the motor in the no-load test and rated current to the blocked rotor test.</li> <li>▪ During the Blocked rotor test fully tighten the rotor shaft</li> <li>▪ Record the meter readings</li> <li>▪ Calculate the output, torque, efficiency etc.</li> <li>▪ Plot the performance characteristics.</li> <li>▪ Verify the performance of the machine.</li> <li>▪ Draw the circle diagram on a graph sheet using the test data</li> <li>▪ Select proper scale to draw the circle diagram</li> </ul>	<ul style="list-style-type: none"> <li>▪ Apply the rated voltage to the motor in the no-load test and rated current to the blocked rotor test.</li> <li>▪ During the Blocked rotor test fully tighten the rotor</li> </ul>
8	Conduct load test on synchronous motor and draw V and inverted V curves	<ul style="list-style-type: none"> <li>▪ Draw the circuit diagram</li> <li>▪ Identify different terminals of the 3-ph synchronous motor</li> <li>▪ Select the range and type of the meters</li> <li>▪ Make the connections as per the circuit</li> <li>▪ Start the motor as per the procedure</li> <li>▪ Switch on the excitation at correct time</li> <li>▪ Vary the excitation in steps</li> <li>▪ Pour water in the brake drum for cooling.</li> <li>▪ Reduce the load to zero gradually.</li> <li>▪ Switch off the motor.</li> <li>▪ Disconnect the circuit.</li> <li>▪ Calculate the output, torque, efficiency etc.</li> <li>▪ Plot the performance characteristics.</li> <li>▪ First switch off the excitation and then only switch off the mains</li> <li>▪ Draw the V and inverted V curves on a single graph sheet</li> </ul>	<ul style="list-style-type: none"> <li>▪ Switch on the excitation at correct time</li> <li>▪ Vary the excitation in steps</li> <li>▪ First switch off the excitation and then only switch off mains</li> </ul>

9	Identify and rectify faults in AC motors	<ul style="list-style-type: none"> <li>▪ Select a faulty motor</li> <li>▪ Identify the different terminals of ac motors.</li> <li>▪ Interpret the name plate details.</li> <li>▪ Identify the different parts of the motor Identify the problems in the motor by physical observation</li> <li>▪ Verify all the connections of the motor and the starter</li> <li>▪ Check for burnout fuses.</li> <li>▪ Identify any loose connections if any to tighten the connections</li> <li>▪ Check the condition of bearings.</li> <li>▪ Check the continuity of different windings by using DMM or Test lamp.</li> <li>▪ Identify any open or short circuits in the windings.</li> <li>▪ Check the continuity between windings and body earthing.</li> <li>▪ Start the motor using a starter without load.</li> <li>▪ Observe whether the motor is running or not</li> <li>▪ If running with normal speed no problem in the motor.</li> <li>▪ If running with low speed check for reversal of phase and Reduce the load to Zero gradually</li> <li>▪ Switch off the motor</li> <li>▪ Disconnect the circuit.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Identify the problems in motor by physical observation</li> <li>▪ check for reversal of phase and Reduce the load to Zero gradually .If the Motor is running with low speed</li> </ul>
10	Identify and rectify faults in AC starters	<ul style="list-style-type: none"> <li>▪ Check the input and output terminals of the starter</li> <li>▪ Check the condition of contactors for opening and closing</li> <li>▪ Check for open circuit and short circuit in the coils of contactor.</li> <li>▪ Check the condition of over load relay coil and no volt coil</li> <li>▪ Check the current setting dial for proper current setting</li> <li>▪ Check the contactor opening and closing time.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Check the current setting dial for proper current setting</li> </ul>

**FIELD PRACTICES**

**Subject Title** : FIELD PRACTICES  
**Subject code** : EE-510  
**Periods/Week** : 06  
**Periods/Semester** : 90 (30 Sessions - 3 periods/session)

**TIME SCHEDULE**

Sl. No	Major Topics	Periods
1.	Maintenance /Charging of the Batteries	6
2.	Testing and repair of Domestic appliances	12
3.	Installation and Testing of UPS.	6
4.	Installation and Testing of Inverters.	6
5.	Installation and Testing of solar panels	6
6.	Installation and Testing of MG set.	6
7.	Overhauling of DC Machine	6
8.	Overhauling of AC Machine	6
9.	Practice on Motor winding	6
10.	Maintenance of transformer	6
11.	Estimation of Power loads	6
12.	Identification of faults in Distribution lines( visit a nearby substation)	6
13.	Departmental procedures of distribution companies	6
14.	Study of HT substation (Industrial Visit)	6
	Total	90

**OBJECTIVES**

**Upon completion of the practice the student shall be able to**

1. Carry out the Maintenance /Charging of the Batteries
2. Test and repair the Domestic appliances
3. Carry out the Installation work and Test the UPS for its performance
4. Carry out the Installation work and Test the Inverters for any faults.
5. Carry out the Installation work and Test the solar panels.
6. Carry out the Installation work and Test the MG set.
7. Perform the Overhauling of DC Machine.
8. Perform the Overhauling of AC Machine.
9. Practice on Motor winding.
10. Carry out the Maintenance of transformer.
11. Estimate the Power loads
12. Identify the faults in Distribution lines.
13. Know the Departmental procedures of distribution companies
14. Write a report on the Industrial visit - HT Substation(66/132 KV Substation).

### Competencies & Key competencies to be achieved by the student

Sl. No	Experiment title	Competencies	Key Competencies
1.	Maintenance /Charging of the Batteries.	<ul style="list-style-type: none"> <li>✓ Record the Electrical specifications of the Battery.</li> <li>✓ Remove the knobs and open the battery.</li> <li>✓ Record the specific gravity of the Electrolyte of each cell using Hydrometer.</li> <li>✓ Note the level of Electrolyte in each cell.</li> <li>✓ Add the distilled water if necessary using a funnel.</li> <li>✓ Tighten the screws after closing the battery.</li> <li>✓ Record the Voltage of each cell using multi-meter.</li> <li>✓ Keep the ventilating plugs open while charging if it is not a maintenance free battery.</li> <li>✓ Connect the battery to the Battery charger by selecting proper method (constant current, Constant voltage), and voltage.</li> <li>✓ Observe the temperature of the battery after charging.</li> <li>✓ Clean the terminals and apply Grease/petroleum Gelli to avoid sulphation.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Choosethe correct battery rating.</li> <li>✓ Measure specific gravity of electrolyte.</li> <li>✓ Preparethe electrolyte.</li> </ul>
2.	Testing and repair of domestic appliances	<ul style="list-style-type: none"> <li>✓ Inspect the appliance visually.</li> <li>✓ Check for any discrepancies.</li> <li>✓ Perform the disassembling operation</li> <li>✓ Test the inner parts for any faults</li> <li>✓ Rectify the faults if any .</li> <li>✓ Replace the parts if necessary.</li> <li>✓ Perform the assembling.</li> <li>✓ Test theDomestic appliance for proper functioning.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Check for any discrepancies.</li> <li>✓ Rectify the faults</li> </ul>
3.	Installation and Testing of UPS.	<ul style="list-style-type: none"> <li>✓ Identify the rating of the UPS for a particular application.</li> <li>✓ Note the rating of UPS</li> <li>✓ Practice the sequenceof operations of switching ON/OFF.</li> <li>✓ Identify and pick the right tools and accessories for installation.</li> <li>✓ Practice the installation.</li> <li>✓ Draw the connection diagram</li> <li>✓ Give the necessary Electrical connections by using standard methods and techniques.</li> <li>✓ Know the maintenance of UPS, batteries and their inter connections.</li> <li>✓ Test the UPS for its performance.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Identify the rating of the UPS for a particular application.</li> <li>✓ Giving Electrical connections</li> </ul>

4.	Installation and Testing of Inverters.	<ul style="list-style-type: none"> <li>✓ Note the block diagram of Inverter and describe about each block.</li> <li>✓ Design the rating of Inverter as per the given load</li> <li>✓ Give Electrical connections as per the connection diagram.</li> <li>✓ Prepare the external wiring to connect an Inverter to a particular installation.</li> <li>✓ Know the maintenance of inverter</li> </ul>	<ul style="list-style-type: none"> <li>✓ Giving Electrical connections.</li> </ul>
5.	Installation and Testing of Solar panels	<ul style="list-style-type: none"> <li>✓ Identify the solar collector used.</li> <li>✓ Note the applications of solar energy in different areas like water heaters, driers, cookers, furnaces, Green houses, water distillation, Electric power plant.</li> <li>✓ Identify the type of solar cell, different module, panel and array construction</li> </ul>	<ul style="list-style-type: none"> <li>✓ Installation of Solar panels as per the atmospheric conditions.</li> </ul>
6.	Installation and Testing of MG set	<ul style="list-style-type: none"> <li>✓ Observe the rating of the MG set .</li> <li>✓ List the electrical accessories required to connect the Generator output through panel board.</li> <li>✓ List the electrical accessories required to connect Motor to an Electric supply.</li> <li>✓ Record the maintenance procedures/ steps involved in operation of MG set</li> </ul>	<ul style="list-style-type: none"> <li>✓</li> </ul>
7.	Overhauling of DC Machine	<ul style="list-style-type: none"> <li>✓ Note the type of given DC machine.</li> <li>✓ Disassemble the End covers.</li> <li>✓ Remove the Armature.</li> <li>✓ Remove the Bearing using Bearing pullers.</li> <li>✓ Test the condition of winding and commutator using electric growler.</li> <li>✓ Test the insulation resistance of the armature and field resistance using megger.</li> <li>✓ Observe the bearings, clean and apply grease.</li> <li>✓ Increase the insulation resistance of the winding by coating/ applying varnish (if insulation resistance is low).</li> <li>✓ Heat the winding to absorb the moisture using Electric Oven/ High wattage lamps ( to improve insulation resistance).</li> <li>✓ Note the condition of Mica insulation between two commutator segments.</li> <li>✓ Gently clean the surface of the commutator.</li> <li>✓ Record the condition of the brushes and brush holders.</li> <li>✓ Reassemble the machine.</li> <li>✓ Record the speed, noise, output and temperature raise of the machine.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Disassemble, assemble, test and repair of DC Machine.</li> <li>✓ Draw the winding diagrams.</li> <li>✓ Test insulation strength of the conductor and coating of varnish.</li> </ul>

8	Overhauling of AC Machine	<ul style="list-style-type: none"> <li>✓ Note the type of given AC machine.</li> <li>✓ Disassemble the End covers.</li> <li>✓ Remove the Armature.</li> <li>✓ Remove the Bearing using Bearing pullers.</li> <li>✓ Note the condition of armature winding using electric growler.</li> <li>✓ Record the insulation resistance of the stator and rotor using megger.</li> <li>✓ Record the condition of bearings, clean and apply grease as per the condition.</li> <li>✓ Improve the insulation resistance of the winding by coating/ applying varnish (if insulation resistance is low)</li> <li>✓ Heat the winding to using Electric Oven/ High wattage lamps to absorb the moisture ( to improve insulation resistance)</li> <li>✓ Reassemble the machine.</li> <li>✓ Record the running condition of the machine both mechanical &amp; electrical aspects</li> </ul>	<ul style="list-style-type: none"> <li>✓ Disassemble, assemble, test and repair of AC Machine.</li> <li>✓ Draw the winding diagrams.</li> <li>✓ Test insulation strength of the conductor and coating of varnish.</li> </ul>
9.	Practice on Motor winding	<ul style="list-style-type: none"> <li>✓ Note the type and rating of the given motor.</li> <li>✓ Record the type of bearings employed in the motor.</li> <li>✓ Identify and test the condition of windings using test lamp / megger.</li> <li>✓ Note the gauge of the winding coil used.</li> <li>✓ Record the class of insulation used.</li> <li>✓ Note the fault in a given machine.</li> <li>✓ Draw the winding diagram according to its construction.</li> <li>✓ Estimate the quantity and cost of material required.</li> <li>✓ Prepare the coils using coil winding machine</li> <li>✓ Insulate the slots by using slot insulating material (Milmen paper, Wooden strips).</li> <li>✓ Insert the coils in to slots and make end connections , insulate the coils using tape and varnish the winding.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Selection of suitable ratings of the Motor as per the application.</li> <li>✓ Identifying the faults and its trouble-shooting.</li> </ul>
10.	Maintenance of transformer	<ul style="list-style-type: none"> <li>✓ Recording the rating of the transformer</li> <li>✓ Note the various components/ terminals.</li> <li>✓ Record the dielectric strength of the transformer oil using Oil testing equipment.</li> <li>✓ Observe the condition of the silica gel in breather and replace if needed.</li> <li>✓ Record the earth resistance of the transformer</li> </ul>	<ul style="list-style-type: none"> <li>✓ Selection of suitable transformer.</li> <li>✓ Testing of dielectric strength of Oil.</li> <li>✓ Replacing Silica gel.</li> </ul>

11.	Estimation of Power loads	<ul style="list-style-type: none"> <li>➤ Record the details of total load and layout of the Electrical installation.</li> <li>➤ Prepare the Electrical circuit layout.</li> <li>➤ List the quantity required and specifications of electrical material.</li> <li>➤ List the different tools required to execute the installation work.</li> <li>➤ Prepare the work schedule and identify the Vendors.</li> <li>➤ Estimate the cost of material and labour.</li> <li>➤ Execute the Electrical installation.( with dummy loads)</li> </ul>	<ul style="list-style-type: none"> <li>✓ Draw the Electrical wiring diagram.</li> <li>✓ Estimate the Materials, tools and labour cost for the work.</li> <li>✓ Identify the vendors.</li> <li>✓ Execute work schedules.</li> </ul>
12.	Identification of faults in Distribution lines	<ul style="list-style-type: none"> <li>✓ Survey the Distribution lines in a given area.</li> <li>✓ Identify the electrical components used.</li> <li>✓ Record the voltage level</li> <li>✓ Identify the type of distribution used.</li> <li>✓ Tighten the loose spans if any.</li> <li>✓ Record the jumpers and its condition.</li> <li>✓ Observe the physical condition of Insulators.</li> <li>✓ Observe the physical condition of the PSCC poles.</li> <li>✓ Observe the physical conditions of ACSR conductor, cross arms and stays.</li> <li>✓ Identify the faults</li> <li>✓ Practice the rectification method.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Surveying the New distribution lines in rural areas.</li> <li>✓ Estimation of line components.</li> <li>✓ Tighten the loose spans.</li> </ul>
13.	Departmental procedures of distribution companies	<ul style="list-style-type: none"> <li>✓ Know the procedures to get service connections for domestic ( 1 phase, 3 phase) purpose.</li> <li>✓ Know the departmental procedures to obtain service connection to Agriculture pump set.</li> <li>✓ Know the departmental procedure to obtain service connection for a small scale industry.</li> <li>✓ Calculate Earth resistances of above installations.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Knowledge of procedures to obtain new service connections for Domestic, Agriculture &amp; Industrial loads.</li> </ul>
14.	Submit a Report on Study of HT substation (Visit)	<ul style="list-style-type: none"> <li>✓ Draw the layout of Sub station.</li> <li>✓ 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 Transformers, Wave trappers, capacitor banks, Batteries, Earth switches etc.)</li> <li>✓ Note the staff structure and duties of each staff and day to day activities carried by staff.</li> <li>✓ Record the maintenance procedures adopted as per IS code and note typical earth resistance values.</li> <li>✓ Record the preventive maintenance schedule of all substation equipment</li> <li>✓ Record the details of frequent faults/breakdowns occurred.</li> <li>✓ Note the safety equipments used and precautions to be taken.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Drawing the layout of substation.</li> <li>✓ Obtain the knowledge of every equipments used in substations.</li> <li>✓ Understand the duties and functions of staff working at the substation.</li> <li>✓ Understand the various faults occurring frequently and safety equipments used.</li> </ul>

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**Important note : The field practice exercises listed above should pave way for student staff interaction and selection of a project work to be performed in the next semester.**

**Text Books:**

Name of Authors	Titles of the Book	Name of the Publisher
1. B. L. Theraja	Electrical Technology Vol I To IV	S. Chand & Co., New Delhi
2. B. V. S. Rao	Operation & Maintenance of Electrical Machines Vol-I	Media Promoters & Publisher Ltd. Mumbai
3. B. V. S. Rao	Operation & Maintenance off Electrical Machines Vol - II	Media Promoters & Publisher Ltd. Mumbai
4. C.J. Hubert	Preventive Maintenance	Hand Books & Journals

**DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING**  
**SCHEME OF INSTRUCTIONS AND EXAMINATIONS**  
**VI Semester**

Subject Code	Name of the Subject	Instruction period / week		Total Period / Sem	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
<b>THEORY:</b>								
EE- 601	Industrial Management	4	-	60	3	20	80	100
EE-602	Electric Traction	4	-	60	3	20	80	100
EE - 603	Power Systems – III (Switch Gear and Protection)	4	-	60	3	20	80	100
EE - 604	Power Electronics	4	-	60	3	20	80	100
EE - 605	Micro Controllers and Applications	4	-	60	3	20	80	100
EE - 606	Industrial Automation	4	-	60	3	20	80	100
<b>PRACTICAL:</b>								
EE- 607	Electrical CAD & Project Management Lab Practice	-	6	90	3	40	60	100
EE -608	Digital Electronics & Micro Controller Lab Practice	-	3	45	3	40	60	100
EE -609	Power Electronics & PLC Lab Practice	-	3	45	3	40	60	100
EE -610	Project work	-	6	90	3	40	60	100
<b>TOTAL</b>		<b>24</b>	<b>18</b>	<b>630</b>		<b>280</b>	<b>720</b>	<b>1000</b>

- Note:** 1. Five no local industrial visits / Interaction, one from each of the courses listed from EE 602 to EE 606 may be arranged to enable the students to have industry exposure.
2. **Duration:** Total of all the visits not exceeding one week
- The students need to submit 2-3 page write up mentioning all salient learning experiences like advance in technology, its evaluation, application, advantages & disadvantages, expected changes in future etc.,.
3. **Industries:** Advanced manufacturing industry / BHEL / ECIL / Traction substations/ service industries etc.

**INDUSTRIAL MANAGEMENT**

Subject Title	:	<b>INDUSTRIAL MANAGEMENT</b>
Subject Code	:	<b>EE-601</b>
Periods/Week	:	<b>04</b>
Periods/semester	:	<b>60</b>

**TIME SCHEDULE**

Sl. No.	Major Topics	Periods	Weightage of marks	Short questions	Essay questions
1.	<b>Overview Of Business</b>	<b>4</b>	<b>6</b>	<b>2</b>	
2.	<b>Management Process</b>	<b>6</b>	<b>13</b>	<b>1</b>	<b>1</b>
3.	<b>Organizational Management</b>	<b>6</b>	<b>13</b>	<b>1</b>	<b>1</b>
4.	<b>Human Resource Management</b>	<b>12</b>	<b>23</b>	<b>1</b>	<b>2</b>
5.	<b>Financial Management</b>	<b>10</b>	<b>16</b>	<b>2</b>	<b>1</b>
6.	<b>Materials Management</b>	<b>8</b>	<b>13</b>	<b>1</b>	<b>1</b>
7.	<b>Project Management</b>	<b>14</b>	<b>26</b>	<b>2</b>	<b>2</b>
	<b>Total</b>	<b>60</b>	<b>110</b>	<b>10</b>	<b>8</b>

**OBJECTIVES**

**Upon completion of the course the student shall be able to**

**1.0 Explain the basics of Business**

- 1.1 Define Business
- 1.2 State the Types of Business ( Service, Manufacturing, Trade)
- 1.3 Explain the business procedures in Engineering sector ( Process industry, Textile industry, Chemical industry, Agro industry,)
- 1.4 State the need for Globalization.
- 1.5 List the Advantages & Disadvantages of globalization w.r.t. India.
- 1.6 Explain the importance of Intellectual Property Rights (I.P.R.)

**2.0 Explain the Management Process:**



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- 2.1 Define Management.
- 2.2 Explain the concept of management
- 2.3 Explain the Different Levels of management
- 2.4 Explain Administration & management
- 2.5 State the principles of Scientific management by F.W.Taylor
- 2.6 State the principles of Management by Henry Fayol (14 principles)
- 2.7 List the Functions of Management
- i) Planning
  - ii) Organizing
  - iii) Directing
  - iv) Controlling
- 2.8 Explain the four Functions of Management.
- 3.0 Appreciate the need for Organizational Management**
- 3.1 Define Organization
- 3.2 List the Types of organization :a) Line b) Line & staff c) Functional d) Project
- 3.3 Explain the four types of organization.
- 3.4 Define departmentation.
- 3.5 Explain the following types of departmentations
- i) Centralized & Decentralized
  - ii) Authority & Responsibility
  - iii) Span of Control
- 3.6 Explain the Forms of ownership
- i) Proprietorship
  - ii) Partnership
  - iii) Joint stock
  - iv) Co-operative Society
  - v) Govt. Sector
- 4.0 Appreciate the need for Human Resource Management**
- 4.1 Define Personal Management.
- 4.2 Explain the functions of Personal Management
- 4.3 Define Staffing .
- 4.4 State the importance of HR Planning.
- 4.5 Explain the various Recruitment Procedures.

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- 4.6 Explain the need for Training & Development .
- 4.7 State the various types of training procedures( Induction, Skill Enhancement etc)
- 4.8 State the different types of Leaderships,
- 4.9 Explain the Maslow's Theory of Motivation
- 4.10 Explain the Causes of accident and the Safety precautions to be followed.
- 4.11 Explain the importance of various Acts - Factory Act, ESI Act, Workmen Compensation Act, Industrial Dispute Act etc.
- 5.0 Explain the basics of Financial Management**
- 5.1 State the Objectives of Financial Management.
- 5.2 State the Functions of Financial Management.
- 5.3. State the necessity of Capital Generation & Management.
- 5.4 List the types of Capitals.
- 5.5 List the Sources of raising Capital.
- 5.6 Explain the Types of Budgets i) Production Budget (including Variance Report )
- ii) Labour Budget.
- 5.7 Describe Profit & Loss Account ( only concepts) .
- 5.8 Describe the proforma of Balance Sheet.
- 5.9 Explain i) Excise Tax ,
- ii) Service Tax
  - iii) Income Tax
  - iv) VAT
  - v) Custom Duty.
- 6.0 Explain the importance of Materials Management**
- 6.1. Define Inventory Management (No Numerical).
- 6.2 State the objectives of Inventory Management.
- 6.3 Explain ABC Analysis.
- 6.4 State Economic Order Quantity.
- 6.5 Describe the Graphical Representation of Economic Order Quantity.
- 6.6 State the objectives of Purchasing.
- 6.7 State the functions of Purchase Department.
- 6.8 Explain the steps involved in Purchasing.
- 6.9 State the Modern Techniques of Material Management.

- 6.10 Describe the JIT / SAP / ERP packages.
- 7.0 Explain the importance of Project Management**
- 7.1 State the meaning of Project Management.
- 7.2 Describe the CPM & PERT Techniques of Project Management.
- 7.3 Identify the critical path and find the project duration.
- 7.4 Explain the concept of Break Even Analysis
- 7.5 Define Quality.
- 7.6 State the concept of Quality.
- 7.7 Describe the various Quality Management systems.
- 7.8 Explain the importance of Quality policy, Quality control, Quality Circle.
- 7.9 State the principles of Quality Assurance.
- 7.10 State the concepts of TQM , Kaizen 5's and 6 sigma.
- 7.11 State the constituents of ISO 9000 series standards.

**Course contents :**

**1.0 Overview of Business:**

Business - types of business in various sectors- service, manufacturing & trade- Industrial sectors - Engineering, process, Textile, Chemical, Agro industries - Globalization and effect of globalization - advantages and Disadvantages- Intellectual Property Rights (I.P.R.)

**2.0 Management process**

Concept of management - levels of management - Scientific management - by FW Taylor - Principles of management- functions of management - Administration - management.

**3.0 Organization management**

Organization - types of organization( line, line & staff, staff & project) - Departmentation - Classification (centralized, decentralized, Authority, Responsibility, and span of control - Forms of Ownership - Proprietorship - Partnership - Joint stock - Co-operative society and Government sectors.

**4.0 Human resource Management**

Personal Management - Staffing - Introduction to HR planning - Recruitment procedures - Types of Trainings -Personal training - skill development training - Leaderships - types - Motivation - Maslows theory - Causes of accidents - safety precautions - Factory Act - Workmen compensation Act - Industrial disputes Act- ESI Act.

**5.0 Finance Management**

Introduction - Objectives of Financial Management - Types of capitals -

sources of raising capital - Types of budgets - production budgets - labour budgets - Concept of Profit loss Account - Concept of balance sheet - proforma - types of taxes - brief concepts of - Excise Tax, Service Tax, Income Tax, VAT and custom duty.

**6.0 Material Management**

Inventory Management - objectives of Inventory Management - ABC Analysis - Economic order Quality - Purchasing - Objectives of purchasing - Functions - Procedures - Material Management - JIT / SAP / ERP.

**7.0 Project Management**

Introduction - CPM & PERT - concept of Break event Analysis - quality system - Definition of Quality , concept of Quality , Quality policy, Quality control, Quality Circle, Quality Assurance, Introduction to TQM- Kaizen 5's and 6 sigma concepts, ISO 9000 series standards.

**REFERENCES**

1. Dr. O.P. Khanna - Industrial Engg & Management-Dhanpath Rai & sons New Delhi
2. Dr. S.C. Saxena & W.H. Newman & E.Kirby Warren-Business Administration & Management -Sahitya Bhavan Agra
3. Andrew R. McGill -The process of Management-Prentice- Hall
4. Rustom S. Davar -Industrial Management-Khanna Publication
5. Banga & Sharma -Industrial Organization & Management -Khanna Publication
6. Jhamb & Bokil -Industrial Management -Everest Publication, Pune.

**ELECTRIC TRACTION**

<b>Subject Title</b>	:	<b>ELECTRIC TRACTION</b>
<b>Subject Code</b>	:	<b>EE-602</b>
<b>Periods/Week</b>	:	<b>04</b>
<b>Periods/semester</b>	:	<b>60</b>

**TIME SCHEDULE**

Sl. No.	Major Topics	Periods	Weightage of marks	Short questions	Essay questions
1.	Electric Traction - Properties	20	39	3	3
2.	Traction system Equipment	20	39	3	3
3.	Constituents of Supply systems in traction	12	26	2	2
4.	Train lighting systems	08	06	2	
	<b>Total</b>	<b>60</b>	<b>110</b>	<b>10</b>	<b>8</b>

**OBJECTIVES**

**Upon completion of the course the student shall be able to**

**1.0 Explain the Properties of Electric Traction**

- 1.1 Describe single-phase A.C. and Composite systems
- 1.2 List the types of services (main line, suburban , Metro and urban)
- 1.3 Sketch the speed-time curves for the above services
- 1.4 State each stage of the speed-time curve with appropriate speeds.
- 1.5 State the importance of speed-time curves
- 1.6 Define Maximum speed, average speed and scheduled speed
- 1.7 List the factors affecting the scheduled speed
- 1.8 Sketch the simplified speed-time curves
- 1.9 Explain the practical importance of the above curves
- 1.10 Derive the expression for
  - i) maximum speed            ii) acceleration and retardation
  - for        a) Trapezoidal speed time curve    &

b) Quadrilateral speed time curve.

- 1.11 Solve numerical examples on above speed time curves
- 1.12 Explain the tractive effort
- 1.13 Derive the expression for tractive effort for acceleration to over come gravity pull and train resistance.
- 1.14 Calculate the tractive effort under given conditions
- 1.15 Explain the mechanics of transfer of power from motor to driving wheel
- 1.16 Define 'Coefficient of adhesion'
- 1.17 List the factors affecting the coefficient of adhesion
- 1.18 solve problems on calculation of number of axels required.
- 1.19 State the methods of improving the coefficient of adhesion
- 1.20 Explain the term specific energy consumption
- 1.21 Derive the formulae for energy output of drive to
  - i) Accelerate
  - ii) To overcome friction
  - iii) To overcome gradient
- 1.22 List the factors affecting specific energy consumption
- 1.23 Solve simple problems on specific energy calculation under given conditions.

**131****2.0 Explain the function of the various Traction system Equipment**

- 2.1 List the various Overhead Equipments (OHE).
- 2.2 State the Principles of Design of OHE like
  - i) Composition of OHE.
  - ii) Height of Contact Wire.
  - iii) Contact Wire Gradient.
  - iv) Encumbrances.
  - v) Span Length.
- 2.3 Explain Automatic Weight Tension and Temp. compensation.
- 2.4 Distinguish between Un insulated Overlaps and Insulated Overlaps.
- 2.5 State the importance of Neutral Section.
- 2.6 State the importance of Section Insulator.
- 2.7 State the importance of an Isolator.
- 2.8 Describe the Polygonal OHE:
  - i) Single Catenary Construction.

- ii) Compound Catenary Construction.
- iii) Switched Catenary Construction.
- iv) Modified Y Compound Catenary.
- 2.9 State the effect of Speed on OHE.
- 2.10 Describe the need for OHE Supporting Structure.
- 2.11 List the different types of signal boards of OHE.
- 2.12 Describe the OHE Maintenance Schedule. (No Derivation and No Numerical)
- 2.13 State the important requirements of traction motor
- 2.14 Explain the suitability of different motors D.C,1- Phase- A.C, 3 - Phase A.C. ,Composite & Kando systems for traction
- 2.15 Explain with legible sketch the control of traction motor by autotransformer method in single phase 25 kv system
- 2.16 Explain the purpose and material used for
  - i) Catenary
  - ii) droppers
  - iii) trolley wires
  - iv) bow collector
  - v) pantograph collector
- 2.17 Explain with legible sketch the construction of
  - i) Diamond Pentograph
  - ii) Faiveley Pentograph
- 2.18 State the methods of Raising and Lowering of Pentograph.
- 2.18 Describe the maintenance of pantograph.
- 2.19 State the need for Booster Transformer.
- 3.0 Explain the Constituents of Supply systems in traction**
- 3.1 List the various constituents of Supply systems in traction Substations.
- 3.2 Describe the various constituents of Supply systems
  - i) Feeding Posts.
  - ii) Feeding and Sectioning Arrangements.
  - iii) Sectioning and Paralleling Post.
  - iv) Sub sectioning and Paralleling Post.
  - v) Sub sectioning Post.
  - vi) Elementary Section.

- vii) Miscellaneous Equipments at Control Post or Switching Stations.
- 3.3 Describe the Major Equipment at traction Substation.
  - i) Transformer.
  - ii) Circuit Breaker.
  - iii) Interrupter.
- 3.5 Describe the Protective System for AC Traction - Transformer Protection and 25 KV Centenary Protection.
- 3.6 Explain the importance of Location and Spacing of Substations.
- 3.7 Explain End on Generation.
- 3.8 Explain Mid on Generation
- 4.0 Explain the various Train lighting systems**
- 4.1 State the requirements of Train lighting.
- 4.2 Describe the method of obtaining Unidirectional polarity.
- 4.3 Describe the method of obtaining constant output.
- 4.4 Explain i) single battery system
  - ii) Double battery parallel block system
- 4.5 Mention the requirements of railway coach air conditioning.

## COURSE CONTENTS

### 1.0 Electric Traction properties

Single-phase A.C. and Composite systems -Types of services (main line, suburban , Metro and urban) - speed-time curves for the above services- importance of speed-time curves - Maximum speed, average speed and scheduled speed- Factors affecting the scheduled speed - Simplified speed-time curves & practical importance -Expression for maximum speed, acceleration and retardation for Trapezoidal & Quadrilateral speed time curves.- numerical examples - tractive effort & derivation - Coefficient of adhesion-factors affecting the coefficient of adhesion - problems on calculation of number of axels required.-methods of improving the coefficient of adhesion- specific energy consumption-factors affecting specific energy consumption-simple problems on specific energy calculation under given conditions.

### 2.0 Traction system Equipment

Overhead Equipments (OHE).- Principles of Design of OHE:- Automatic Weight Tension and Temp. compensation.- Un insulated Overlaps.- Insulated Overlaps - Neutral Section - Section Insulator.- Isolator -

Polygonal OHE -Single Catenary Construction - Compound Catenary Construction - Switched Catenary Construction - Modified Y Compound Catenary - Effect of Speed on OHE - OHE Supporting Structure. - Different types of signal boards of OHE.- Maintenance of OHE - OHE Maintenance Schedule- State the important requirements of traction motor - suitability of different motors D.C,1-Phase A.C, 3- Phase A.C. ,Composite & Kando systems for traction - Control of traction motor by autotransformer method in single phase 25 kv system - purpose and material used for Catenary, droppers, trolley wires, bow collector, pantograph collector- Need of Booster Transformer.

### 3.0 Constituents of Supply systems in traction

Substations - Feeding Post - types - Miscellaneous Equipments at Control Post or Switching Stations.- Major Equipments at traction Substation. - Protective System for AC Traction - Transformer Protection and 25 KV Catenary Protection - Location and Spacing of Substations - End on Generation- Mid on Generation.

### 4.0 Train lighting systems

Requirements of Train lighting- Unidirectional polarity - single battery system - Double battery parallel block system- requirements of railway coach air conditioning.

### REFERENCES

1. S.K.Pillai -A first course on Electric Drives-.
2. M.V.Deshpande -Electrical Motors applications and control
4. S.L.Uppal -Electrical power
5. J.B.Gupta -Electrical power
6. H.Pratab - Modern Electric Traction -Dhanpat Rai & sons
7. J.Upadhyay , S.N.Mahendra - Electric Traction \_ Allied Publishers Ltd.

### POWER SYSTEMS -III

<b>Subject Title</b>	:	<b>POWER SYSTEMS-III (SWITCHGEAR AND PROTECTION)</b>
<b>Subject Code</b>	:	<b>EE - 603</b>
<b>Periods / Week</b>	:	<b>04</b>
<b>Periods /Semester</b>	:	<b>60</b>

### TIME SCHEDULE

Sl. No	Major Topics	Periods	Weightage of marks	Short questions	Essay questions
1.	Switch Gear and Circuit Breakers	9	16	2	1
2.	Fuses and Reactors	7	13	1	1
3.	Protective Relays	12	21	2	1 ½
4.	Protection of Alternators and Transformers	12	23	1	2
5.	Protection of Transmission Lines and feeders	11	21	2	1 ½
6.	Lighting Arrestors and Neutral Grounding	9	16	2	1
	<b>Total</b>	<b>60</b>	<b>110</b>	<b>10</b>	<b>8</b>

### OBJECTIVES

**On completion of the course the student shall be able to**

- 1.0 Comprehend Switch Gear and Circuit Breakers.**
  - 1.1 State the types of faults in power system and their effects.
  - 1.2 Define switch gear
  - 1.3 Classify switch gear
  - 1.4 State the purpose of isolators, air break switches and knife switches.
  - 1.5 Give the Classification of the switches,
  - 1.6 List the uses and limitations of the different types of switches.
  - 1.7 Explain the phenomenon of arc, arc voltage, arc current and its effects.
  - 1.8 State factors responsible for arc formation.

- 1.9 Describe the methods of arc quenching.
- 1.10 Classify the circuit breakers based upon medium of arc quenching.
- 1.11 State the principle of Bulk oil circuit breaker(B.O.C.B)
- 1.12 List the types of BOCB.
- 1.13 Explain the working of each type of B.O.C.B.
- 1.14 State the principle of Minimum oil circuit breaker M.O.C.B
- 1.15 Explain the working of MOCB.
- 1.16 Compare B.O.C.B and M.O.C.B
- 1.17 State the properties of SF<sub>6</sub> gas
- 1.18 State the principle of working of SF<sub>6</sub> circuit breakers.
- 1.19 Explain the working of SF<sub>6</sub> CB .
- 1.20 Explain the principle and working of Air break circuit breaker(A.B.C.B.)
- 1.21 Compare OCB, SF<sub>6</sub> CB and A.B.C.B.
- 2.0 Comprehend Fuses and Reactors**
- 2.1 Explain fuse as protective device
- 2.2 List various types of fuses.
- 2.3 Define the following :
- i) Rated current ii) Fusing current and iii) Fusing factor.
- 2.4 List different fuse materials.
- 2.5 State the importance of current limiting reactors.
- 2.6 List the types of reactors
- 2.7 Describe the construction of the different types of reactors.
- 2.8 Draw the schematic diagram of reactor connections.
- 2.9 State the importance of short circuit KVA
- 2.10 Solve simple problems
- 3.0 Comprehend Protective Relays.**
- 3.1 State the basic requirements of relays.
- 3.2 State the important features of relays.
- 3.3 Classify the relays based upon
- i) Principle of Operation ii) Time of operation.
- 3.4 Explain the working of thermal relay.
- 3.5 List the uses of thermal relay.
- 3.6 List the merits and demerits of thermal relay.

- 3.7 Describe the working of solenoid plunger
- 3.8 Describe the working of attracted armature relays
- 3.9 List the uses of attracted armature relays
- 3.10 Describe the construction of induction type over current relay.
- 3.11 Explain the working of induction type over current relay.
- 3.12 Describe the current setting, time setting and application of above relay.
- 3.13 Explain the principle of obtaining directional property in induction relays.
- 3.14 Describe the working of directional over current induction relay
- 3.15 List the applications of directional over current induction relay.
- 3.16 Explain the principle of working of impedance relay.
- 3.17 Describe the construction of impedance relay.
- 3.18 List the applications of impedance relay.
- 3.19 Explain distance relay.
- 3.20 List the uses of distance relay.
- 3.21 Describe the two types differential protection.
- 4.0 Understand the Protection of Alternators and Transformer.**
- 4.1 List the probable faults in Alternator Stator and Rotor
- 4.2 State the effects of faults on Alternator Stator and Rotor.
- 4.3 Describe the scheme of protection against excessive heating of stator and rotor.
- 4.4 Explain the differential protection for alternator stator.
- 4.5 Explain the earth fault protection for rotor.
- 4.6 Explain the split phase protection of alternator against inter-turn short circuits.
- 4.7 Explain the need and working of field suppression protection.
- 4.8 List the possible faults in a transformer by mentioning their effects.
- 4.9 List the precautions to be taken for applying differential protection to transformers.
- 4.10 Explain differential protection of transformer.
- 4.11 Explain the working of Buchholz relay and its protection scheme for transformer.
- 5.0 Understand the Protection of Transmission Lines and feeders**
- 5.1 Explain the different schemes of protection for single and duplicate bus bars.

- 5.2 Describe the transmission line protection and feeder protection.
- 5.3 Explain pilot wires and their effects.
- 5.4 Explain the protection of transmission lines using distance and impedance relays.
- 5.5 Explain the combined protection by using definite distance and time distance relays.
- 5.6 Explain protection of radial feeders using time graded fuses.
- 5.7 Explain protection of parallel feeders using directional relays.
- 5.8 Explain protection of ring main feeder using directional relays.
- 5.9 Derive a relation between number of sections and minimum relay time.
- 5.10 Explain differential protection for parallel feeders of transmission lines.
- 6.0 Understand the Lightning Arrestors and Neutral Grounding.**
- 6.1 Define surge.
- 6.2 List the types of surges.
- 6.3 Give reasons for the cause of surges..
- 6.4 Explain the scheme of surge protection with diagram.
- 6.5 Explain the types of lightning arrestors or surge diverters.
- 6.6 List the six types of lightning arrestors
- 6.7 Describe the construction of following types of lightning arrestors.  
i) Rod gap ii) Sphere gap iii) Horn gap iv) Valve type v) Thyrite type  
iv) Lead oxide.
- 6.8 Explain the , working of the above lightning arrestors
- 6.9 List the applications of the above lightning arrestors.
- 6.10 Explain the necessity of neutral grounding
- 6.11 Give the merits and demerits of neutral grounding.
- 6.12 Describe the following methods of neutral grounding  
i) solid grounding ii)Resistance grounding  
iii) Reactance grounding iv)voltage transformer grounding  
v) Zig-zag transformer grounding.
- 6.13 Compare the different methods of neutral grounding .

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**COURSE CONTENT****1. Switch Gear and Circuit Breakers**

Switch gear and their classification - Isolators, air break switches and knife switches - Explain the phenomenon of arc, arc voltage, arc current and their effects - Factors responsible for arc and arc quenching. Circuit breakers and their classification based on the medium of arc quenching - B.O.C.B, M.O.C.B their comparison - Properties of SF<sub>6</sub> gas and principles of SF<sub>6</sub> circuit breakers - Working of A.B.C.B, O.C.B, SF<sub>6</sub> CB and their comparisons.

**2. Fuses and Reactors**

Fuse as protective device and different types of fuses based on rated current, fusing current, fusing factor - Current limiting reactors and their necessity. Types of reactors and their construction - Equation for short circuit KVA and solve problems.

**3. Protective Relays.**

Requirements, activities of relays - Classifications based on duty, principle of operation and time of operation - Thermal, Solenoid plunger and attracted armature relays - Their uses merits and demerits. Construction and working of induction type over current type relays - Directional Over current relay Principle, construction working of impedance, distance relay.

**4. Protection of Alternators ,Transformer**

Protection of Alternators Scheme of protection probable faults in alternators against excessive heating of stator and rotor. Earth fault protection for stator and rotor - Split phase protection for alternator against short circuits. Field suppression protection . Protection of Transformer, Possible faults and their types in the transformer - Precautions required for protection - Differential protections of Buchholz relay, protection against excessive heating of transformed oil.

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

Transmission line and feeder protection - Pilot wires, protection of transmission lines using distance and impedance relays. Combined protection using definite distance and time distance relays - Protection of radial feeders, parallel feeders, ring main feeders using time graded fuses directional relays. Surge Protection Surge types and causes for production - Scheme of surge protection with diagram. Types of lightning arrestors - Working and applications of rod gap, sphere gap, horn gap, valve type, Thyrite type and lead oxide.

**6. Lightning Arrestors and Neutral grounding**

Need for Surge Protection and its methods - Various types of LA's , Horn

gap - Sphere Gap - Valve type, Thyrite type and Lead Oxide type, Necessity of neutral grounding, Its merits and demerits- Methods of Grounding the neutral.

#### Reference Books

1. V.K. Mehta -Principles of Power systems
2. S.L. Uppal -Electrical power
3. Sony,Gupta and Bhatnagar -A Text book of Electrical. Power
4. JB Gupta-Electrical Power
5. CL Wadhwa- Electrical power Systems-Wiley Eastern
6. Hand book of Switch gear (BHEL) Tata Mc Graw Hill
7. B.Ravindranath &M.Chander-Power system Protection and Switch gear-New Age International.

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#### POWER ELECTRONICS

<b>Subject Title</b>	:	<b>Power Electronics</b>
<b>Subject Code</b>	:	<b>EE-604</b>
<b>Periods/Week</b>	:	<b>04</b>
<b>Periods/Semester</b>	:	<b>60</b>

#### TIME SCHEDULE

S. no	Major Topics	No. of periods	Weightage of marks	Short questions	Essay questions
1	Power Electronic devices	20	39	3	3
2	Converters, AC Regulators & Choppers	15	26	2	2
3	Inverters and Cyclo-converters	8	16	2	1
4	Speed control of AC / DC Motors	9	16	2	1
5	Application of Power Electronic circuits	8	13	1	1
	Total	60	110	10	8

#### OBJECTIVES

Upon completion of the course the student shall be able to

- 1.0 Understand the construction and working of Power Electronic Devices**
  - 1.1 List different thyristor family devices.
  - 1.2 Draw the ISI circuit symbols for each device.
  - 1.3 Describe constructional details of SCR
  - 1.4 Explain the Operation of SCR.
  - 1.5 Describe the two transistor analogy of SCR.
  - 1.6 Explain the Volt - Ampere characteristics of SCR with the help of a diagram.
  - 1.7 Draw the Gate characteristics of SCR
  - 1.8 Mention the ratings of SCR.
  - 1.9 Give the advantages of SCR as a switch.
  - 1.10 List ten applications of SCR.
  - 1.11 Explain the construction of GTO SCR
  - 1.12 Compare the characteristics of GTO SCR and SCR.
  - 1.13 Explain the Volt-ampere characteristics of Diac under forward / Reverse bias.



- 1.14 Explain the Volt-ampere characteristics of Triac under forward / Reverse bias.
- 1.15 State the four modes of Triac triggering.
- 1.16 Distinguish between SUS, SBS, SCS & LASCR
- 1.17 Explain SCR circuit triggered by UJT.
- 1.18 Explain power control circuits of the following  
i)Diacs            ii) Triacsand            iii) SCR's.
- 1.19 Explain the working of the following  
i)Reverse conducting thyristor (RCT)  
ii)Asymmetrical SCR (ASCR)  
iii)Power BJT iv)Insulated gate Bipolar transistor (IGBT)  
v)MOS-controlled thyristors (MCT) by giving their V-I characteristics.
- 1.20 State the necessity of Commutation in SCR's
- 1.21 Explain various methods of Commutation.
- 1.22 Describe the mechanism of protecting power devices.
- 2.0 Understand the working of Converters, AC regulators and Choppers.**
- 2.1 Classify converters.
- 2.2 Explain the working of single-phase half wave controlled converter with Resistive and R-L loads.
- 2.3 Understand need of freewheeling diode.
- 2.4 Explain the working of single phase fully controlled converter with resistive and R- L loads.
- 2.5 Explain the working of three-phase half wave controlled converter with Resistive load
- 2.6 Explain the working of three phase fully controlled converter with resistive load.
- 2.7 Explain the working of single phase AC regulator.
- 2.8 Explain the working principle of chopper.
- 2.9 Describe the control modes of chopper
- 2.10 Explain the operation of chopper in all four quadrants.
- 3.0 Understand the Inverters and Cyclo-converters**
- 3.1 Classify inverters.
- 3.2 Explain the working of series inverter .
- 3.3 Explain the working of parallel inverter
- 3.4 Explain the working of single-phase bridge inverter.

- 3.5 Explain the working of three-phase inverter.
- 3.6 Explain the basic principle of Cyclo-converter.
- 3.7 Explain the working of single-phase centre tapped Cyclo-converter.
- 3.8 Applications of Cyclo-converter.
- 4.0 Understand speed control of DC / AC Motors**
- 4.1 Mention the factors affecting the speed of DC Motors.
- 4.2 Describe speed control for DC Shunt motor using converter.
- 4.3 Describe speed control for DC Shunt motor using chopper.
- 4.4 List the factors affecting speed of the AC Motors.
- 4.5 Explain the speed control of Induction Motor by using AC voltage regulator.
- 4.6 Explain the speed control of induction motor by using converters and inverters (V/F control).
- 5.0 Understand the Applications of power electronic circuits**
- 5.1 List any six applications of power electronic circuits.
- 5.2 Explain the Light dimmer circuit using DIAC/TRIAC with the help of a legible sketch.
- 5.3 Explain the Burglar alarm circuit using SCR with the help of a diagram.
- 5.4 Explain the Emergency lamp circuit using SCR with the help of a diagram.
- 5.5 Explain the Battery charger circuit using SCR with the help of a diagram.

## COURSE CONTENTS

### 1. Power Electronic Devices

Types of power semiconductor devices - SCR, Triac, Power BJT, IGBT- Construction, Working principle of all devices, symbol. 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-protection of power devices.

### 2. Converters AC Regulators & Choppers

Classification of converters, single phase half wave fully controlled converter, freewheeling diode, single phase fully controlled converter, three phase half wave, three phase half wave and full wave controlled converter , single phase ac regulator, choppers- Four quadrant operation -different modes of operation.

**3. Inverters&Cyclo-converters**

Classification of Inverters-basic series Inverter- parallel Inverter- single - phase bridge Inverter- Three phase bridge Inverter. Cyclo-converter - basic principle of operation- single-phase center tapped Cyclo-converter- applications of Cyclo-converters.

**4. Speed Control of DC/AC Motors**

DC Motor control- Introduction-Speed control of DC shunt Motor by using converters and choppers

AC Motor Controls: speed control of induction Motor by using AC voltage controllers - V/F control (Converters and invertors control).

**5. Application of Power Electronic Circuits**

Light dimmer Circuit- Burglar alarm Circuit- Emergency lamp and Battery charger Circuit using SCR- Advantages of the above circuits.

**REFERENCES**

- 1 Jamil Asghar -Power Electronics- PHI, New Delhi.
- 2 Chute -Industrial Electronics
- 1 Mithal- Industrial Electronics
- 2 P.C.Sen.-Industrial Electronics
- 3 Berde-Industrial Electronics
- 4 P.C.Sen.-Advanced Power Electronics
- 5 Harish Rai -Industrial & Power Electronics.
- 6 R.K.Sugandhi & KK Sugandhi -Thyristor ( theory & applications)

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**MICRO CONTROLLERS & APPLICATIONS**

<b>Subject title</b>	:	<b>Micro controllers &amp; Applications</b>
<b>Subject code</b>	:	<b>EE- 605</b>
<b>Periods/week</b>	:	<b>04</b>
<b>Periods/semester</b>	:	<b>60</b>

**TIME SCHEDULE**

Sl. No.	Major Topics	No. of Periods	Weightage of marks	Short Answer Questions	Essay Questions
1	Micro processors & Micro controllers	14	19	3	1
2	Architecture of 8051	08	19	3	1
3	Addressing modes & Instruction set of 8051	14	26	2	2
4	Programming concepts of 8051	14	26	2	2
5	Applications of 8051	10	20	-	2
	<b>Total</b>	<b>60</b>	<b>110</b>	<b>10</b>	<b>8</b>

**OBJECTIVES**

**Upon completion of the course the student shall be able to**

- 1.0 Differentiate between Micro processors & Micro controllers**
  - 1.1 Define the terms used in Micro processor literature.
  - 1.2 Describe the Evolution of Micro processor.
  - 1.3 Explain the basic fundamental blocks of Micro processor.
  - 1.4 Explain the Micro processor-based system.
  - 1.5 Distinguish between Micro, Mini and Large computers.
  - 1.6 Describe the features of Intel 8085.
  - 1.7 Explain the concept of Peripheral interfacing.
  - 1.8 Draw the functional block diagram, interface with 8085 and write Command word of 8255, 8279 & 8237.
  - 1.9 State RS-232 standards.
  - 1.10 Explain the concept of Micro controllers.

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- 1.11 Compare Embedded with External memory devices.
  - 1.12 Differentiate between CISC and RISC processors.
  - 1.13 Differentiate between Harvard and Von Neumann architectures.
  - 1.14 List the three commonly used Commercial Microcontroller Device families.
- 2.0 Appreciate the Architecture of 8051**
- 2.1 Draw the block diagram of a microcontroller and explain the function of each block.
  - 2.2 Explain the features of micro controllers.
  - 2.3 Draw the functional block diagram of 8051 microcontroller
  - 2.4 Describe the register structure of 8051.
  - 2.5 Explain the functions of various special function registers.
  - 2.6 Draw the pin diagram of 8051 micro controller and specify the purpose of each pin.
  - 2.7 Describe internal memory, external memory and ports of 8051.
  - 2.8 Describe counters & timers in 8051
  - 2.9 Explain serial input/output of 8051
  - 2.10 Explain interrupts in 8051.
  - 2.11 Describe the four timer modes in 8051.
- 3.0 Explain the Instruction set and Addressing modes of 8051**
- 3.1 State the need for an instruction set.
  - 3.2 Describe the instruction format of 8051.
  - 3.3 Explain fetch cycle, execution cycle and instruction cycle.
  - 3.4 Distinguish between machine cycle and T-state.
  - 3.5 Draw the timing diagram for memory write, memory read operations of 8051.
  - 3.6 Define the terms machine language, assembly language, and mnemonics.
  - 3.7 Give the difference between machine level and assembly level programming.
  - 3.8 List the major groups in the instruction set along with examples.
  - 3.9 Explain the terms operation code, operand and illustrate these terms by writing an instruction.
  - 3.10 Explain the data manipulation functions data transfer, arithmetic, logic and branching.
  - 3.11 Classify the 8051 instructions into one byte, two byte and three byte instructions.
  - 3.12 Describe the five addressing modes of 8051.
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- 3.13 Explain data transfer instructions of 8051.
  - 3.14 Explain the arithmetic instructions and recognise the flags that are set or reset for given data conditions.
  - 3.15 Explain the logic instructions and recognize the flags that are set or reset for given data conditions.
  - 3.16 Illustrate the logic operations and explain their use in making, setting and resetting of individual bits.
  - 3.17 Explain unconditional and conditional jump and how flags are used to change the sequence of program.
- 4.0 Appreciate the Programming concepts of 8051**
- 4.1 List the various symbols used in drawing flow charts.
  - 4.2 Draw flow charts for some simple problems.
  - 4.3 Write programs in mnemonics to illustrate the application of data copy instructions and translate these mnemonics into hex codes.
  - 4.4 Write programs of instructions to perform single byte, double byte and multi byte addition and subtraction.
  - 4.5 Illustrate the application of jump instruction in the program.
  - 4.6 Write a program using counter techniques.
  - 4.7 Define a subroutine and explain its use.
  - 4.8 Explain the sequence of program when subroutine is called and executed.
  - 4.9 Explain how information is exchanged between the program counter and the stack and identify the stack pointer register when a subroutine is called.
  - 4.10 Write program to perform Single byte & Multi byte addition.
  - 4.11 Write program to sum up given 'N' numbers.
  - 4.12 Write program to sum up given 1st 'N' natural numbers.
  - 4.13 Write program to multiply two 8-bit numbers using 'MUL' instruction.
  - 4.14 Write program to find biggest data value in given Data array.
  - 4.15 Write program to convert a given 'HEX' number to 'BCD' number.
- 5.0 Appreciate the applications of 8051.**
- 5.1 Explain the working of 8051 Microcontroller in Traffic light controller.
  - 5.2 Explain the working of 8051 Microcontroller in Clock program using the kit.
  - 5.3 Explain the working of 8051 Microcontroller as Dot matrix display interface.
  - 5.4 Explain the working of 8051 Microcontroller as Printer interface.
  - 5.5 Explain the working of 8051 Microcontroller in Stepper motor control.
  - 5.6 Explain the working of 8051 Microcontroller as Keyboard interface.
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- 5.7 Explain the working of 8051 Microcontroller as a Seven segment display interface.

### COURSE CONTENTS

#### 1.0 Micro processors & Micro controllers:

Terms used, History, interfacing, commercially used microcontrollers.

#### 2.0 Architecture of 8051:

Block diagram of microcomputer, Block diagram of 8051, Pin out diagram of 8051, registers, timers, interrupts, modes of operation.

#### 3.0 Instruction set and Addressing modes of 8051:

Instruction set of 8051, instruction format, fetch cycle, execution cycle, instruction cycle, machine cycle, timing diagrams, machine language, assembly language, classification of instructions, addressing modes- Groups of instructions, Opcode, operand.

#### 4.0 Programming concepts of 8051:

Flow charts, Data transfer, subroutines, single and multi byte addition and subtraction, multiplication, conversion

#### 5.0 Applications of 8051:

Traffic lights, clock program, dot matrix display interface, printer interface, stepper motor control, keyboard interface, seven-segment display interface.

### TEXT BOOKS :

1. Mazidi and Mazidi -8051 Micro controller.
2. Kenneth J.Ayala. -8051 Micro controller
3. Myke Predko -Programming customizing the 8051 Microcontroller - TM
4. Douglas Hall -Microprocessors and interfacing -McGraw Hill.
5. Ramesh S Gaonkar-Micro Processors

### REFERENCES:

1. Barry Brey-Intel Microprocessors -Prentice-Hall.
2. Ghosh & Sridhar-0000 to 8085: Introduction to microprocessors for engineers and scientists Prentice-Hall.
3. Ajay V Deshmukh -Microcontrollers (Theory and applications)- TMH

### INDUSTRIAL AUTOMATION

Subject Title	:	INDUSTRIAL AUTOMATION
Subject code	:	EE-606
Periods/Week	:	04
Periods/Semester	:	60

### TIME SCHEDULE

Sl. No	Major Topics	Periods	Weightage	Short Questions	Essay Questions
1.	Basic Concepts of Control Systems	10	21	02	1 & 1/2
2.	Components of control systems	08	13	01	01
3.	Electrical Actuators and Controllers	12	26	02	02
4.	Block Diagram Reduction Techniques	10	16	02	01
5.	Control Procedures in Control systems	5	08	01	1/2
6.	PLC and its applications	15	26	02	02
	<b>Total</b>	<b>60</b>	<b>110</b>	<b>10</b>	<b>08</b>

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### OBJECTIVES

Upon completion of the course the student shall be able to

#### 1.0 Basic Concepts of Control Systems

- 1.1 State the need for Automation.
- 1.2 List the advantages of Automation
- 1.3 Mention the requirements of Automation.
- 1.4 Explain the importance of control engineering in day to day life and industry
- 1.5 State the concept of control systems like Automobile control system, Speed control of AC/DC motor, Water level Controller.
- 1.6 Define the following terms using the above ideas
  - (i) Input of a control system
  - (ii) Output of a Control system
  - (iii) Control Elements
- 1.7 Explain the Open loop and Closed loop control systems with examples like water level controller, Temperature Controller etc

- 1.8 Describe how the temperature of a room is controlled with setup
- 1.9 State the need for feedback in a control system
- 1.10 Understand concepts of types of feed back
- 1.11 Draw a generalized block diagram of a feed back control system and give the terminology
- 1.12 Define transfer function and derive it
- 1.13 State the equivalence of physical system components into electrical System elements
- 2.0 Components of control systems**
- 2.1 Explain the contact types(Normally open and Normally closed)
- 2.2 Describe AC and DC Solenoids
- 2.3 Explain the different Input devices-Push button, Selector switch, Photo electric, Level Control, Pressure sensing device
- 2.4 Explain the different output devices-contactors, valves, Pilot lamps
- 2.5 Explain the working of Electromagnetic relay and Reed Relay
- 3.0 Electrical Actuators and Controllers**
- 3.1 Explain the working of Potentiometers and their use as error detector
- 3.2 State the working principle of AC & DC Servomotors
- 3.3 Explain the working of Synchros - transmitter, control transformer and their use as error detector
- 3.4 State the concept and purpose of a Tacho - generator
- 3.5 State the concept of Electric controller
- 3.6 List the 4 types of controllers (Hydraulic, Pneumatic, Electrical, Electronic and Digital)
- 3.7 List the advantages and disadvantages of Hydraulic controllers
- 3.8 Differentiate between Hydraulic and Pneumatic controllers.
- 3.9 Give the concept of Electrical and Electronic controller
- 3.10 Give the concept of Digital controller
- 4.0 Block Diagram Reduction Techniques**
- 4.1 Explain how a given system is characterized
- 4.2 Explain the use of transfer function in characterizing a system equation
- 4.3 State the properties, limitations of transfer functions of systems
- 4.4 Obtain the impulse response of a system
- 4.5 Convert the Electrical systems like R, L and C in Laplace transform domain

- 4.6 Solve simple problems to obtain the transfer function relating to Electrical systems
- 4.7 Solving simple problems on reduction of block diagram
- 5.0 Control Procedures in Control systems**
- 5.1 Obtain the concepts of the following systems:
- (i) Linear and Non-Linear control system
- (ii) Time Variant and Time invariant system
- (iii) Continuous data and sampled data system
- (iv) Digital Control system
- 5.2 Obtain the concepts of the following control actions:
- (i) P- Controller (ii) I- Controller
- (iii) PI Controller (iv) PD Controller (v) PID Controller
- 6.0 PLC and its applications**
- 6.1 Define Programmable Logic Controller(PLC)
- 6.2 State the advantages of PLC
- 6.3 Explain the different parts of PLC by drawing the Block diagram.
- 6.4 State the purpose of each part of PLC.
- 6.5 State the applications of PLC
- 6.6 Explain Ladder diagram
- 6.7 Explain contacts and coils in the following states
- i) Normally open ii) Normally closed iii) Energized output
- iv) latched Output v) branching
- 6.8 Draw ladder diagrams for
- i) AND gate ii) OR gate and iii) NOT gate.
- 6.9 Draw ladder diagrams for combination circuits using NAND,NOR, AND, OR and NOT
- 6.10 Explain the following Timers-
- i)T ON ii) T OFF and iii) Retentive timer
- 6.11 Explain Counters-CTU, CTD
- 6.12 Draw ladder diagrams using Timers and counters
- 6.13 Explain PLC Instruction set
- 6.14 Explain ladder diagrams for following
- (i) DOL starter and STAR-DELTA starter
- (ii) Stair case lighting

(iii) Traffic light control

(iv) Temperature Controller

6.15 Explain the Hardware and software used in following special control systems

(i) Distributed Control system(DCS)      (ii) SCADA

## COURSE CONTENT

### 1.0 Basic Concepts of Control Systems

Basic concepts-Definition of open loop and closed loop system, examples with block diagrams. Terms used in the control systems-Types of feedback-Transfer function-Definition & derivation control systems-Equivalence of physical system components into electrical System elements

### 2.0 Components of control systems

Contact types-Normally open & Normally closed, Solenoids-AC/DC, Input devices-Push button, Selector switch, Photo electric, Level Control, Pressure sensing device, Output devices- contactors, valves, Pilot lamps, Relays-Electromagnetic and ReedRelay

### 3.0 Electrical Actuators and Controllers

Potentiometers -working principle, AC & DC Servomotors-working principle, working of Synchros - transmitter, control transformer, concept and purpose of a Tacho - generator

### 4.0 Block Diagram Reduction Techniques

Transfer function -Purpose and properties- limitations of transfer functions of systems- Impulse response of system-Conversion of Electrical systems like R, L and C in Laplace transform domain- simple problems to obtain the transfer functions-Block diagram reduction Technique-Solving Simple problems using reduction technique

### 5.0 Control Procedures in Control systems

Types of control systems-Time Variant/ Invariant systems, Continuous data and sampled data system, Linear and Non-Linear control system, Digital Control system-Concept of controllers- P Controller, I Controller, PI Controller, PD Controller, PID Controller

### 6.0 PLC and its applications

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-Special control systems-DCS, SCADA

## REFERENCES

1. Nagarath & Gopal- Control Systems
2. Ogata- Control systems
3. S.K.Bhattacharya -Control of Electrical Machines
4. Jacob -Industrial control engineering
5. Jon Sterenson-Industrial automation and process control -
6. John W.Webb -Programmable Logic controllers
7. Gary Dunning- Introduction to PLC - Delmar Cengage learning.
8. B.C. Kuo - Automatic Control Systems -John Wiley and Sons
9. NISE-Control Systems Engineering John Wiley Publishers.
10. N. K. Sinha -Control Systems-New age international (P) limited

**ELECTRICAL CAD AND PROJECT MANAGEMENT LAB PRACTICE**

**Subject Title** : Electrical CAD and Project Management  
**Lab Practice**  
**Subject Code** : EE-607  
**Periods/Week** : 06  
**Periods/Year** : 90 (30 sessions each of 3 periods duration )

**TIME SCHEDULE**

S. No.	Major Topics	No. of Sessions
1.	Study the Auto cad screen, various tool bars menus	2
2.	Exercise on standard commands	1
3.	Exercise on 2D drawing commands	1
4	Exercise on modify 2D commands	2
5.	Exercise on dimensioning commands	1
6	Exercise on formatting commands	1
7	Exercise on Insert commands	1
8	Exercise on view commands	1
9	Exercise on isometric drawings in 2D	3
10	Exercise on Electrical drawings	7
11	Exercise on shading of 3D models	2
12	Study of Project Management Software tools	3
13	Practising of Project Management Software	5
	TOTAL SESSIONS	30

**OBJECTIVES**

**Upon completion of the practice the student shall be able to**

**1.0 Study the Auto cad screen components.**

- 1.1 Study components in menu bar
- 1.2 Customise and arrange tool bar
- 1.3 Display the drawing created in the working area.
- 1.4 Study user coordinate system(UCS)

- 1.5 Increase or decrease layouts
- 1.6 Give the inputs in the command bar
- 1.7 Display name and purpose of the tools
- 1.8 Study cross hair to locate the cursor
- 1.9 Invoke the commands
- 1.10 Getting started with AutoCAD
- 2.0 Practice Exercises on Standard commands.**
- 2.1 Create a new file by NEW command
- 2.2 Open a file by OPEN command
- 2.3 Save a file by SAVE command
- 2.4 Close a file by CLOSE command
- 2.5 Delete the object or text using CUT command
- 2.6 Copy the object or text using COPY command
- 2.7 Paste entities copied by using PASTE command
- 2.8 Zoom an object by using ZOOM command.
- 3.0 Practice Exercises on 2D drawing commands.**
- 3.1 Draw a line using LINE command
- 3.2 Create a multiple parallel lines by using MLINE command
- 3.3 Create a poly line using POLYLINE command
- 3.4 Add arc segments to a poly line using ARC command
- 3.5 Draw a circle using CIRCLE command, with centre point and radius.
- 3.6 Draw a polygon using POLYGON command
- 3.7 Draw a helix using HELIX command
- 3.8 Draw a rectangular, Triangular and quadrilateral areas filled with a solid colour with the help of plane tool
- 3.9 Draw a smooth curve to a series of points using SPLINE command
- 3.10 Draw an elliptical curve using ELLIPSE command
- 3.11 Divide a object into specified segments using DIV command
- 3.12 Insert a block into the current drawing using INSERT command
- 3.13 Fill an enclosed area or an object using HATCH command
- 4.0 Practice Exercises on modifying 2D commands**
- 4.1 Create a mirror image of an entity using MIRROR command
- 4.2 Create multiple images of an entity using ARRAY command
- 4.3 Change the size of an object by using STRETCH command

- 4.4 Trim the edges of an object at the edges of another object using TRIM command
- 4.5 Break a line or an object between two points using BREAK command
- 4.6 Join two similar objects to form a single using JOINT command
- 4.7 Create a fillet round the edges of two arcs using FILLET command
- 4.8 Chamfer on lines which are crossed, radiating or unlimited long using CHAMFER command
- 4.9 Break a compound object into its component objects using EXPLODE command
- 4.10 Form a group of selected entities by using GROUP command
- 5.0 Practice Exercises on dimensioning commands.**
- 5.1 Create and modify quickly a series of dimensions using QDIM command
- 5.2 Practice LINEAR ,ALIGNED ,and COORDINATE dimensions
- 5.3 Indicate radii and diameters of arcs and circles using RADIUS or DIAMETER commands
- 5.4 Measure angle between two lines using ANGLUR dimension command
- 5.5 Measure length of arc using ARC LENGTH command
- 5.6 Create a base line dimension from a specified baseline using BASELINE command
- 5.7 Mark a centre of an arc or circle using CENTREMARK command
- 6.0 Practice Exercises on formatting commands.**
- 6.1 Create layers using LAYER command.
- 6.2 Control the visibility of objects and assigned properties to objects.
- 6.3 Practice the locking unlocking of layers.
- 6.4 Write a text to drawing, change font size and style.
- 6.5 Create a standard naming convention to a text styles, table styles, layer styles, dimension styles etc.
- 7.0 Practice Exercises on insert commands.**
- 7.1 Insert blocks into current drawing file using INSERT command
- 7.2 Attach an image to a drawing image using ATTACH RASTER IMAGE command
- 7.3 Add an attribute to a drawing by defining it and save it by using DEFINE ATTRIBUTE
- 7.4 Define attribute by specifying the characteristics of the attribute, including its name, prompt and default values

- 8.0 Practice Exercises on view commands.**
- 8.1 Redraw or refresh a display by using REDRAW command
- 8.2 Regenerate or reproduce the current viewports of all entities by using Regen command
- 8.3 Show the orthographic views (side view, top view, front view) of any object
- 8.4 Show the isometric views of any object
- 8.5 Shade a given object with solid colour using SHADE command
- 8.6 Create a hidden line view of a model using HIDE command
- 8.7 Create wire frame model using WIRE FRAME command
- 9.0 Practice Exercises on isometric drawings in 2D.**
- 9.1 Visualise the isometric view of a box from top or bottom and left or right corners like SW,NE isometric views
- 9.2 Create two dimensional isometric drawings by using Isometric SNAP and GRID
- 9.3 Visualise the boundary of drawing and distances between entities by using reference grid
- 9.4 Use set snap spacing ensure accuracy of drawing
- 9.5 Change the default axis colours, size of the crosshair display by using crosshair tab
- 9.6 Create an isometric circle on the current isometric plane using Ellipse Isocircle
- 10.0 Practice Exercises on Electrical drawings**
- 10.1 Draw Electrical symbols
- 10.2 Draw core section of transformer
- 10.3 Draw electrical poles and towers
- 10.4 Draw pipe earthing with dimensions
- 10.5 Draw plate earthing with dimensions
- 10.6 Draw simple electronic circuits
- 10.7 Draw the views of electrical machines like DC and AC machines
- 11.0 Practice Exercises on shading of 3D models**
- 11.1 Draw and shade 3D models of box, pyramid, cone, cylinder, sphere
- 11.2 Create a torus.
- 11.3 Make the 3D model Revolve.
- 12.0 Understanding Project Management Software Open Project( free open source software)**



- 12.1 State the features and applications of Project management software
- 12.2 Understand the Various Menus used in Open Project Software.
- 12.3 Determine project costs
- 13.0 Practice tools in Open Project Management software**
- 13.1 Study the components of input data.
- 13.2 Study the various commands to execute the given input data.
- 13.3 Create a new project file.
- 13.4 Create tasks in a project.
- 13.5 Create relationships between tasks.
- 13.6 Create a pool of resources for a project
- 13.7 Assign resources to tasks.
- 13.8 Prepare schedules for resource allocation.
- 13.9 Prepare modules for execution of projects.
- 13.10 Report the progress of a project.

### Competencies & Key competencies to be achieved by the student

S · N o	Name of the experiment	Competencies	Key competencies
1	Study the Auto cad screen, various tool bars menus	<ul style="list-style-type: none"> <li>▪ Study the Auto cad screen components.</li> <li>▪ Study components in menu bar</li> <li>▪ Customise and arrange tool bar</li> <li>▪ Study user coordinate system(UCS)</li> <li>▪ Give the inputs in the command bar</li> <li>▪ Invoke the commands</li> </ul>	<ul style="list-style-type: none"> <li>▪ Study the Auto cad screen components.</li> <li>▪ Study components in menu bar</li> <li>▪ Customise and arrange tool bar</li> <li>▪ Study user coordinate system(UCS)</li> <li>▪ Give the inputs in the command bar</li> <li>▪ Invoke the commands</li> </ul>
2	Exercise on standard commands	<ul style="list-style-type: none"> <li>▪ Create a new file by NEW command</li> <li>▪ Open a file by OPEN command</li> <li>▪ Save a file by SAVE command</li> <li>▪ Close a file by CLOSE command</li> <li>▪ Zoom an object by using ZOOM command.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Study Menu Commands thoroughly</li> </ul>
3	Exercise on 2D drawing commands	<ul style="list-style-type: none"> <li>▪ Draw a line using LINE command</li> <li>▪ Add arc segments to a poly line using ARC command</li> <li>▪ Draw a circle using CIRCLE command, with centre point and radius.</li> <li>▪ With plane tool draw a rectangular, Triangular and quadrilateral areas filled with a solid colour.</li> <li>▪ Draw a elliptical curve using ELLIPSE command</li> <li>▪ Divide a object into specified segments using DIV command</li> <li>▪ Insert a block into the current drawing using INSERT command</li> <li>▪ Fill an enclosed area or an object using HATCH command</li> </ul>	<ul style="list-style-type: none"> <li>▪ Study 2D Draw Commands thoroughly</li> </ul>
4	Exercise on modifying 2D commands	<ul style="list-style-type: none"> <li>▪ Create a mirror image of an entity using MIRROR command</li> <li>▪ Change the size of an object by using STRETCH command</li> <li>▪ Trim the edges of an object at the edges of another object using TRIM command</li> <li>▪ Break a line or an object between two points using BREAK command</li> <li>▪ Join two similar objects to form a single using JOINT command</li> <li>▪ Create a fillet round the edges of two arcs using FILLET command</li> <li>▪ Chamfer on lines which are crossed, radiating or unlimited long using CHAMFER command</li> <li>▪ Break a compound object into its component objects using EXPLODE command</li> <li>▪ Form a group of selected entities by using GROUP command</li> </ul>	<ul style="list-style-type: none"> <li>▪ Study Edit Commands thoroughly</li> </ul>

Sl. No.	Name of the experiment	Competencies	Key competencies
5	Exercise on dimensioning commands	<ul style="list-style-type: none"> <li>Create and modify quickly a series of dimensions using QDIM command</li> <li>Indicate radii and diameters of arcs and circles using RADIUS or DIAMETER commands</li> <li>Measure angle between two lines using ANGLUR dimension command</li> <li>Mark a centre of an arc or circle using CENTREMARK command</li> </ul>	<ul style="list-style-type: none"> <li>Practice Dimension Commands Thoroughly</li> </ul>
6	Exercise on formatting commands	<ul style="list-style-type: none"> <li>Create layers using LAYER command.</li> <li>Control the visibility of objects and assigned properties to objects.</li> <li>Write a text to drawing, change font size and style.</li> </ul>	<ul style="list-style-type: none"> <li>Practice Formatting Commands Thoroughly</li> </ul>
7	Exercise on insert commands	<ul style="list-style-type: none"> <li>Inserts blocks into current drawing file using INSERT command</li> <li>Define attribute by specifying the characteristics of the attribute, including its name, prompt and default values</li> </ul>	<ul style="list-style-type: none"> <li>Practice Insert Commands Thoroughly</li> </ul>
8	Exercise on view commands	<ul style="list-style-type: none"> <li>Show the orthographic views (side view, top view, front view) of any object</li> <li>Show the isometric views of any object</li> <li>Shade a given object with solid colour using SHADE command</li> <li>Create a hidden line view of a model using HIDE command</li> <li>Create wire frame model using WIRE FRAME command</li> </ul>	<ul style="list-style-type: none"> <li>Practice View Commands Thoroughly</li> </ul>
9	Exercise on isometric drawings in 2D	<ul style="list-style-type: none"> <li>Look down the isometric view of a box from top or bottom and left or right corners like SW,NE isometric views</li> <li>Change the default axis colours, size of the crosshair display by using crosshair tab</li> <li>Create an isometric circle on the current isometric plane using Ellipse, Isocircle</li> </ul>	<ul style="list-style-type: none"> <li>Practice on Isometric drawings in 2D Thoroughly</li> </ul>
10	Exercise on Electrical drawings	<ul style="list-style-type: none"> <li>Draw electrical symbols</li> <li>Draw the views of electrical machines like dc and ac machines</li> </ul>	<ul style="list-style-type: none"> <li>Practice Commands Thoroughly</li> </ul>
11	Exercise on shading of 3D models	<ul style="list-style-type: none"> <li>Draw and shade 3D models of box, pyramid, cone, cylinder, sphere</li> <li>Revolve the 3D model</li> </ul>	<ul style="list-style-type: none"> <li>Practice shading of 3D models Thoroughly</li> </ul>
12	Study the Project Management Software Open Project	<ul style="list-style-type: none"> <li>Study the features and applications of Project management software</li> <li>Understand the Various Menus used in Open Project Software</li> </ul>	<ul style="list-style-type: none"> <li>Understand the Project Management software Open-Project</li> </ul>
13	Practicing on Project Management Software MS-Project/Primavera	<ul style="list-style-type: none"> <li>Understands the input data.</li> <li>Understands various commands to execute the given input data.</li> <li>Prepare schedules for resource allocation.</li> <li>Prepare modules for execution of projects.</li> </ul>	<ul style="list-style-type: none"> <li>Prepares and executes the Various Management projects</li> </ul>

## REFERENCES

1. An introduction to Auto CAD-Dayanithi (NITTTTR)
2. CAD Software by 4M CAD,Intelly CAD
3. Auto CAD-S.Vishal.
4. Project Management Practice software: Open Project

**DIGITAL ELECTRONICS & MICROCONTROLLERS LAB PRACTICE**

**Subject Title** : **Digital Electronics & Microcontrollers Lab Practice**  
**Subject Code** : **EE-608**  
**Periods/Week** : **03**  
**Periods/Semester** : **45**

**TIME SCHEDULE**

S.No.	Major Topics	No. Of Periods
1.	Logic Gates	09
2.	Combinational Logic Circuits	12
3.	Sequential Logic Circuits	12
4.	Micro Controllers	12
	Total	45

**LIST OF EXPERIMENTS**

- 1.(a) Identify the given digital ICs from the number by referring to data sheets
  - i) logic gate type(AND,OR,NOT)
  - ii) Logic family
  - iii) Operating Voltage
- 1.(b) Draw the pin diagrams of the above digital ICs.
- 1 (c) Verify the truth tables of basic gates and universal gates.
2. Show NAND gate and NOR gate as Universal gates.
3. Realize a given Boolean function after simplification and obtain its truth table.
4. Construct half adder and full adder and verify the truth tables.
5. Verify the function of 74138 decoder IC.
6. Verify the working of Multiplexer (Using IC 74153)
7. Verify the functional table of 4-bit magnitude comparator 7485IC.
8. Construct and verify the truth tables of NAND & NOR latches
- 9(a) Construct clocked RS FF using NAND gates and Verify its truth table.

- 9(b) Verify the table of JK FF using 7476 IC.
- 9(c) Construct D and T flip flops using 7476 and verify the truth tables.
10. Working with microcontroller kits and Simulators
  - a) Familiarization of 8051 Microcontroller Kit
  - b) Familiarization of 8051 simulator EDSIM 51 (or similar)
  - c) Write small ALP to demonstrate different register addressing techniques
11. Practicing Arithmetic instructions of 8051
  - a) Write an ALP to demonstrate Addition, subtraction, division and multiplication of 8 bit numbers using immediate data access.
  - b) Write an ALP to Add and Subtract 16 bit numbers
  - c) Write an ALP to Square and Cube program
  - d) Write an ALP to find LCM of given numbers
  - e) Write an ALP to find HCF of given numbers
12. Interfacing Switches and LEDS to 8051
  - a) To make an LED connected to port 1.5, light up for specific time on pressing a switch connected to port 2.3
  - b) Write a Program to make an LED connected to pin 1.7 to blink at a specific rate
  - c) Connect a Relay in place of LED to control a AC 230 V Lamp

### Competencies & Key Competencies to be achieved by the student

S. No	Experiment Name (Periods)	Competencies	Key Competencies
1.	Identify the given digital ICs and draw their pin diagrams (3)	<ul style="list-style-type: none"> <li>Read the IC numbers.</li> <li>Identify the importance of numbering on the ICs</li> <li>Identify the no. of pins of each IC</li> <li>Identify the type of IC package.</li> <li>Draw the pin diagram of each IC from the data sheets</li> <li>Identify the no. of gates present in each IC.</li> <li>Identify the input and output pins</li> <li>Note down the important specifications from the data sheets</li> <li>Identify the power supply pins.</li> <li>Observe the layout on a bread board.</li> <li>Measure the output of the given dc power supply.</li> <li>Read the logic diagram for Each Gate</li> <li>Read the truth table of each gate.</li> <li>Apply inputs as per the truth table and observe the outputs.</li> <li>Identify basic gates and universal gates.</li> </ul>	<ul style="list-style-type: none"> <li>Draw the pin diagram of each IC from the data sheets</li> <li>Remove an IC from the bread board using IC remover.</li> </ul>
2.	Show NAND and NOR gates as universal gates. (3)	<ul style="list-style-type: none"> <li>Identify two input NAND and NOR gate ICs</li> <li>Mount the NAND and NOR ICs properly on bread board.</li> <li>Read the pin diagrams of ICS.</li> <li>Find the input pins, out pins, power supply pins.</li> <li>Read the circuit diagrams.</li> <li>Rig up the circuit diagrams one by one</li> <li>Apply different input combinations as per truth table and observe the corresponding outputs.</li> <li>Show that NAND gate and NOR gate are universal gates.</li> </ul>	<ul style="list-style-type: none"> <li>Rig up the circuit diagram.</li> <li>Apply the inputs and observing the outputs.</li> </ul>
3.	Realize a given Boolean function after simplification and obtain its truth table (3)	<ul style="list-style-type: none"> <li>Identify the no. of literals present in the given Boolean expression.</li> <li>Find the form of expression(SOP or POS)</li> <li>Simplify the Boolean expression</li> <li>Identify the logic gates required</li> <li>Find the sourcing and sinking characteristics of logic gates from the data sheets.</li> <li>Draw the logic diagram.</li> <li>Find the Required logic ICs.</li> <li>Rig up the circuit.</li> <li>Apply different input combinations as per truth table and note down the observations.</li> </ul>	<ul style="list-style-type: none"> <li>Apply different input combinations as per truth table</li> </ul>
4.	Construct half adder and full adder and verify the truth tables. (3)	<ul style="list-style-type: none"> <li>Identify the no. of inputs and outputs of half adder and full adder.</li> <li>Determine the truth tables of Half adder and full adder.</li> <li>Write Boolean expressions for the output variables from the truth tables.</li> <li>Simplify the Boolean expressions.</li> <li>Draw the logic diagrams of half adder and full adder.</li> <li>Identify the logic gates required.</li> <li>Rig up the circuits.</li> <li>Verify the truth tables of half adder and full adder by applying different input combinations.</li> <li>Show that construction of full adder can be done using two half adders.</li> <li>Identify a 4-bit parallel adder IC</li> </ul>	<ul style="list-style-type: none"> <li>Write the Boolean expressions.</li> <li>Simplify the Boolean expressions.</li> <li>Determine the logic gates required.</li> </ul>

5.	Verify the function of 74138 decoder IC. (3)	<ul style="list-style-type: none"> <li>Draw the pin diagram of 74138 IC from the data manual.</li> <li>Identify the significance of numbering.</li> <li>Identify the input and output pins</li> <li>Identify the enable pins.</li> <li>Note down the active low and active high pins.</li> <li>Read the truth table.</li> <li>Read the logic diagram.</li> <li>Rig up the circuit</li> <li>Apply the inputs to the enable inputs properly.</li> <li>Check the effect of enable inputs.</li> <li>Apply the inputs as per the truth table and observe the outputs.</li> </ul>	<ul style="list-style-type: none"> <li>Identify the enable pins.</li> <li>Note down the active low and active high pins</li> <li>Check the effect of enable inputs.</li> </ul>
6.	Verify the working of Multiplexer (Using IC 74153) (3)	<ul style="list-style-type: none"> <li>Draw the pin diagram of 74153 IC from the data manual.</li> <li>Identify the input and output pins</li> <li>Identify the enable pins.</li> <li>Note down the active low and active high pins.</li> <li>Read the truth table.</li> <li>Read the logic diagram.</li> <li>Rig up the circuit</li> <li>Apply the inputs to the enable inputs properly.</li> <li>Check the effect of enable inputs.</li> <li>Apply different inputs as per the truth table and observe the outputs.</li> <li>Find applications of MUX</li> <li>Identify different multiplexers.</li> <li>Construct and test simple circuit using a multiplexer.</li> </ul>	<ul style="list-style-type: none"> <li>Identify the enable pins.</li> <li>Note down the active low and active high pins</li> <li>Checking the effect of enable inputs.</li> <li>Identifying different multiplexers.</li> </ul>
7.	Verify the functional table of 4-bit magnitude comparator 7485IC. (3)	<ul style="list-style-type: none"> <li>Determine the function of magnitude comparator.</li> <li>Draw the pin diagram of 7485 IC from the data manual.</li> <li>Identify the pins to which one 4-bit no. is to be applied.</li> <li>Identify the pins to second 4-bit no. is to be applied</li> <li>Identify the output pins and note down their significance.</li> <li>Identify the cascading pins and note down their significance.</li> <li>Read the functional table of 7485 from the manual</li> <li>Observe the difference between functional table and truth table.</li> <li>Rig up the circuit</li> <li>Apply the inputs and verify the functional table.</li> <li>Connect two 7485 ICs in cascade and observing the working of 8-bit magnitude comparator.</li> </ul>	<ul style="list-style-type: none"> <li>Identify the pins to which one 4-bit no. is to be applied.</li> <li>Connect two 7485 ICs in cascade and observe the working of 8-bit magnitude comparator</li> </ul>
8.	Construct and verify the truth tables of NAND & NOR latches (3)	<ul style="list-style-type: none"> <li>Identifying the two input NAND and NOR ICs.</li> <li>Drawing the pin diagram of NAND and NOR ICs.</li> <li>Mounting the ICS on the bread board properly.</li> <li>Reading the logic diagram</li> <li>Rigging up the circuit diagram</li> <li>Visualizing a latch can store one bit of data.</li> <li>Comparing truth tables of NAND and NOR latches.</li> <li>Observing the forbidden state in each latch.</li> </ul>	<ul style="list-style-type: none"> <li>Visualizing a latch</li> <li>Observing the forbidden state in each latch.</li> </ul>

9.	Construct clocked RS FF using NAND gates and Verify its truth table (3)	<ul style="list-style-type: none"> <li>Identify the required digital ICs on the digital trainer kit</li> <li>Observe the clock circuitry on the trainer kits.</li> <li>Draw the pin diagrams of required ICs from the data manual</li> <li>Read the circuit diagrams</li> <li>Construct clocked RS FF</li> <li>Apply inputs and observe the outputs.</li> <li>Observe the effect of clock</li> <li>Identify the no. of FFs present in 7476 IC</li> <li>Observe the preset and clear inputs of 7476</li> <li>Apply the inputs and clock to the 7476 and verifying the truth table</li> <li>Observe the effect of Pr and CLR inputs of 7476.</li> <li>Construct T and D FF using 7476.</li> <li>Observe the outputs for the inputs as per the truth table.</li> <li>Apply continuous clock to T flip flop and observe the output.</li> </ul>	<ul style="list-style-type: none"> <li>Observe the preset and clear inputs of 7476</li> <li>Apply continuous clock to T flip flop.</li> </ul>
10	Working with Microcontroller Kits and Simulators (3)	<ul style="list-style-type: none"> <li>Familiarization of 8051 Microcontroller Kit</li> <li>Familiarization of 8051 simulator EDSIM 51</li> <li>Write small ALP to demonstrate different register addressing techniques</li> </ul>	
11	Practicing Arithmetic instructions of 8051 (3)	<ul style="list-style-type: none"> <li>Write an ALP to demonstrate Addition, subtraction, division and multiplication of 8 bit numbers using immediate data access.</li> <li>Write an ALP to Add and Subtract 16 bit numbers</li> <li>Write an ALP to Square and Cube program</li> <li>Write an ALP to find LCM of given numbers</li> <li>Write an ALP To find HCF of given numbers</li> </ul>	
12	Interfacing Switches and LEDs to 8051 (3)	<ul style="list-style-type: none"> <li>Draw the practice diagrams</li> <li>List the tools required</li> <li>List different LEDs</li> <li>Identify the leads of LED</li> <li>Check the working of switch using DMM</li> <li>Check the continuity of Relay using DMM</li> <li>Implement of key de-bouncing (hardware).</li> </ul>	<ul style="list-style-type: none"> <li>Identify leads of led with observation</li> <li>Identify color of LED,</li> <li>Note R value for current limiting</li> <li>Make relay connections</li> </ul>

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## POWER ELECTRONICS AND PLC LAB PRACTICE

<b>Subject Title</b>	:	<b>Power Electronics and PLC Lab Practice</b>
<b>Subject Code</b>	:	<b>EE-609</b>
<b>Periods/Week</b>	:	<b>03</b>
<b>Periods/Year</b>	:	<b>45</b>

## TIME SCHEDULE

S. No.	Major Topics	No. of Periods
1.	Characteristics of different Power Electronic Devices	06
2.	Study the working of different Power Electronic circuits	06
3.	Speed control of the DC motor using the Power Electronic Devices	06
4.	Speed control of the single phase motor using SCR	03
5	Execution of the different Ladder Diagrams	09
6	Execution of the Ladder Diagrams with model applications	15
<b>Total</b>		<b>45</b>

## LIST OF EXPERIMENTS

- 1.0 Plot the Characteristics of the different Power Electronic Devices**
  - (a) Plot the Characteristics of SCR
  - (b) Plot the Characteristics of IGBT, GTO
- 2.0 Study the working of different Power Electronic circuits**
  - (a) Study of the working of single phase half wave converter
  - (b) Study of the working of single phase full wave converter
- 3.0 Speed control of the DC motor using the Power Electronic Devices**
  - (a) Speed Control of DC motor using single phase full converter
  - (b) Speed Control of DC motor using Chopper
- 4.0 Speed control of the 1- phase AC motor using the Power Electronic Devices**
  - (a) Speed Control of 1-phase AC motor using SCR
- 5.0 Execute the different Ladder Diagrams**
  - (a) Demonstrate PLC and Ladder diagram-Preparation , downloading and running

- (b) Execute Ladder diagrams for different Logical Gates
- (c) Execute Ladder diagrams using timers & counters
- 6.0 Execute the Ladder Diagrams with model applications**
- (a) Execute Ladder diagrams with model applications
  - (i) DOL starter (ii) Star-Delta starter
- (b) Execute Ladder diagrams with model applications
  - (i) Stair case lighting
  - (ii) Traffic light controller

**Competencies & Key competencies to be achieved by the student**

S.No	Experiment title	competencies	Key competencies
1	Characteristics of i) SCR ii) IGBT and iii) GTO (6)	<ul style="list-style-type: none"> <li>• Identify the different Power electronic devices available in the laboratory like SCR, IGBT, GTO</li> <li>• Draw the symbols of the above devices.</li> <li>• Identify the different terminals.</li> <li>• Draw the necessary circuit diagram and identify the apparatus required</li> <li>• Make the connections of the circuit as per the circuit diagram of forward bias</li> <li>• Record the different values of voltage and current in forward bias</li> <li>• Change the connections of the circuit as per the circuit diagram of Reverse bias</li> <li>• Record the different values of voltage and current in reverse bias</li> <li>• Plot the forward and reverse characteristics on a graph sheet</li> <li>• Repeat the experiment for IGBT, GTO and plot the V-I characteristics.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Identify the different terminals</li> <li>▪ Make the connections of the circuit as per the circuit diagram of forward bias and reverse bias.</li> </ul>
2	i) Working of single phase half wave converter ii) working of single phase full wave converter (6)	<ul style="list-style-type: none"> <li>• Draw the circuit diagram for the single phase half wave converter</li> <li>• Identify the different components and apparatus required for the circuit</li> <li>• Make the necessary connections as per the circuit diagram with resistive load.</li> <li>• Verify the waveforms in the CRO at different gate current pulses</li> <li>• Change the R- load with R-L load and observe the waveforms at different gate current pulses</li> <li>• Study the working of the single phase full wave converter with R load and R-L load in similar way as above</li> <li>• Draw the circuit diagram for the single phase full wave converter using SCR's</li> <li>• Identify the different components and apparatus required for the circuit</li> <li>• Make the necessary connections as per the circuit diagram</li> <li>• Verify the waveform in the CRO for different gate pulses</li> </ul>	<ul style="list-style-type: none"> <li>▪ Verify the waveforms in the CRO at different gate current pulses</li> </ul>

3	i) Speed Control of DC motor using single phase full converter ii) Speed Control of DC motor using Chopper. (6)	<ul style="list-style-type: none"> <li>• Draw the circuit diagram for the speed control of the DC motor using the single phase full wave convertor</li> <li>• Identify the different apparatus required from the circuit diagram</li> <li>• Make the necessary connections according to the circuit</li> <li>• Change the triggering angles and Noting down the readings of the speed of the DC motor</li> <li>• Plot the graph Speed Vs Triggering Angles</li> <li>• Perform another experiment in similar way on speed control of the DC motor using a single phase chopper</li> <li>• Change the duty cycle</li> <li>• Note down the readings of the speed of the DC motor</li> <li>• Plot the graph : Speed Vs Duty cycle</li> </ul>	<ul style="list-style-type: none"> <li>▪ Change the triggering angles</li> <li>▪ Change the duty cycle</li> </ul>
4	Speed control of single phase AC motor using SCR. (3)	<ul style="list-style-type: none"> <li>• Draw the circuit diagram for the speed control of the single phase AC motor using the Silicon controlled Rectifier</li> <li>• Identify the different apparatus required from the circuit</li> <li>• Make the necessary connections according to the given circuit diagram</li> <li>• Note down the readings of the speed of the DC motor by changing the triggering angles</li> <li>• Draw the graph between Speed Vs Triggering Angles</li> </ul>	<ul style="list-style-type: none"> <li>▪ change the triggering angles</li> <li>▪ Draw the graph between Speed Vs Triggering Angles</li> </ul>
5	a) Demonstrate PLC and Ladder diagram b) Execute Ladder diagrams for different Logical Gates c) Execute Ladder diagrams using timers & counters (9)	<ul style="list-style-type: none"> <li>• Identify the PLC trainer kit, the Personal Computer and Loaded PLC software</li> <li>• Observe the input and output ports of the PLC</li> <li>• Make the interfacing between the PC and the PLC.</li> <li>• Prepare the appropriate ladder diagrams for different logical gates(AND, OR, NOT, NOR,NAND)</li> <li>• Save the ladder diagram with relevant file names</li> <li>• Execute each ladder diagram program and checking for errors</li> <li>• Rectify errors if any then save and again executing the program</li> <li>• Download the LD program into the PLC</li> <li>• Run each program and checking its output logic with relevant inputs.</li> <li>• Prepare simple ladder diagrams using "timers and counters" instructions</li> <li>• Execute ,Run and check the output logic for each program</li> </ul>	<ul style="list-style-type: none"> <li>▪ Modify the existing program and design new programs</li> <li>▪ Test the ladder logic with logic GATES examples</li> <li>▪ Test the ladder logic with Timer/Counter instructions in ladder diagrams</li> </ul>

6	Execute Ladder diagrams with model applications (i) DOL starter (ii) Star-Delta starter (iii) Stair case lighting (iv) Traffic light controller  (15)	<ul style="list-style-type: none"> <li>• Identify the different available model application kits in the lab</li> <li>▪ Draw the ladder diagrams for the DOL starter and star/delta starter</li> <li>• Prepare the ladder diagrams in the Computer, saving and executing the program</li> <li>• Make proper connections of the model application at the output port of PLC and downloading its relevant LD program in PLC</li> <li>• Run the LD program and observing the outputs with the model applications</li> <li>• Execute the Ladder diagrams for other model applications like "Stair case lighting and Traffic signal control model" in the same way as above</li> </ul>	<ul style="list-style-type: none"> <li>▪ Execute the LD programs and observe the performance of starters</li> <li>▪ Design Ladder Logic for the stair case lighting, Traffic light controller</li> </ul>
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### PROJECT WORK

<b>Subject Title</b>	:	<b>Project Work</b>
<b>Subject Code</b>	:	<b>EE- 610</b>
<b>Periods / Week</b>	:	<b>06</b>
<b>Periods / Semester</b>	:	<b>90</b>

### OBJECTIVES

**Upon completion of the Project work the student shall be able to**

#### 1.0 Project work

- 1.1 Identify different works to be carried out in the Project.
- 1.2 Collect data relevant to the project work.
- 1.3 Carry out need survey.
- 1.4 Select the most efficient method from the available choices based on preliminary investigation.
- 1.5 Design the required elements of the project work as per standard practices.
- 1.6 Prepare the working modules / equipments required for the project work.
- 1.7 Estimate the cost of project, technological need, computer skills, materials and other equipments.
- 1.8 Prepare the plan and schedule of starting time and sequence of operations to be carried out at the various stages of the project work in detail.
- 1.9 Prepare of critical activities at the various stages of the project work.
- 1.10 Test for various conditions with different electrical input parameter if required.
- 1.11 Implement the given project work and record the results at various places.
- 1.12. Collect necessary information to procure necessary finance, and equipment.
- 1.13 Prepare a chart or model for the project.
- 1.14 Preparation of project report.

#### 2.0 Report on observations in Industrial visits

Visit nearby Traction Sub-station / Loco shed and submit a report.

## COURSE CONTENT

Project work is intended to provide training in the solution of various fields of engineering problems relating to Rural Electrification Systems: Solar Lamps, Solar Cooker, Solar Water pumping systems etc.

Energy Saving Equipments: Replacing of Tungsten filament lamps with effective Implementation of LED, CFL Lamps at various applications.

**Automobile Field:** Solar Operated Vehicles, Battery Operated Vehicles, Remote Operated electrical Devices, Usage of advanced Tubular Batteries for improving the efficiency.

**Energy Management Techniques:** Energy auditing at various reputed Industries.

**Electrical Power Systems:** Working Models of Hydel, Thermal and Non Conventional Power Generation Systems. Transmission and distribution system analysis.

**Power Devices:** Inverter, SCR based applications, UPS and Automatic switching DG Sets etc.

**Electric traction :** Metro-line projects .

### Industrial Visit nearby Power Station

Project work will also include the implementation of Innovative Ideas which improves the nation growth and preparation of the feasibility report for any one type of enterprise under self - employment schemes also.

Students shall be divided into groups of five each and shall be assigned a problem that calls for application of the knowledge he/she acquired in the course and also which involves some extra study of reference materials.

### Exercises:

- Planning of a Electrical Power Distribution Lines inside the Institution premises.
- Wirings of existing system.
- Industrial complex wiring designs.
- Rural electrification supply Scheme.
- Energy efficient management systems.
- Power Saving systems.
- Design of Substations.
- Set up of a small enterprise under self employment scheme.

Every student should prepare a project report and submit the same for assessment. Every student puts his share to the work in all the operations of the project. The end examination in Project work shall consist of

power point presentation and Viva-voce test which is to be assessed by a panel of examiners comprising of an External examiner. The Head of Section, and member of staff who guided the project as Internal examiner.

### Scheme of assessment

1)	Seminar 1	-	10 Marks
2)	Seminar 2	-	10 Marks
3)	Project Report assessment	-	20 Marks
4)	Project	-	40 Marks
5)	Viva-Voce	-	20 Marks
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		Total Marks	100
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### Safety Precautions

- Care less use of Electricity is dangerous.
- The person working on live part should not come into touch with wet ground.
- Always use insulated tools and instruments.
- Never place fuse in neutral
- Switch off mains before replacing a blownout fuse
- Always use correct rating fuse wire
- All the equipment should be properly earthed.
- Always wear gloves and rubber shoes while working
- Do not disconnect a plug by pulling the cable.
- Never touch an overhead line unless it is made dead and earthed.
- When fire occurs on live equipment do not through water on it. Use sand or fire extinguisher.
- Place danger board and caution notice boards near the work place of switching.
- Keep sand buckets and fire extinguishers in the work place.
- Never wear silk, nylon, polyester clothing while doing electrical work.
- Use proper insulated rubber mats at the work places.
- Be attentive at all times.