GOVERNMENT OF ANDHRA PRADESH

STATE BOARD OF TECHNICAL EDUCATION AND TRAINING

Andhra Pradesh :: Amaravathi

Globally Competetive

CURRICULUM (C-16)

For Polytechnic Diploma Courses
In Andhra Pradesh

DIPLOMA IN
ELECTRICAL & ELECTRONICS ENGINEERING

Front Cover Page

Objective of the New Curriculum (C-16)

To make the students 'Globally Competetive & Employable' by learning industry relevant subjects & undergoing Industrial training

Suggestions from Industrialists have been incorporated in the Curriculum by organising **Industry Institute Interaction Meet.**

Highlights of the Curriculum (C-16)

- 6 months /1 year industrial training in all the Diploma Courses.
- 1 year industrial training in collaboration with BOAT (Board of Apprenticeship & Training (SR), Chennai).
- Virtual labs for ECE & Computer Branches & Strengthening of Skill Development Centers to provide industrial training to students.

Fundamentals of 'Internet of Things' (IoT) is included for all the Branches in the Subject "Industrial Management & Smart Technologies".

"Communication Skills" and "Life Skills" have been introduced as practical subjects for all the Branches.

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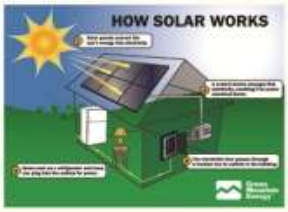
"Computer Fundamentals Laboratory" is introduced for all the Branches in First year. AutoCAD specific to the Branch has been given emphasis in the Curriculum.

C Language, Programmable Logic Controllers (PLC), Microcontrollers, Solar Energy are introduced in Electrical Engineering Branch.



Mobile Communications, Consumer Electronics are introduced in Electronics and Communication Branch

CAD/ CAM, CNC Machines, Power Plant Engineering are introduced in Mechanical Engineering Branch.

OOPS through JAVA, Web Designing, Computer Hardware & Networking are introduced in Computer Engineering Branch.

Automobile Chassis and Body Engineering, Recent Trends In Automobile Engineering, Motor Transport Organization etc are introduced in Automobile Engineering Branch.

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Journal (JPAP)

The Department of Technical Education, A.P. has a bi- annual 'Journal of Polytechnics of Andhra Pradesh' JPAP

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CURRICULUM-2016
(C-16)

FOR DIPLOMA COURSES IN ANDHRA PRADESH

PREAMBLE

The State Board of Technical Education and Training, Andhra Pradesh under the aegis of the Department of Technical Education, Andhra Pradesh generally reviews the Curricula once in every five years. However, recognizing the needs of the industries and enhancing the employability skills of Polytechnic students, the Government of Andhra Pradesh constituted a committee vide G.O.Rt.No:95 of Higher Education (TE) Dept dated: 29-4-2016 and G.O.Rt.No:98 of Higher Education (TE) Dept dated: 4-5-2016 for updation of polytechnic curriculum under the chairmanship of Sri. S. Balasubrahmanyam, IAS (Retd.,). The committee submitted a report on 31-5-2016 making certain recommendations and suggesting new initiatives to be incorporated in the curriculum. An Industry Institute Interaction Meet was organized with Industry experts and subject experts on 26-12-2016 and the suggestions from Industrialists have also been incorporated in the curriculum. 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 Andhra Pradesh, 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–2016 (C-16) is approved by BoG of SBTET for its implementation with effect from 2016-17.

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. 6 Months/ 1 year Industrial Training is introduced for all the Diploma courses.
4. Fundamentals of Internet of Things (IOT) is introduced for all the Diploma courses in the subject.
5. Modern subjects relevant to the industry are introduced in all the Diploma courses.
6. CISCO course content has been incorporated into the ECE and CME courses to get certification from CISCO along with Diploma.
7. 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.

8. 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 for all the branches.
9. 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.
10. AutoCAD specific to the branch has been given more emphasis in the curriculum. Preparing drawings using CAD software has been given more importance.
11. Every student is exposed to the computer lab at the 1st year itself in order to familiarize himself with skills required for keyboard/mouse operation, internet usage and e-mailing.
12. Upon reviewing the existing C-14 curriculum, it is found that the theory content is found to have more weightage than the Practical content. In the revised C-16 curriculum, more emphasis is given to the practical content of Laboratories and Workshops, thus strengthening the practical skills.
13. 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.
14. Curricula 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 G.S. Panda Das, I.A.S., Special Commissioner of Technical Education & Chairman of SBTET, AP. and Sri. Adityanath Das, I.A.S., Principal Secretary of Higher Education 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 Sri. A.Nirmal Kumar Priya, Secretary, SBTET, Andhra Pradesh and other officials of Directorate of Technical Education and the State Board of Technical Education, Andhra Pradesh, experts from industry, academia from the universities and higher learning institutions and all teaching fraternity from the Polytechnics who are directly or indirectly involved in preparation of the curricula.

RULES AND REGULATIONS

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 BM course, the training will be in the seventh semester. Run-through system is adopted for all the Diploma Courses, subject to eligibility conditions.

2 PROCEDURE FOR ADMISSION INTO THE DIPLOMA COURSES:

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

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

Only the candidates satisfying the following requirements will be eligible to appear for

the Common Entrance Test for admissions into Polytechnics (POLYCET).

b) The candidates seeking admission should have appeared for S.S.C examination, conducted by the Board of Secondary Education, Andhra Pradesh or equivalent examination thereto, at the time of making application to the Common Entrance Test for admissions into Polytechnics (POLYCET). In case of candidates whose results of their Qualifying Examinations is pending, their selection shall be subject to production of proof of their passing the qualifying examination in one attempt or compartmentally at the time of admission

c) Admissions are made based on the merit obtained in the Common Entrance Test (POLYCET) and the reservation rules stipulated by the Government of Andhra Pradesh from time to time.

d) 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

3 MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

4 PERMANENT IDENTIFICATION NUMBER (PIN)

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

5 NUMBER OF WORKING DAYS PER SEMESTER / YEAR:

a). The Academic year for all the Courses shall be in accordance with the Academic Calendar.

b). The Working days in a week shall be from Monday to Saturday

c). There shall be 7 periods of 50 minutes duration 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.

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 1st year may be granted on medical grounds.

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

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

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

7 READMISSION

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

1. a) Within 15 days after commencement of class work in any semester (Except Industrial Training).

   b) For Industrial Training: before commencement of the Industrial training.

2. Within 30 days after commencement of class works 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.

8 SCHEME OF EXAMINATION

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, VI and VII Semesters:

THEORY EXAMINATION: Each subject carries usually 80 marks and 30 marks in respect of specified subjects of 3hours duration, along with 20 marks for internal evaluation (sessional marks) respectively.

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

9 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) Practical Subjects: Student's performance in Laboratories / Workshop shall be assessed during the year/ semester 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 work 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 Section preferably choosing a qualified person from any local Industry/ nearby Government Polytechnic/ Local Government Organization. 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 the marks are to 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 institution level (Seminar/Viva-voce)shall be done by three members, viz., Internal Faculty member, External Examiner and Head of Section and be averaged.

10 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 end examination marks put together. In case of D.C.C.P., the pass mark for typewriting and short hand is 45% in the end examination. There are no sessional marks for typewriting and Shorthand subjects of D.C.C.P course.

11. PROVISION FOR IMPROVEMENT

1. Improvement is allowed only after he / she has completed all the subjects from First Year to Final semester of the Diploma.
2. Improvement is allowed in any 4 (Four) subjects of the Diploma.
3. The student can avail of this improvement chance **ONLY ONCE**, that too within the succeeding two examinations after the completion of Diploma. However, the duration including Improvement examination shall not exceed FIVE years from the year of first admission.
4. No improvement is allowed in Practical / Lab subjects or Project work or Industrial Training assessment. However, improvement in drawing subject(s) is allowed.
5. If improvement is not achieved, the marks obtained in previous Examinations hold good.
6. Improvement is not allowed in respect of the candidates who are punished under Mal-practice in any Examination.
7. Examination fee for improvement shall be paid as per the notification issued by State Board of Technical Education and Training from time to time.
8. 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.

12. RULES OF PROMOTION FROM 1ST YEAR TO 3,rd, 4,th 5th ,6th and 7th SEMESTERS:

a) For Diploma Courses of 3 Years duration

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

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

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

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

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

ii) Should not have failed in more than Four backlog subjects of 1st year

For IVC & ITI Lateral Entry Students:

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

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

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

i) Puts the required percentage of attendance in the 5th semester

ii) Should get eligibility to appear for 4th Semester examination.

For IVC& ITI Lateral Entry students:

i) Puts the required percentage of attendance in the 5th semester
ii) Should not have failed in more than Four backlog subjects of 3rd Semester

v) A candidate shall be promoted to 6th semester provided he/she puts in the required percentage of attendance in the 5th semester and pay the examination fee. A candidate who could not pay the 5th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 6th semester.

A candidate is eligible to appear for 6th semester Industrial Training assessment (Seminar/Viva-voce)

i) Puts the required percentage of attendance, ie., 90% in 6th semester Industrial Training

ii) Should get eligibility to appear for 4th Semester Examination.

For IVC & ITI Lateral Entry students:

i) Puts the required percentage of attendance, ie., 90% in 6th semester Industrial Training.
ii) should get eligibility to appear for 5th Semester Examination.

Important Note:

Seminar/Viva-voce should not be conducted for Not-Eligible Candidates, till the candidate gets eligibility. The record of internal assessment for Industrial Training for 260 marks shall be maintained at Institution Level for all candidates and the data is to be uploaded only for eligible candidates. For not eligible candidates the data is to be uploaded as and when the candidate gets eligibility.

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

1. A candidate shall be permitted to appear for 1st year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds upto 10%) i.e. attendance after condonation on Medical grounds should not be less than 65% and pay the examination fee.
2. A candidate shall be promoted to 3rd semester if he/she puts the required percentage of attendance in the 1st year and pays the examination fee. A candidate who could not pay the 1st year examination fee has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 3rd semester.
3. A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and pay the examination fee. A candidate, who could not pay the 3rd semester exam fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 4th semester.

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

i) Puts the required percentage of attendance in the 4th semester
ii) Should not have failed in more than Four backlog subjects of 1st year.

For IVC & ITI Lateral Entry students:

(i) Puts the required percentage of attendance in the 4th semester

4. A candidate shall be promoted to 5th semester industrial training provided he / she puts the required percentage of attendance in the 4th semester and pays the examination fee. A candidate, who could not pay the 4th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5th semester.
5. Promotion from 5th to 6th semester is automatic (i.e., from 1st spell of Industrial Training to 2nd spell) provided he/she puts the required percentage of attendance, which in this case ie.,90 % of attendance and attends for the VIVA-VOCE examination at the end of training.
6. A candidate shall be promoted to 7th semester provided he / she puts the required percentage of attendance in the 6th semester and pays the examination fee. A candidate, who could not pay the 6th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 7th semester.
7. A candidate shall be promoted to 7th semester of the course provided he/she has successfully completed both the spells of Industrial Training.

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

i) Puts the required percentage of attendance in the 7th semester
ii) Should get eligibility to appear for 4th semester Examination.

For IVC & ITI Lateral Entry students:

i) Puts the required percentage of attendance in the 7th semester
ii) Should not have failed more than four backlog subjects of 3rd Semester

OTHER DETAILS

a) In case a candidate does not successfully complete the Industrial training, he / she will have to repeat the training at his / her own cost.

b) The I spell of Industrial training shall commence 10 days after the completion of the last theory examination of 4th Semester.

c) The Second spell of Industrial training shall commence within 10 days after the completion of I spell of Industrial training.

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

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

1. A candidate shall be permitted to appear for first year examination provided he / she puts in 75%

attendance (which can be condoned on Medical grounds upto 10%) i.e. attendance after condonation on Medical grounds should not be less than 65% and pay the examination fee.

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

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

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

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

   ii) Should not have failed in more than Four backlog subjects of 1st year

For IVC & ITI Lateral Entry Students:

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

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

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

   i) Puts the required percentage of attendance in the 5 th semester

   ii) Should get eligibility to appear for 4th Semester examination.

For IVC & ITI Lateral Entry students:

iii) Puts the required percentage of attendance in the5th semester
iv) Should not have failed in more than Four backlog subjects of 3rd Semester

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

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

A candidate is eligible to appear for 6th semester examination

i) Puts the required percentage of attendance in 6th semester and

ii) should get eligibility to appear for 4th Semester Examination.

For IVC & ITI Lateral Entry students:

i) Puts the required percentage of attendance in 6th semester.
ii) should get eligibility to appear for 5th Semester Examination.

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

A candidate is eligible to appear for 7th semester Industrial Training assessment

(Seminar/Viva-voce) if he/she

i) Puts the required percentage of attendance, ie., 90% in 7th semester Industrial Training
ii) Should get eligibility to appear for 4th Semester Examination.

For IVC & ITI Lateral Entry students:

i) Puts the required percentage of attendance, ie., 90% in 7th semester Industrial Training.
ii) Should get eligibility to appear for 5th Semester Examination.

Important Note:

Seminar/Viva-voce should not be conducted for Not-Eligible Candidates, till the candidate gets eligibility. However, the record of internal Assessment for Industrial Training for 260 marks shall be maintained at Institution Level for all candidates and the data is to be uploaded only for eligible candidates. For not eligible candidates the data is to be uploaded as and when the candidate gets eligibility.

OTHER DETAILS

a) In case a candidate does not successfully complete the Industrial training, he / she will have to repeat the training at his / her own cost.

b) The Industrial training shall commence 10 days after the completion of the last theory examination of 6th Semester.

13. STUDENTS PERFORMANCE EVALUATION

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

1. First Class with Distinction shall be awarded to the candidates who secure an overall aggregate of 75% marks and above.

2. First Class shall be awarded to candidates who secure overall aggregate of 60% marks and above and below 75% marks.

3. 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 3rd and subsequent Semesters.

   In respect IVC & ITI Lateral Entry candidates who are admitted directly into diploma course at the 3rd semester (i.e., second year) level the aggregate of (100%) marks secured at the 3rd and subsequent semesters of study shall be taken into consideration for determining the overall percentage of marks secured by the candidates for award of class/division.

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

14. EXAMINATION FEE SCHEDULE:

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

15. 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 hours duration.

a) 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.

b) 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.

c) Practical Examinations

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

Max. Marks for an experiment / exercise : 50%

Max. Marks for VIVA-VOCE : 10%

Total : 60% (of total marks for the subject)

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.

16. ISSUE OF MEMORONDUM OF MARKS

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

17. MAXIMUM PERIOD FOR COMPLETION OF DIPLOMA COURSES:

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

18. 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.

For IVC & ITI Lateral Entry students:

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

5 academic years.

ii. He / she has completed all the subjects.

Students who fail to fulfill all the academic requirements for the award of the Diploma within 4 / 5 academic years from the year of admission shall forfeit their seat in the course & their seat shall stand cancelled.

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

A) FOR ISSUE OF PHOTO COPIES OF VALUED ANSWER SCRIPTS

1. A candidate desirous of applying for Photo copy of valued answer script/ scripts should apply within prescribed date from the date of the declaration of the result.
2. Photo copies of valued answer scripts will be issued to all theory subjects and Drawing subject(s).
3. The Photo copy of valued answer script will be dispatched to the concerned candidate's address as mentioned in the application form by post.
4. No application can be entertained from third parties.

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

1. A candidate desirous of applying for Re-verification of valued answer script should apply within prescribed date from the date of the declaration of the result.
2. Re-verification of valued answer script shall be done for all theory subjects and Drawing subject(s).
3. The Re-verification committee constituted by the Secretary, SBTETAP with subject experts shall re-verify the answer scripts.

I) RE-COUNTING

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

2) RE-VERIFICATION

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

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

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

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

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

considered as follows:

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

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

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

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

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

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

20. MAL PRACTICE CASES:

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

21. DISCREPANCIES/ PLEAS:

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

22. ISSUE OF DUPLICATE DIPLOMA

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

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

23. ISSUE OF MIGRATION CERTIFICATE AND TRANSCRIPTS:

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

24. GENERAL

i. The Board may change or amend the academic rules and regulations or syllabi at any time and the

changes or amendments made shall be applicable to all the students, for whom it is intended, with effect from the dates notified by the competent authority.

ii. All legal matters pertaining to the State Board of Technical Education and Training are within the jurisdiction of Vijayawada.

iii. In case of any ambiguity in the interpretation of the above rules, the decision of the Secretary, SBTET, A.P is final.

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

Subject Code	Name of the Subject	Instruction period / week		Total Period / year	Scheme of Examination			
		Theory	Practical/Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
EE-101	English	3	-	90	3	20	80	100
EE-102	Engineering Mathematics - I	5	-	150	3	20	80	100
EE-103	Engineering Physics	4	-	120	3	20	80	100
EE-104	Engineering Chemistry and Environmental Studies	4	-	120	3	20	80	100
EE-105	Electrical Engineering Materials	3	-	90	3	20	80	100
EE-106	Basic Electrical Engineering	5	-	150	3	20	80	100
PRACTICAL:								
EE-107	Engineering Drawing	-	6	180	3	40	60	100
EE-108	Basic Electrical and Electronics Laboratory	-	6	180	3	40	60	100
EE-109	Physics Laboratory	-	3	90	3	20	30	50
EE-110	Chemistry Laboratory				3	20	30	50
EE-111	Computer Fundamentals Laboratory	-	3	90	3	40	60	100
TOTAL		24	18	1260	-	290	710	1000

01,102,103,104,107,109,110 &111 Common with all branches

DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING

SCHEME OF INSTRUCTIONS AND EXAMINATIONS

C-16 - (THIRD 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
THEORY								
EE-301	Engg mathematics –II	5		75	3	20	80	100
EE-302	D.C. machines & measuring instruments	5		75	3	20	80	100
EE-303	Electrical circuits	5		75	3	20	80	100
EE-304	General mechanical engg	5		75	3	20	80	100
EE-305	Electronics engg - I	4		60	3	20	80	100
Practical								
EE-306	Dc machines & Measurements lab		6	90	3	40	60	100
EE-307	Electrical wiring & Maintenance lab		6	90	3	40	60	100
EE-308	C-language lab		3	45	3	40	60	100
EE-309	Electronics Engg lab – i		3	45	3	40	60	100
Total		24	18	630	27	260	640	900

SCHEME OF INSTRUCTIONS AND EXAMINATIONS
(FOURTH 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
Theory								
EE-401	A.C. machines -I	5		75	3	20	80	100
EE-402	Power systems -I(G& P)	5		75	3	20	80	100
EE-403	Electrical utilization & traction	5		90	3	20	80	100
EE-404	Electrical installation & estimation	4		60	3	20	80	100
EE-405	Electronics Engg - II	5		75	3	20	80	100
Practical								
EE-406	Electrical engg drawing		7	90	3	40	60	100
EE-407	A.C. machines -I laboratory		4	60	3	40	60	100
EE-408	Communication skills lab		3	45	3	40	60	100
EE-409	Electronics lab - ii		4	60	3	40	60	100
Total		24	18	630	27	260	640	900

NOTE: EE-403 : INCLUDES INDUSTRIAL DRIVES

SCHEME OF INSTRUCTIONS AND EXAMINATIONS
(FIFTH 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
THEORY								
EE-501	Industrial management & smart technologies	5		75	3	20	80	100
EE-502	A.C. machines-II	5		75	3	20	80	100
EE-503	Power systems -II (T,D & P)	5		75	3	20	80	100
EE-504	Power electronics & PLC	5		75	3	20	80	100
EE-505	Digital electronics & Micro controllers	5		75	3	20	80	100
Practical								
EE-506	A.C. machines laboratory-II		4	60	3	40	60	100
EE-507	Power electronics & PLC lab		6	90	3	40	60	100
EE-508	Life skills		3	45	3	40	60	100
EE-509	Digital electronics & Micro controllers Lab		4	60	3	40	60	100
Total		25	17	630	27	260	640	900

DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS

C-16-VI SEMESTER

EE - 601 INDUSTRIAL TRAINING

S.NO	Subject	Duration	Items	Max Marks	Remarks
1	Practical Training in the Industry	6 Months	1.First Assessment (at the end of 3rd month)	100	
			2. Second Assessment (at the end of 6th month)	100	
			3.Training Report a)Log Book b)Record	 30 30	
			4. Seminar	40	
TOTAL			300		

The industrial training shall carry **300** marks and pass marks are **50**%.A candidate failing to secure the minimum marks should complete it at his own expenses. No apprenticeship training stipend is payable in such case

During Industrial training the candidate shall put in a minimum of **90%**attendance.

FIRST YEAR

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

Subject Code	Name of the Subject	Instruction period / week		Total Period / year	Scheme of Examination			
		Theory	Practical/Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
EE-101	English	3	-	90	3	20	80	100
EE-102	Engineering Mathematics - I	5	-	150	3	20	80	100
EE-103	Engineering Physics	4	-	120	3	20	80	100
EE-104	Engineering Chemistry and Environmental Studies	4	-	120	3	20	80	100
EE-105	Electrical Engineering Materials	3	-	90	3	20	80	100
EE-106	Basic Electrical Engineering	5	-	150	3	20	80	100
PRACTICAL:								
EE-107	Engineering Drawing	-	6	180	3	40	60	100
EE-108	Basic Electrical and Electronics Laboratory	-	6	180	3	40	60	100
EE-109	Physics Laboratory	-	3	90	3	20	30	50
EE-110	Chemistry Laboratory				3	20	30	50
EE-111	Computer Fundamentals Laboratory	-	3	90	3	40	60	100
TOTAL		24	18	1260	-	290	710	1000

101,102,103,104,107,109,110 &111 Common with all branches

C-16-COMMON-101- ENGLISH
(Common to all Branches)

Subject Title : ENGLISH
Subject Code : Common - 101
Periods per Week : 3
Periods per Year : 90

Time Schedule& Weightage

Sl No	Major Topics	Titles of the Lessons	No. of Periods	Weightage of Marks	No of Short Answers	No of Long Answers
1	Vocabulary& Need for English	Lessons 1,2& Regular and essential vocabulary	5	13	1	1
2	Grammar	Lessons 11,12 & 19 to 26	30	31	7	1
3	Reading	Lessons 13 To 18	10	10	-	1
4	Writing	Lessons 27 To 40	30	40	-	4
5	English in Action	Lessons 3 To 10	15	16	2	1
		Total	90	110	10	08

Rationale and Scope

Globalization has ushered in an era of opportunities for those who have the necessary competencies. Effective communication is one among them. This shift demands strengthening of English in polytechnics. In C-16 Curriculum the focus is on the special needs of English for technicians.. This course aims at integration of the four fold language abilities viz., listening, speaking, reading and writing. The use of English for learning technical subjects and for performing technical functions like, writing reports, giving instructions and interpreting graphics/data is of great importance. Therefore the curriculum C-16 focuses on improving communicative abilities equipping the students to become industry- ready and employable.

On completion of this course the student will be able to:

1.0 Build vocabulary in the direction of future needs
2.0 Learn various grammatical structures
3.0 Read and comprehend English and understand the details and draw inferences
4.0 Learn to be competent in various forms of written communication (writing composition and data interpretation)
5.0 Practice spoken communication suited to various situations

1.0 Extend their vocabulary in the direction of their future needs
1.1 Locate words, learn spellings, understand meanings
1.2 Pronounce words intelligibly

1.3 Find synonyms and antonyms
1.4 Use affixation
1.5 Comprehend meanings of words by understanding meanings of roots

2.0 Learn various grammatical structures

2.1 Identify and use nouns
2.2 Identify and use pronouns
2.3 Use the present tense
2.4 Use the past tense
2.5 Use the future tense
2.6 Identify and use adjectives
2.7 Identify and use adverbs
2.8 Use prepositions
2.9 Use linkers
2.10 State basic sentence structures
2.11 Construct different types of sentences
2.12 Frame questions to elicit information
2.13 Frame questions for confirmation
2.14 Use active voice
2.15 Use passive voice
2.16 Use direct speech
2.17 Use indirect speech
2.18 Identify and correct errors

3.0 Read and comprehend English

3.1 Identify the main ideas
3.2 Identify the specific details
3.3 Draw inferences
3.4 Give contextual meanings of the words
3.5 Perceive tone in a text

4.0 Learn to excel in various forms of written communication (writing composition and data interpretation)

4.1 Identify components of a good paragraph
4.2 Write types of paragraphs
4.3 Distinguish between formal and informal letters
4.4 Write personal letters
4.5 Write leave letters
4.6 Write official letters
4.7 Write letters of complaints
4.8 Prepare a resume
4.9 Write a cover letter
4.10 Write short messages
4.11 Report incidents
4.12 Report experiments
4.13 Report Industrial visits
4.14 Write work done statements
4.15 Write maintenance reports
4.16 Make notes using Cue method and Mapping method
4.17 Summarize Paragraphs
4.18 Present and Interpret Data from flow charts, tree diagrams, bar graphs, tables, pie charts

Practice spoken communication suited to various situations.

4.19 Use appropriate expressions to greet and take leave
4.20 Use proper expressions to make requests
4.21 Use apt expressions for asking and giving directions
4.22 Use suitable expressions to seek and offer suggestions
4.23 Use suitable expressions to state intentions
4.24 Use suitable expressions to state feelings
4.25 Use appropriate expressions to state agreement and disagreement
4.26 Use proper expressions to make complaints
4.27 Use suitable expressions to express obligations

Course Material

The textbook prepared by the faculty of English of Polytechnics in AP.

Reference Books

1. Essential English Grammar (Intermediate Level) Raymond Murphy
2. Learn English (A Fun Book of Functional Language, Grammar and Vocabulary) Santanu Sinha Chaudhuri
3. Grammar Builder (Entire Series) Oxford University Press
4. High School English Grammar (Revised Edition) Wren and Martin
5. Sentence skills with Readings (fourth Edition, Tata McGraw Hill) John Langan, Paul Langan
6. Word Power Made Easy Norman Lewis
7. Spoken English Shashi Kumar and Dhamija

Engineering Mathematics - I

(Common to all Branches)

Subject Title : **Engineering Mathematics - I**

Subject Code : **Common- 102**

Periods per Week : **5**

Periods per Year : **150**

Time Schedule

S. No	Major Topic	No of Periods		Weightage of Marks	Short Type			Essay Type		
	Unit - I : Algebra	**Theory**	**Practice**		**R**	**U**	**App**	**R**	**U**	**App**
1	Logarithms	3	0	0	0	0	0	0	0	0
2	Partial Fractions	5	0	3	0	1	0	0	0	0
3	Matrices and Determinants	10	10	16	2	0	0	0	0	1
	Unit - II : Trigonometry									
4	Trigonometric Ratios	2	0	0	0	0	0	0	0	0
5	Compound Angles	3	2	3	1	0	0	0	0	0
6	Multiple and Submultiple angles	4	4	3	0	1	0	0	0	0
7	Transformations	4	4	5	0	0	0	1/2	0	0
8	Inverse Trigonometric Functions	3	2	5	0	0	0	0	1/2	0
9	Trigonometric Equations	3	2	5	0	0	0	1/2	0	0
10	Properties and solutions of triangles	4	4	5	0	0	0	0	0	1/2
11	Hyperbolic Functions	2	0	0	0	0	0	0	0	0
12	Complex Numbers	4	2	3	1	0	0	0	0	0
	Unit III : Co-ordinate									

	Geometry									
13	Straight Lines	5	3	6	1	1	0	0	0	0
14	Circle	4	2	5	0	0	0	0	1/2	0
15	Conic Sections	4	3	5	0	0	0	0	1/2	0
	Unit – IV : Differential Calculus									
16	Limits and Continuity	4	2	3	0	1	0	0	0	0
17	Differentiation	18	10	23	1	0	0	1	1	0
S. No	**Major Topic**	**No of Periods**		**Weightage of Marks**	**Short Type**			**Essay Type**		
	Unit - V : Applications of Differentiation	**Theory**	**Practice**		**R**	**U**	**App**	**R**	**U**	**App**
18	Geometrical Applications	3	2	5	0	0	0	0	0	1/2
19	Physical Applications	2	2	5	0	0	0	0	0	1/2
20	Maxima and Minima	3	4	5	0	0	0	0	0	1/2
21	Errors and Approximations	2	0	5	0	0	0	0	0	1/2
	Total	92	58	110	6	4	0	2	2 1/2	3 1/2
				Marks	18	12	0	20	25	35

R: Remembering type 38 marks
U: Understanding type 37 marks
App: Application type 35 marks

ENGINEERING MATHEMATICS – I

COMMON TO ALL BRANCHES – 102

Objectives

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

UNIT – I

Algebra

1.0 Use Logarithms in engineering calculations

1.1 Define logarithm and list its properties.

1.2 Distinguish natural logarithms and common logarithms.

1.3 Explain the meaning of e and exponential function.

1.4 State logarithm as a function and its graphical representation.

1.5 Use the logarithms in engineering calculations.

2.0 Resolve Rational Fraction into sum of Partial Fractions in engineering problems

2.1 Define the following fractions of polynomials:

1. Rational,
2. Proper and
3. Improper

2.2 Explain the procedure of resolving rational fractions of the type mentioned below into partial fractions

$$i)\quad \frac{f(x)}{(x+a)(x+b)(x+c)} \qquad ii)\quad \frac{f(x)}{(x+a)^2(x+b)(x+c)}$$

$$iii)\quad \frac{f(x)}{(x^2+a)(x+b)} \qquad iv)\quad \frac{f(x)}{(x+a)(x^2+b)^2}$$

3.0 Use Matrices for solving engineering problems

3.1 Define a matrix and order of a matrix.

3.2 State various types of matrices with examples (upto 3rd order square matrices).

3.3 Compute sum, scalar multiplication and product of matrices.

3.4 Illustrate the properties of these operations such as associative, distributive, commutative properties with examples and counter examples.

3.5 Define the transpose of a matrix and write its properties.

3.6 Define symmetric and skew-symmetric matrices.

3.7 Resolve a square matrix into a sum of symmetric and skew- symmetric matrices with examples in all cases.

3.8 Define minor, co-factor of an element of 2X2 and 3x3 square matrices with examples.

3.9 Expand the determinant of a 3 x 3 matrix using Laplace expansion formula.

3.10 Distinguish singular and non-singular matrices.

3.11 State properties of determinants with simple examples.

3.12 Define multiplicative inverse of a matrix and list properties of adjoint and inverse.

3.13 Compute adjoint and multiplicative inverse of a square matrix.

3.14 Representation of system of linear equations (2 variables in 2 equations and 3 variables in 3 equations) in matrix form.

3.15 Solve system of linear equations using Cramer's rule.

3.16 Solve system of linear equations by matrix inversion method

3.17 State elementary row operations.

3.18 Solve a system of linear equations by Gauss- Jordan method

UNIT – II

Trigonometry :

4.0 Understand Trigonometric Ratios

4.1 Define trigonometric ratios of any angle.

4.2 List the values of trigonometric ratios at specified values.

4.3 Draw graphs of trigonometric functions

4.4 Explain periodicity of trigonometric functions.

5.0 Solve simple problems on Compound Angles

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

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

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

5.4 Solve simple problems on compound angles.

6.0 Solve problems using the formulae for Multiple and Sub- multiple Angles

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

6.2 Derive useful allied formulas like $\sin A = (1 - \cos 2A)/2$ etc.,

6.3 Solve simple problems using the above formulae

7.0 Apply Transformations for solving the problems in Trigonometry

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

8.0 Use Inverse Trigonometric Functions for solving engineering problems

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

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

8.3 Derive relations between inverse trigonometric functions so that given A= $\sin^{-1}x$, express angle A in terms of other inverse trigonometric functions - with examples.

8.4 State various properties of inverse trigonometric functions and identities like $\sin^{-1}x+\cos^{-1}x = \frac{\pi}{2}$ etc.

8.5 Derive formulae like $\tan^{-1}x + \tan^{-1}y = \tan^{-1}\left(\frac{x+y}{1-xy}\right), \quad where \ x \geq 0, y \geq 0, xy < 1$ etc., and solve simple problems.

9.0 Solve Trigonometric Equations in engineering applications

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

9.2 Solve models of the type $a \sin^2 x + b \sin x + c=0$, $a \cos x + b \sin x=c$ etc., and problems using simple transformations.

10.0 Appreciate Properties of triangles and their solutions

10.1 State sine rule, cosine rule, tangent rule and projection rule.

10.2 Explain the formulae for sin A/2, cos A/2, tan A/2 and cot A/2 in terms of semi-perimeter and sides a, b, c .

10.3 List various formulae for the area of a triangle.

10.4 Solve problems using the above formulae.

10.5 Solve a triangle when (i) three sides, (ii) two sides and an included angle, (iii) two sides and an opposite angle-case of two solutions and (iv) one side and two angles are given.

11.0 Represent the Hyperbolic Functions in terms of logarithm functions

11.1 Define Sinh x, cosh x and tanh x and list the hyperbolic identities.

11.2 Represent inverse hyperbolic functions in terms of logarithms.

12.0 Represent Complex numbers in various forms

12.1 Define complex number, its modulus , conjugate and list their properties.

12.2 Define the operations on complex numbers with examples.

12.3 Define amplitude of a complex number

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

12.5 State DeMoivre's theorem and its applications to complex numbers e.g., finding the roots, powers, simplifications of a complex number with illustrative examples

UNIT - III

Coordinate Geometry

13.0 Solve the problems on Straight lines

13.1 Write the different forms of a straight line – point slope form, two point form, intercept form, normal form and general form

13.2 Solve simple problems on the above forms

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

14.0 Solve the problems on Circles

14.1 Define locus of a point – circle and its equation.

14.2 Find the equation of a circle given

(i) Center and radius

(ii) Two ends of a diameter

(iii) Centre and a point on the circumference

(iv) Three non collinear points

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

15.0 Appreciate the properties of Conics in engineering applications

15.1 Define a conic section.

15.2 Explain the terms focus, directrix, eccentricity, axes and latus rectum of a conic with illustrations.

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

15.4 Describe the properties of Parabola, Ellipse and Hyperbola in standard form.

UNIT - IV

Differential Calculus

16.0 Use the concepts of Limit and Continuity for solving the problems

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

16.2 Mention the Standard limits $\lim_{x \to a} \frac{x^n - a^n}{x - a}$, $\lim_{x \to 0} \frac{\sin x}{x}$, $\lim_{x \to 0} \frac{\tan x}{x}$, $\lim_{x \to 0} \frac{a^x - 1}{x}$, $\lim_{x \to 0} \frac{e^x - 1}{x}$, $\lim_{x \to 0} (1 + x)^{\frac{1}{x}}$, $\lim_{x \to \infty} \left(1 + \frac{1}{x}\right)^x$ (All without proof).

16.3 Solve the problems using the above standard limits

16.4 Evaluate the limits of the type $\lim_{x \to l} \frac{a x^2 + b x + c}{\alpha x^2 + \beta x + \gamma}$ and $\lim_{x \to \infty} \frac{f(x)}{g(x)}$

16.5 Explain the concept of continuity of a function at a point and on an interval with some examples whether a given function is continuous or not.

17.0 Appreciate Differentiation and its meaning in engineering situations

17.1 State the concept of derivative of a function y = f(x) – definition, first principle as

$\lim_{h \to 0} \frac{f(x + h) - f(x)}{h}$ and also provide standard notations to denote the derivative of a function.

17.2 State the significance of derivative in scientific and engineering applications.

17.3 Find the derivatives of elementary functions like x^n , a^x, e^x, log x, sin x, cos x, tanx, Secx, Cosecx and Cot x using the first principles.

17.4 Find the derivatives of simple functions from the first principle.

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

17.6 Explain the method of differentiation of a function of a function (Chain rule) with illustrative examples such as

(i) $\sqrt{t^2 + \frac{2}{t}}$ **(ii)** $x^2 \sin 2x$ **(iii)** $\frac{x}{\sqrt{x^2 + 1}}$ **(iv)** $\log(\sin(\cos x))$.

17.7 Find the derivatives of Inverse Trigonometric functions and examples using the Trigonometric transformations.

17.8 Explain the method of differentiation of a function with respect to another function and also differentiation of parametric functions with examples.

17.9 Find the derivatives of hyperbolic functions.

17.10 Explain the procedures for finding the derivatives of implicit function with examples.

17.11 Explain the need of taking logarithms for differentiating some functions with examples like $[f(x)]^{g(x)}$.

17.12 Explain the concept of finding the higher order derivatives of second and third order with examples.

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

17.14 Explain the definition of Homogenous function of degree n

17.15 Explain Euler's theorem for homogeneous functions with applications to simple problems.

UNIT - V

Applications of the Differentiation

18.0 Understand the Geometrical Applications of Derivatives

18.1 State the geometrical meaning of the derivative as the slope of the tangent to the curve y=f(x) at any point on the curve.

18.2 Explain the concept of derivative to find the slope of tangent and to find the equation of tangent and normal to the curve y=f(x) at any point on it.

18.3 Find the lengths of tangent, normal, sub-tangent and sub normal at any point on the curve y=f(x).

18.4 Explain the concept of angle between two curves and procedure for finding the angle between two given curves with illustrative examples.

19.0 Understand the Physical Applications of Derivatives

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

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

20.0 Use Derivatives to find extreme values of functions

20.1 Define the concept of increasing and decreasing functions.

20.2 Explain the conditions to find points where the given function is increasing or decreasing with illustrative examples.

20.3 Explain the procedure to find the extreme values (maxima or minima) of a function of single variable - simple problems yielding maxima and minima.

20.4 Solve problems on maxima and minima in applications like finding areas, volumes, etc.

21.0 Use Derivatives to find Errors and Approximations

21.1 Find the absolute error, approximate error, relative error and percentage error in functions of single variable.

COURSE CONTENT

Unit-I

Algebra

1. Logarithms :

Definition of logarithm and its properties, natural and common logarithms; the meaning of e and exponential function, logarithm as a function and its graphical representation.

2. Partial Fractions :

Rational, proper and improper fractions of polynomials. Resolving rational fractions in to their partial fractions covering the types mentioned below:

$i)\quad \frac{f(x)}{(x+a)(x+b)(x+c)}$ $\qquad ii)\quad \frac{f(x)}{(x+a)^2(x+b)(x+c)}$

$iii)\quad \frac{f(x)}{(x^2+a)(x+b)}$ $\qquad iv)\quad \frac{f(x)}{(x+a)(x^2+b)^2}$

Matrices:

3. Definition of matrix, types of matrices-examples, algebra of matrices-equality of two matrices, sum, scalar multiplication and product of matrices. Transpose of a matrix-Symmetric, skew symmetric matrices-Minor, cofactor of an element-Determinant of a square matrix-Laplace's expansion, properties of determinants. Singular and non singular matrices-Adjoint and multiplicative inverse of a square matrix-examples-System of linear equations in 2 or 3 variables-Solutions by Cramer's rule, Matrix inversion method-examples-Elementary row operations on matrices -Gauss-Jordan method to solve a system of equations.

Unit-II

Trigonometry :

4.Trigonometric ratios: definition of trigonometric ratios of any angle, values of trigonometric ratios at specified values, draw graphs of trigonometric functions, periodicity of trigonometric functions.

5. Compound angles: Formulas of sin(A±B), cos(A±B), tan(A±B),cot(A±B),and related identities with problems.

6. Multiple and sub multiple angles: trigonometric ratios of multiple angles 2A,3A and submultiple angle A/2 with problems.

7. Transformations of products into sums or differences and vice versa simple problems

8. Inverse trigonometric functions : definition, domains and ranges-basic properties- problems.

9. Trigonometric equations: concept of a solution, principal value and general solution of trigonometric equations :

sin x =k , cos x= k, tan x =k.

Solutions of simple quadratic equations, equations involving usage of transformations- problems.

10. Properties and solutions of triangles: relation between sides and angles of a triangle- sine rule, cosine rule, tangent rule and projection rule-area of a triangle- solving a triangle- problems.
11. Hyperbolic functions: Definitions of hyperbolic functions, identities of hyperbolic functions, inverse hyperbolic functions and expression of inverse hyperbolic functions in terms of logarithms.
12. Complex Numbers: Definition of a complex number, Modulus and conjugate of a complex number, Arithmetic operations on complex numbers, Modulus- Amplitude (polar) form, Exponential form (Euler) form of a complex number- Problems. DeMoivre's Theorem and its applications in complex numbers- Simple problems.

UNIT-III

Coordinate geometry

13. Straight lines: various forms of straight lines, angle between lines, perpendicular distance from a point, distance between parallel lines- examples.
14. Circle: locus of a point, Circle definition-Circle equation given (i) center and radius, (ii) two ends of a diameter (iii) centre and a point on the circumference (iv) three non collinear points - general equation of a circle - finding center, radius.
15. Definition of a conic section, equation of a conic when focus directrix and eccentricity are given. Properties of parabola, ellipse and hyperbola, standard forms.

UNIT-IV

Differential Calculus

16. Concept of Limit- Definition- Properties of Limits and Standard Limits -Simple Problems-Continuity of a function at a point- Simple Examples only.
17. Concept of derivative- definition (first principle) - different notations-derivatives of elementary functions - problems. Derivatives of sum, product, quotient, scalar multiplication of functions - problems. Chain rule, derivatives of inverse trigonometric functions, derivative of a function with respect to another function, derivative of parametric functions, derivative of hyperbolic, implicit functions, logarithmic differentiation – problems in each case. Higher order derivatives - examples – functions of several variables – partial differentiation, Euler's theorem-simple problems.

UNIT-V

Applications of Derivatives:

18. Geometrical meaning of the derivative, equations of Tangent and normal to a curve at any point. Lengths of tangent, normal, sub tangent and subnormal to the curve at any point. Angle between the curves - problems.
19. Physical applications of the derivative – velocity, acceleration, derivative as a rate Measure – Problems.
20. Applications of the derivative to find the extreme values – Increasing and decreasing functions, finding the maxima and minima of simple functions - problems leading to applications of maxima and minima.
21. Applications of derivative in finding errors and approximations of functions and simple problems.

Reference Books :

1. A text book of matrices by Shanti Narayan,
2. Plane Trigonometry, by S.L Loney
3. Co-ordinate Geometry, by S.L Loney
4. Thomas Calculus, Pearson Addison-Wesley publishers
5. Calculus – I, by Shanti Narayan and Manicavachgam Pillai, S.V Publications

ENGINEERING PHYSICS

Subject Title : **Engineering Physics**
Subject Code : **Common -103**
Periods per week : **04**
Total periods per year : **120**

TIME SCHEDULE

S.No	Major Topics	No. of Periods	Weightage of Marks	Short Answer Type	Essay Type
1.	Units and Dimensions	08	03	1	-
2.	Elements of Vectors	12	13	1	1
3.	Kinematics	14	13	1	1
4.	Friction	08	10	-	1
5.	Work, Power and Energy	12	10	-	1
6.	Simple Harmonic Motion	12	13	1	1
7.	Heat & Thermodynamics	12	13	1	1
8.	Sound	12	13	1	1
9.	Properties of matter	10	06	2	-
10.	Electricity & magnetism	12	13	1	1
11.	Modern Physics	08	03	1	-
	Total:	**120**	**110**	**10**	**8**

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Understand the concept of Units and dimensions

1.1 Explain the concept of Units
1.2 Define the terms
a) Physical quantity, b) Fundamental physical quantities and
c) Derived physical quantities
1.3 Define unit
1.4 Define fundamental units and derived units
1.5 State SI units with symbols
1.6 State Multiples and submultiples in SI system
1.7 State Rules of writing S.I. units
1.8 State advantages of SI units
1.9 Define Dimensions
1.10 Write Dimensional formulae
1.11 Derive dimensional formulae of physical quantities
1.12 List dimensional constants and dimensionless quantities
1.13 State the principle of Homogeneity of Dimensions
1.14 State the applications of Dimensional analysis
1.15 State the limitations of dimensional analysis
1.16 Solve problems

2.0 Understand the concept of Elements of Vectors

2.1 Explain the concept of Vectors
2.2 Define Scalar and Vector quantities
2.3 Give examples for scalar and vector quantities
2.4 Represent vectors graphically

2.5 Classify the Vectors
2.6 Resolve the vectors
2.7 Determine the Resultant of a vector by component method
2.8 Represent a vector in space using unit vectors (I, j, k)
2.9 State triangle law of addition of vectors
2.10 State parallelogram law of addition of vectors
2.11 Illustrate parallelogram law of vectors in case of flying bird and sling.
2.12 Derive expression for magnitude and direction of resultant of two vectors
2.13 State polygon law of addition of vectors
2.14 Explain subtraction of vectors
2.15 Define Dot product of two vectors with examples (Work done, Power)
2.16 Mention the properties of Dot product
2.17 Define Cross products of two vectors with examples (Torque, Linear velocity)
2.18 Mention the properties of Cross product.
2.19 Solve the related numerical problems

3.0 Understand the concept of Kinematics

3.1 Write the equations of motion in a straight line
3.2 Explain the acceleration due to gravity
3.3 Derive expressions for vertical motion
a) Maximum Height, b) time of ascent, c) time of descent, and d) time of flight
3.4 Derive height of a tower when a body projected vertically upwards from the top of a tower.
3.5 Explain projectile motion with examples
3.6 Explain Horizontal projection
3.7 Derive an expression for the path of a projectile in horizontal projection
3.8 Explain oblique projection
3.9 Derive an expression for the path of projectile in oblique projection
3.10 Derive formulae for projectile in oblique projection
a) Maximum Height, b) time of ascent, c) time of descent, and d) time of flight
e) Horizontal Range, f) Maximum range
3.11 Solve the related numerical problems

4.0 Understand the concept of Friction

4.1 Define friction
4.2 Classify the types of friction and define
4.3 Explain the concept of Normal reaction
4.4 State the laws of friction
4.5 Define coefficients of friction
4.6 Explain the Angle of friction
4.7 Derive an expression for acceleration of a body on a rough horizontal surface
4.8 Derive an expression for the displacement and time taken to come to rest over a rough horizontal surface
4.9 Define Angle of repose
4.10 Derive expressions for acceleration of a body on a smooth inclined plane (up and down)
4.11 Derive expressions for acceleration of a body on a rough inclined plane (up and down)
4.12 List the Advantages and Disadvantages of friction
4.13 Mention the methods of minimizing friction
4.14 Solve the related numerical problems

5.0 Understand the concepts of Work, Power, and Energy

5.1 Define the terms 1. Work, 2. Power and Energy
5.2 State SI units and dimensional formulae for 1. Work, 2. Power, and Energy
5.3 Define potential energy and state examples
5.4 Derive the expression for Potential energy
5.5 Define kinetic energy and state examples
5.6 Derive the expression for kinetic energy
5.7 State and derive Work- Energy theorem
5.8 Derive the relation between Kinetic energy and momentum
5.9 State the law of conservation of energy and mention examples
5.10 Verify the law of conservation of energy in the cases of a freely falling body and vertically projected body in the upward direction
5.11 Solve the related numerical problems

6.0 Understand the concept of Simple harmonic motion

6.1 Define Simple harmonic motion
6.2 Give examples for Simple harmonic motion
6.3 State the conditions of Simple harmonic motion
6.4 Explanation of SHM in terms of projection of circular motion on any one of the diameters of the circular path
6.5 Derive expression for displacement
6.6 Derive expression for velocity
6.7 Derive expression for acceleration
6.8 Derive expression for Time period and frequency of S H M
6.9 Define phase of S H M and explain from the expression of displacement
6.10 Define Ideal simple pendulum and derive expression for Time period of simple pendulum
6.11 State the laws of motion of simple pendulum and mention formulae
6.12 Solve the related numerical problems

7.0 Understand the concept of Heat and thermodynamics

7.1 Explain the concept of expansion of gases
7.2 State and explain Boyle's law and also express it in terms of density
7.3 Define absolute zero temperature
7.4 Explain absolute scale of temperature
7.5 State Charles laws in terms of absolute temperature and explain
7.6 Define ideal gas and distinguish from real gas
7.7 Derive Ideal gas equation
7.8 Define Specific gas constant and Universal gas constant
7.9 Explain why universal gas constant is same for all gases
7.10 State SI unit and dimensional formula of universal gas constant
7.11 Calculate the value of universal gas constant
7.12 State the gas equation in different forms (as a function of density and mass)
7.13 Distinguish between r and R
7.14 State and Explain Isothermal process
7.15 State and Explain adiabatic process
7.16 Distinguish between isothermal and adiabatic processes
7.17 State first and second laws of thermodynamics and state applications
7.18 Define specific heats & molar specific heats of a gas and differentiate them
7.19 Derive the relation $C_p - C_v = R$ (Mayer's Equation)
7.20 Solve the relavent numerical problems

8.0 Understand the concept of Sound

8.1 Define the term sound
8.2 Explain longitudinal and transverse wave motion and state differences
8.3 Distinguish between musical sound and noise
8.4 Explain noise pollution and state SI unit for intensity level of sound
8.5 Explain causes of noise pollution
8.6 Explain effects of noise pollution
8.7 Explain methods of minimizing noise pollution
8.8 Explain the phenomenon of beats
8.9 State the applications of beats
8.10 Define Doppler effect
8.11 List the Applications of Doppler effect
8.12 Define reverberation and reverberation time
8.13 Write Sabine's formula and name the parameters contained
8.14 Define and Explain echoes and also state its applications
8.15 State conditions of good auditorium
8.16 Solve the related numerical problems

9.0 Understand the properties of matter

9.1 Define the term Elasticity
9.2 Define the terms stress and strain and also define different types of stress and strain
9.3 State the units and dimensional formulae for stress and strain
9.4 State and explain Hooke's law
9.5 Define surface tension and state examples
9.6 Explain Surface tension with reference to molecular theory
9.7 Define angle of contact
9.8 Define capillarity
9.9 Write the formula for surface tension based on capillarity and name the parameters
9.10 Explain the concept of Viscosity
9.11 Mention examples of Viscosity
9.12 State Newton's formula for viscous force and explain
9.13 Define co-efficient of viscosity and write its units and dimensional formula
9.14 Explain the effect of temperature on viscosity of liquids and gases
9.15 State Poiseulle's equation for Co-efficient of viscosity and name the physical quantities involved
9.16 Solve the related numerical problems

10.0 Understand the concept of Electricity and Magnetism

10.1 Explain the concept of Electricity
10.2 State Ohm's law and write the formula
10.3 Explain Ohm's law
10.4 Define specific resistance, conductance and state their units
10.5 State Kichoff's laws
10.6 Explain Kichoff's laws
10.7 Describe Wheatstone's bridge with legible sketch
10.8 Derive an expression for balancing condition of Wheatstone's bridge
10.9 Describe Meter Bridge experiment for the determination of resistivity with a neat circuit diagram
10.10 Write the formula in Meter Bridge to determine specific resistance
10.11 Explain the concept of magnetism
10.12 State the Coulomb's inverse square law of magnetism
10.13 Define magnetic field and magnetic lines of force and write the properties of magnetic lines of force

10.14 State the Magnetic induction field strength and mention its units and dimensionsal formula
10.15 Derive an expression for the moment of couple on a bar magnet placed in a uniform magnetic field
10.16 Derive Magnetic induction field strength at a point on the axial line
10.17 Derive Magnetic induction field strength at a point on the equatorial line
10.18 Solve the related numerical problems

11.0 Understand the concept of Modern physics

11.1 State and Explain Photo-electric effect
11.2 Write Einstein's photoelectric equation and explain
11.3 State laws of photoelectric effect
11.4 Explain the Working of photoelectric cell
11.5 List the Applications of photoelectric effect
11.6 Recapitulate refraction of light and its laws
11.7 Define critical angle
11.8 Explain the Total Internal Reflection
11.9 Explain the principle and working of Optical Fiber
11.10 Mention types of optical fibbers
11.11 List the applications of Optical Fiber
11.12 Define super conductor and superconductivity and mention examples for superconductors
11.13 State the properties of superconducting materials
11.14 List the applications of superconductors

COURSE CONTENT

1. Units and Dimensions:

Introduction – Physical quantity – Fundamental and Derived quantities – Fundamental and Derived units- SI units –Multiples and Sub multiples – Rules for writing S.I. units-Advantages of SI units – Dimensions and Dimensional formulae- Dimensional constants and Dimensionless quantities- Principle of Homogeneity- Advantages and limitations of Dimensional analysis- - Problems.

2. Elements of Vectors:

Scalars and Vectors –Types of vectors(Proper Vector, Null Vector, Unit Vector, Equal , Negative Vector, Like Vectors, Co-Initial Vectors, Co-planar Vectors and Position Vector).Addition of vectors- Representation of vectors- Resolution of vectors - Parallelogram, Triangle and Polygon laws of vectors–Subtraction of vectors- Dot and Cross products of vectors-Problems

3. Kinematics

Introduction- Concept of acceleration due to gravity- Equations of motion for a freely falling body and for a body thrown up vertically- Projectiles- Horizontal and Oblique projections- Expressions for maximum height, time of flight, range - problems

4. Friction:

Introduction to friction- Causes- Types of friction- Laws of friction- Angle of repose-Angle of friction— Motion of a body over a horizontal surface- smooth inclined plane- rough inclined plane- Advantages and disadvantages of friction- Methods of reducing friction – Problems

5. Work, Power and Energy:

Work, Power and Energy- Definitions and explanation- potential energy- kinetic energy-Derivations of Potential and Kinetic energies-K.E and Momentum relation - Work-Energy theorem- Law of Conservation of energy- Problems

6. Simple Harmonic Motion:

Introduction- Conditions of SHM- Definition- Examples- Expressions for displacement, velocity, acceleration, Time period, frequency and phase in SHM- Time period of a simple pendulum- Laws of simple pendulum-seconds pendulum- Problems

7. Heat and Thermodynamics:

Expansion of Gases- Boyle's law- Absolute scale of temperature- Charles laws- Ideal gas equation- Universal gas constant- Differences between r and R- Isothermal and adiabatic processes- Laws of thermodynamics- Specific heats - molar specific heats of a gas –Derivation of Mayer's Equation- Problems

8. Sound:

Sound- Nature of sound- Types of wave motion -musical sound and noise- Noise pollution – Causes & effects- Methods of reducing noise pollution- Beats- Doppler effect- Echo- Reverberation-Reverberation time-Sabine 's formula-Conditions of good auditorium- Problems

9. **Properties of matter**

Definition of Elasticity –Definition of stress and strain -the units and dimensional formulae for stress and strain-The Hooke's law- Definition of surface tension-Explanation of Surface tension with reference to molecular theory - Definition of angle of contact - Definition of capillarity -The formula for surface tension based on capillarity - Explanation of concept of Viscosity - Examples for surface tension and Viscosity - Newton's formula for viscous force- Definition of co-efficient of viscosity- The effect of temperature on viscosity of liquids and gases - Poiseuille's equation for Co-efficient of viscosity- The related numerical problems

10. Electricity & Magnetism:

Ohm's law and explanation- Specific resistance- Kirchoff 's laws- Wheatstone's bridge - Meter bridge- Coulomb's inverse square law magnetic field- magnetic lines of force-Magnetic induction field strength- magnetic induction field strength at a point on the axial line - magnetic induction field strength at a point on the equatorial line –problems.

11. Modern Physics;

Photoelectric effect –Einstein's photoelectric equation-laws of photoelectric effect - photoelectric cell –Applications of photo electric effect- Total internal reflection- fiber optics- -principle and working of an optical fiber-types of optical fibers - Applications of optical fibers- superconductivity - applications

REFERENCE BOOKS

1. Intermediate physics Volume-I & 2 — Telugu Academy (English version)
2. Unified physics Volume 1,2,3 and 4 — Dr.S.L Guptha and Sanjeev Guptha
3. Text book of physics Volume I — Resnick & Holiday
4. Text book of applied physics — Dhanpath Roy
5. Fibre optics — D.A Hill
6. NCERT Text Books ---------- XI & XII Standard

Blue Print for setting question paper at different levels

S.No	Major Topics	No. of Periods	Weightage of Marks	Short answer type			Essay type		
				K	U	A	K	U	A
1.	Units and Dimensions	08	03	1	0	0	0	0	0
2.	Elements of Vectors	12	13	0	0	1	0	1	0
3.	Kinematics	14	13	0	1	0	1	0	0
4.	Friction	08	10	0	0	0	0	1	0
5.	Work, Power and Energy	12	10	0	0	0	0	1	0
6.	Simple Harmonic Motion	12	13	0	0	1	0	1	0
7.	Heat & Thermodynamics	12	13	0	1	0	1	0	0
8.	Sound	12	13	0	1	0	0	0	1
9.	Properties of Matter	10	06	1	1	0	0	0	0
10.	Electricity & magnetism	12	13	0	1	0	0	1	0
11.	Modern Physics	08	03	1	0	0	0	0	0
	Total:	**120**	**110**	**3**	**5**	**2**	**2**	**5**	**1**

C – 16, ENGINEERINGCHEMISTRY &ENVIRONMENTALSTUDIES
(Common to all Branches)

Subject Title : Engineering Chemistry & Environmental Studies
Subject Code : Common-104
Periods per week : 04
Total periods per year : 120

Scheme of instruction and examination Time Schedule

S.No	Major topic	No of Periods	Weightage of marks	Short type (3marks)			Essay type (10 marks)			remarks
				R	U	A	R	U	A	
A. ENGINEERING CHEMISTRY										
1	Fundamentals of Chemistry	18	16	1	0	1	0	1	0	
2	Solutions	10	8	1	0	0	0	0	1/2	5 mark
3	Acids and bases	10	8	0	0	1	0	1/2	0	5 mark
4	Principles of Metallurgy	10	10	0	0	0	1	0	0	
5	Electrochemistry	14	13	0	1	0	0	0	1	
6	Corrosion	8	10	0	0	0	0	1	0	
7	Water Technology	14	13	1	0	0	1	0	0	
8	Polymers	12	13	1	0	0	1	0	0	
9	Fuels	6	3	1	0	0	0	0	0	
B. ENVIRONMENTALSTUDIES		18	16	1	1	0	0	1	0	
total		120	110	6	2	2	3	3 1/2	1 1/2	
				18	6	6	30	35	15	

OBJECTIVES

Upon completion of the course the student shall be able to

A.ENGINEERINGCHEMISTRY

1.0 Understand the concept of Atomic structure

1.1 Explain the charge and mass of fundamental particles of an atom (electron, proton and neutron)

1.2 Explain the concept to f atomic number and mass number.

1.3 State the Postulates of Bohr's atomic theory and its limitations.

1.4 Explain the significance of four Quantum numbers.

1.5 Explain 1. Aufbau principle, 2 Pauli's exclusion principle 3 Hund's rule.

1.6 Define Orbital in an atom.

1.7 Draw the shapes of s,pandd - Orbitals .

1.8 Distinguish between Orbit and Orbital

1.9 Write the electronic configuration of elements up to atomic number 30

1.10 Explain the significance of chemical bonding

1.11 Explain the Postulates of Electronic theory of valency

1.12 Define the types of Chemical bonding viz., Ionic, Covalent bonds.

1.13 Explain the types of Chemical bonding viz., Ionic, Covalent bonds with examples.

1.14 Explain bond formation in NaCl and MgO.

1.15 List Properties of Ionic compounds

1.16 Explain bond formation in Hydrogen molecule, Oxygen molecule, and Nitrogen molecule using Lewis dot method.

1.17 List Properties of Covalent compounds

1.18 Distinguish between properties of ionic compounds and covalent compounds.

1.19 Structures of ionic solids-define a) Unit cell b) co-ordination number.

1.20 Structures of Unit cells of NaCl and CsCl.

1.21 Define the term. Oxidation number.

1.22 Calculate the Oxidation Number of underlined atoms in the following examples

a)$K\underline{Mn}O_4$ b) $K_2\underline{Cr}_2O_7$ c) $H\underline{N}O_3$ d) $H_2\underline{S}O_4$ e) $\underline{Cl}O_4^-$ f) $\underline{N}H_4^+$

1.23 Differentiate between Oxidation Number and Valency

2.0 Calculate Molarity and Normality of given Solution

2.1 Define the terms 1.Solution, 2.Soluteand 3.Solvent

2.2 Classify solutions based on physical state and solubility

2.3 Define mole

2.4 Problems on 'Mole concept'

2.5 Define the terms 1. Atomic weight, 2.Molecular weight and 3. Equivalent weight

2.6 Calculate Molecular weight and Equivalent weight of given Acids,($HCl, H_2SO_4 HNO_3$)Bases (NaOH, KOH, $Ca(OH)_2$) and Salts (NaCl, Na_2CO_3, $CaCO_3$)

2.7 Define 1.Molarity, 2.Normality of solutions

2.8 Solve Numerical problem son Molarity and Normality

a) calculate the Molarity or Normality if weight of solute and volume of solution are given

b) calculate the weight of solute if Molarity or normality with volume of solution are given

c) problems on dilution to convert high concentrated solutions to low concentrated solutions

3.0 Understand the concepts of Acids and bases

3.1 Explain Arrhenius theory of Acids and Bases

3.2 State the limitations of Arrhenius theory of Acids and Bases

3.3 Explain Bronsted – Lowry theory of acids bases

3.4 State the limitations of Bronsted – Lowry theory of acids bases

3.5 Explain Lewis theory of acids and bases

3.6 State the limitations of Lewis theory of acids and bases

3.7 Explain the Ionic product of water

3.8 Define pH and explain Sorens on scale

3.9 Solve the Numerical problems on pH(Strong Acids and Bases)

3.10 Define Buffer solution

3.11 Give atleast three examples for Buffer solutions

3.12 State the applications of Buffer solution

4.0 Understand the Principles of Metallurgy

4.1 List at least eight Characteristics of Metals

4.2 Distinguish between Metals and Non Metals

4.3 Define the terms 1.Mineral, 2.Ore, 3. Gangue, 4.Fluxand 5.Slag

4.4 Describe the methods of concentration of Ore; 1.Handpicking,2.Levigation, and3. Froth Floatation

4.5 Describe the methods involved in extraction of crude metal- Roasting, Calcination and Smelting.

4.6 Explain the purification of Metals by Electrolytic Refining

4.7 Define an Alloy

4.8 Write the Composition of the following alloys:1.Brass, 2. Germansilver, 3 Nichrome

4.9 List the uses of the following Alloys: 1. Brass, 2.Germansilver, 3.Nichrome

5.0 Understand the concepts of Electrochemistry

5.1 Define the terms1. Conductor, 2. Insulator, 3.Electrolyte 4.Non–electrolyte

5.2 Distinguish between metallic conduction and Electrolytic conduction

5.3 Explain electrolysis by taking example fused NaCl

5.4 Explain Faraday's laws of electrolysis

5.5 Define 1. Chemical equivalent (E) 2. Electrochemicalequivalent (e) and their relation.

5.6 Solve the Numerical problems based on Faraday's laws of electrolysis

5.7 Define Galvanic cell

5.8 Explain the construction and working of Galvanic cell

5.9 Distinguish between electrolytic cell and galvanic cell

5.10 Explain the electrode potentials and standard electrode potentials

5.11 Explain the electro chemical series and its significance

5.12 Explain the emfofa cell.

5.13 Solve the numerical problems on emfof the cell based on standard electrode potentials.

6.0 Understand the concept of Corrosion

6.1 Define the term corrosion

6.2 state the Factors influencing the rate of corrosion

6.3 Describe the formation of a)composition cell, b)stress cell ,c) concentration cell during corrosion.

6.4 Define rusting of iron and Explain the mechanism of rusting of iron.

6.5 Explain the methods of prevention of corrosion:

a)Protective coatings (anodic and cathodic coatings)

b) Cathodic protection (Sacrificial anode process and

Impressed–voltage process)

7. 0 Understand the concept of Water Technology

7.1 State the various Sources of water like Surface water and sub-surface water.

7.2 Define the terms soft water and hard water with respect to soap consumption.

7.3 Define the term hardness of water

7.4 Types of hardness of water 1.Temporary hardness 2. Permanent hardness

7.5 List the salts that causing hardness of water(with Formulae)

7.6 State the disadvantages of using hard water in industries

7.7 Define Degree of hardness, units of hardness(mg/L) or ppm.

7.8 Explain the methods of softening of hard water:a) Ion-Exchange process, b)Permutit process or zeolite process

7.9 Concept of Osmosis and Reverse Osmosis with examples .

7.10 State the applications of Reverse Osmosis.

7.11 State essential qualities of drinking water.

8.0 Understand the concepts of Polymers

8.1 Explain the concept of polymerization

8.2 Describe the methods of polymerization a) addition polymerization of Ethylene b)condensation polymerization of phenol and formaldehyde(Only flow chart i.e. without chemical equations)

8.3 Define the term plastic

8.4 Classify the plastics with examples

8.5 Distinguish between thermo and thermo setting plastics

8.6 List the Characteristics of plastics

8.7 State the advantages of plastics over traditional materials

8.8 State the disadvantages of using plastics.

8.9 Explain the methods of preparation of the following plastics:

1.Polythene, 2. PVC, 3.Teflon, 4. Polystyrene and 5. Urea formaldehyde

8.10 Explain the uses of the following plastics:

1.Polythene, 2. PVC, 3.Teflon, 4.Polystyrene and 5. Urea formaldehyde

8.11 Define the term natural rubber

8.12 write the structural formula of Natural rubber

8.13 Explain the processing of Natural rubber from latex

8.14 List the Characteristics of natural rubber

8.15 Explain the process of Vulcanization

8.16 List the Characteristics of Vulcanized rubber

8.17 Define the term Elastomer

8.18 Describe the preparation of the following synthetic rubbers a) Buna-s and b)Neo prene rubber

8.19 List the uses of the following synthetic rubbers a) Buna-s and b)Neo prene rubber

9.0 Understand the concepts of Fuels

9.1 Define the term fuel

9.2 Classify the fuels based on physical state–solid, liquid and gaseous fuels,

9.3 Classify the fuels based on occurrence-primary and secondary fuels

9.4 List the characteristics of good fuel

9.5 State the composition and uses of gaseous fuels:
a)water gas, b)producer gas, c)natural gas, d)coal gas, e)Biogas and f) acetylene

B. ENVIRONMENTALSTUDIES

1.1 Define the term environment

1.2 Explain the scope and importance of environmental studies

1.3 Segments of environment 1).Lithosphere, 2).Hydrosphere, 3).Atmosphere, 4).Biosphere,

1.4 Define the following terms 1)Pollutant, 2).Pollution, 3).Contaminant, 4)receptor, 5)sink, 6) particulates, 7)dissolved oxygen, 8)Threshold limit value, 9).BOD, and 10).COD 11) eco system .

1.5 State the renewable and non renewable energy sources with examples.

1.6 Define the terms:
1).Producers, 2).Consumers and 3).Decomposers with examples.

1.7 Explain bio diversity and threats to biodiversity

1.8 Define air pollution

1.9 Classify the air pollutants-based on origin and physical state of matter.

1.10 Explain the causes of Air pollution.

1.11 Explain the effects of air pollution on human beings, plants and animals.

1.12 State the uses of forest resources.

1.13 State the deforestation and its causes and effects.

1.14 Explain the 1.) Green house effect , 2) Ozone layer depletion and 3) Acidrain.

1.15 Explain the methods of control of Air pollution

1.16 Define Water pollution

1.17 Explain the causes of Water pollution

1.18 Explain the effects of Water pollution on living and Non-living things.

1.19 Explain the methods of control of Water pollution.

COURSE CONTENT

A. ENGINEERINGCHEMISTRY

1. Fundamentals of Chemistry

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

Chemical Bonding: Introduction – types of chemical bonds – Ionic and covalent bond with examples–Properties of Ionic and Covalent compounds- structures of ionic crystals NaCl, CsCl.

,**Oxidation Number**- calculations, differences between Oxidation Number and Valency.

2. Solutions

Introduction-concentration methods – Mole concept, Molarity, Normality, Equivalent weights, Numerical problems on Mole, Molarity and Normality.

3. Acids and Bases

Introduction – Theories of acids and bases and limitations – Arrhenius theory-Bronsted –Lowry theory – Lewis acid base theory – Ionic product of water– pH and related numerical problems–Buffer solutions–Applications.

4. Principles of Metallurgy

Characteristics of Metals and distinction between Metals and Non Metals, Metallurgy, ore, Gangue, Flux, Slag - Concentration of Ore –Hand picking, Levigation, Froth floatation – Methods of Extraction of crude Metal – Roasting, Calcination, Smelting – Alloys – Composition and uses of Brass, German silver and Nichrome

5. Electrochemistry

Conductors, insulators, electrolytes– electrolysis – Faraday's laws of electrolysis- numerical problems – Galvanic cell – standard electrode potential – electrochemical series–emf and numerical problems on emfofa cell

6. Water technology

Introduction–soft and hard water–causes of hardness–types of hardness
–dis advantages of hard water – degree of hardness (ppm) – softening methods – permut it process – ion exchange process– drinking water –Osmosis, Reverse Osmosis –Applications of Reverse osmosis

7. Introduction - factors influencing corrosion - composition, stress and concentration cells–rusting of iron and its mechanism – prevention of corrosion by coating methods, cathodic protection

8. Polymers

Introduction – polymerization – types of polymerization – addition, condensation with examples – plastics – types of plastics – advantages of plastics over traditional materials –Disadvantages of using plastics – preparationandusesofthefollowingplastics:1.Polythene 2.PVC 3.Teflon 4.Polystyrene 5. Urea formal dehyde – Rubber – Natural rubber – processing from latex –Vulcanization – Elastomers, Buna-s, Neoprene rubber and their uses.

9. Fuels

Definition and classification of fuels–characteristics of good fuel – composition and uses of gaseous fuels.

B. ENVIRONMENTALSTUDIES

Introduction– environment –scope and importance of environmental studies important terms– renewable and non-renewable energy sources–Concept of ecosystem, producers, consumers and decomposers – Biodiversity, definition and threats to Bio diversity.

Air pollution – causes-Effects– forest resources: uses and over exploitation, deforestation, acid rain, greenhouse effect –ozone depletion – control of air pollution – Water pollution – causes – effects – control measures,

REFERENCEBOOKS

1. Intermediate chemistry Vol 1&2 Telugu Academy
2. Intermediate chemistry Vol 1&2 Vikram Publishers
3. Intermediate chemistry Vol 1&2 Vignan Publishers &Deepthi Publishers
4. Engineering Chemistry Jain & Jain
5. Engineering Chemistry O.P. Agarwal, Hi-Tech.
6. Engineering Chemistry Sharma
7. Engineering Chemistry A.K. De

Electrical Engineering Materials

Subject Title : Electrical Engineering Materials

Subject Code : EE-105

Periods/Week : 03

Periods/Year : 90

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage	Short questions	Essay questions
1.	Conducting Materials	18	26	02	02
2.	Semiconducting Materials	09	8	01	1/2
3.	Insulating Materials	15	16	02	01
4.	Di- electric Materials	9	8	01	1/2
5.	Magnetic Materials	10	13	01	1
6.	Special Purpose Materials	11	13	01	1
7.	Batteries	18	26	02	02
	Total	90	110	10	08

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Comprehend the Conducting Materials

1.1 Define Conducting Materials

1.2 State the properties of conducting materials

1.3 Define the terms (i) Hardening (ii) Annealing

1.4 Explain the effects of Hardening and Annealing on copper with regard to Electrical and Mechanical properties

1.5 State the main requirements of Low Resistivity Materials

1.6 List some examples of i)Low Resistivity Materials

ii)High Resistivity materials

1.7 Mention the Properties & Applications of Copper and Aluminium

1.8 Distinguish between Copper and Aluminum

1.9 Mention the properties & applications of ACSR Conductors and AAAC.

1.10 State the requirements of High Resistive Materials

1.11 State the types of High Resistive Materials

1.12 List the properties & Applications of High Resistive Materials

i) Manganin ii) Eureka
iii) Constantan iv) Nichrome

v) Tungsten vi) Platinum

vii) Mercury viii) Carbon

1.13 List the color codes of resistors as per BIS

2.0 Understand the Semiconducting Materials

2.1 Define Semiconducting materials

2.2 Understand Semiconducting materials

2.3 Classify Semiconducting materials

2.4 Define (i) Intrinsic Semiconductors and (ii)Extrinsic Semiconductors

2.5 Distinguish between Intrinsic and Extrinsic semiconductors.

2.6 Explain the formation of

(i) P type semiconductorand (ii)N type semiconductor

2.7 Distinguish between P and N type Semiconductors

3.0 Comprehend the Insulating Materials

3.1 Define Insulating Materials

3.2 Draw energy level diagrams of conductors, insulators and semi-Conductors

3.3 Distinguish between Conductors, Insulators and Semiconductors

3.4 State the important electrical properties of Insulating materials

(i) Insulation resistance (ii) Volume (iii)Surface resistance

3.5 Explain factors affecting insulation resistance

3.6 Classify Insulating materials on the basis of temperature

i.e., (Y, A, E, B, F, H and C class)

3.7 Classify insulating materials

3.8 State the properties of (i) Impregnated paper (ii)Wood

(iii)Cardboard (iv)Asbestos (v)Mica (vi)Ceramics (vii)Glass.

3.9 List the applications of the above insulating materials

3.10 Explain Thermoplastic & Thermosetting resins with examples

3.11 Explain the properties of PVC

3.12 List the applications of PVC

3.13 State the effects of the following on P.V.C.

(i) Filler (ii) Stabilizer (iii) Plasticizer (iv) Additives.

3.14 State the Properties of the following gases

(i) Air (ii) Nitrogen (iii) Hydrogen (iv) Sulphur – Hexafluoride (SF_6)

3.15 List the applications of the following gases

i) Air (ii) Nitrogen (iii) Hydrogen (iv) Sulphur – Hexafluoride (SF_6)

4.0 Understand the Di- electric materials

4.1 Know the Permittivity of commonly used di - electric materials

i)	Air	ii)	Bakelite
iii)	Glass	iv)	Mica
v)	Paper	vi)	Porcelain
vii)	Transformer oil		

4.2 Explain Polarization

4.3 Explain Di-electric Loss

4.4 List any four applications of Di-electrics

4.5 List the color codes of capacitors as per BIS

5.0 Comprehend the Magnetic Materials

5.1 Classify the Magnetic Material as

(i) Ferro (ii) Para (iii) Dia-Magnetic materials with examples

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

5.3 Draw (i) B-H. Curve (ii)Hysteresis loop

5.4 Explain Hysteresis loop

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

5.6 Explain Eddy Current Losses

5.7 State Curie point

5.8 Define Magnetostriction

6.0 Understand the Special Purpose Materials

6.1 State the need for protective materials

6.2 List the various protective materials like Lead, Paints, Steel Tapes etc.

6.3 Explain the thermo couple materials

6.4 State the Bi-metals

6.5 State the soldering materials

6.6 Define fuse

6.7 State the different types of materials used for fuse

6.8 Explain the process of Galvanizing and Impregnation

6.9 State the use of Enamel coated copper wires (thin, medium and thick)

6.10 State the importance of Nano Materials

7.0 Comprehend theworking ofBatteries

7.1 Classify cells as Primary and Secondary cells

7.2 Distinguish between Primary and Secondary cells

7.3 Explain Back EMF

7.4 Explain how Back EMF is determined

7.5 Explain when it is preferred to have series and parallel connections of cells to form Battery

7.6 Give the formulae for output voltage and current when connected in
(i) Series and (ii) Parallel

7.7 Explain the significance of Internal resistance of a battery

7.8 Classify storage cells as Lead-Acid, Nickel-Iron and Nickel- Cadmium type

7.9 Explain the constructional details of Lead-Acid battery

7.10 Write chemical reactions during charging and discharging of Lead-Acid battery

7.11 List indications of fully charged Lead-Acid battery

7.12 List the precautions to be observed while maintaining Lead acid batteries

7.13 Explain parts of Nickel –Iron cells

7.14 Write chemical reactions during charging and discharging of Nickel – Iron cell

7.15 State applications of
(i) Lead-Acid battery (ii) Nickel-Iron cell (iii) Nickel-Cadmium battery

7.16 Compare Lead-Acid cell with Nickel-Iron cell

7.17 Explain charging of batteries by

(i) Constant Current method and (ii) ConstantVoltage method

7.18 State precautions to be taken during charging & discharging of batteries

7.19 Explain Trickle charging

7.20 State capacity of a battery and factors affecting capacity

7.21 State Ampere- hour efficiency and Watt- Hour efficiency of battery

7.22 Solve problems on the Ampere – Hour Efficiency and Watt – Hour Efficiency

7.23 Explain the construction and working of maintenance free battery

7.24 Differentiate between maintenance free batteries and Lead-Acid batteries

7.25 State the applications of maintenance free batteries

7.26 Explain Lithium ion batteries, Button cells (both Lithium and Silver oxide type)

7.27 Mention the common and the IEC standard codes to specify the size of the cell

COURSE CONTENTS

1. **Conducting Materials :**
   Conducting Materials – Properties -Hardening, Annealing – Its effects- Low Resistive Materials – Requirements – Properties and applications of Copper and Aluminum - Comparison between Copper and Aluminum - ACSR Conductors, AAAC, - High Resistive Materials – Requirements- Properties and applications of Manganin, Eureka, Constantan,Nichrome, Tungsten, Platinum, Mercury and Carbon- Color coding of Resistors.

2. **Semiconducting Materials**

   Semiconductors - Intrinsic and Extrinsic semiconductors- `P' and `N' type materials- Distinguish between P-type and N- type Semi Conductors.

3. **Insulating Materials**

   Properties -Insulation resistance - Factors effecting Insulation resistance - Classification of Insulating materials - Properties & Applications of Impregnated Paper, Wood, Card Board, Asbestos, Mica, Ceramic, Glass- Thermo Plastics, Thermo Setting resins – PVC- Effects on PVC

4. **Di- electric materials**

   Permittivity ofdifferent Di - electric materials- Polarization - Dielectric Loss –

   Applications of Dielectrics – Color codes of Capacitors.

5. **Magnetic Materials**

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

6. **Special Purpose Materials**

   Need of Protective materials – List of Special Purpose Materials (Lead, Paints, Steel Tapes) - Thermocouple - Bi-metals- Soldering- Fuses -Galvanizing and Impregnating - Use Enameled Coated Copper Wires- Nano Materials.

7. **Batteries**

   Primary cell and Secondary cells-Lead-Acid, Nickel-Iron and Nickel - Cadmium-Chemical reactions during charging and discharging – Charging of Batteries- Constant Current method and Constant Voltage method-Trickle charging - Capacity of Battery - Ampere-Hour efficiency and Watt-Hour efficiency - Maintenance free batteries – Button cells – IEC standard code of the cell.

REFERENCES

1 Electronic Components -Dr. K.Padmanabham
2 Electronic Components -D.V.Prasad
3 Electrical Engineering Materials – N.I T.T.T.R Publications
4 Introduction to Engineering materials – B.K.Agarwal.
5 Material science for Electrical and Electronic Engineers – Ian P.Jones (Oxford Publications)

BASIC ELECTRICAL ENGINEERING

Subject Title : Basic Electrical Engineering

Subject Code : EE-106

Periods/Week : 05

Periods/Year : 150

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage	Short questions	Essay questions
1.	Basic Principles of Electricity	35	26	02	02
2.	Work, Power and Energy	10	13	01	01
3.	Heating effects of electric Current	15	13	01	01
4.	Magnetic effects of Electric current	30	16	02	01
5.	Electromagnetic Induction	35	26	02	02
6.	Electrostatics and Capacitance	25	16	02	01
	Total	150	110	10	08

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Comprehend the Basic Principles of Electricity

1.1 Mention various sources of Electricity
1.2 List merits of Electrical Energy over other types of energy
1.3 Explain the concept of Electric Current, Potential difference, Voltage and EMF
1.4 Explain the concept of DC Current and Voltage
1.5 Explain the difference between conventional Current direction and Electron flow direction
1.6 Distinguish between Conductor, Insulator and Semiconductor with respect to Valence electrons

1.7 State Ohm's Law
1.8 Explain Ohm's Law
1.9 List the limitations of Ohms Law
1.10 Explain the concept of Resistance to flow of electrons
1.11 Define the terms i) Specific resistance ii)Conductance iii)Conductivity
1.12 Deduce the relation $R = (\rho l) / a$

1.13 Solve simple problems based on the Ohm's Law & $R = (\rho l) / a$

1.14 State the effects of Alloying on Resistivity

1.15 Explain the effects of temperature on resistance

1.16 Develop the expression for resistance at any temperature as $R_t = R_o (1+\alpha_o t)$

1.17 Define temperature Co-efficient of resistance and give its unit

1.18 Develop the formula for Co-efficient of resistance at any temperature as

$\alpha_t = \alpha_o / (1+\alpha_o t)$

1.19 Solve problems based on the formulae $R_t = R_o (1+\alpha_o t)$ & $\alpha_t = \alpha_o / (1+\alpha_o t)$

1.20 Develop the expressions for equivalent Resistance with simple SERIES connections

1.21 Develop the expressions for equivalent Resistance with simple PARALLEL connections

1.22 Solve problems on equivalent resistance in the case of Series- Parallel networks

1.23 Solve problems on division of current when two Resistors are connected in parallel

1.24 Explain the various effects of Electric Current

2.0 Explain the concept of Work, Power & Energy

2.1 Define Electric power

2.2 State the formula for Electric power and mention S.I. System of units for Work, Power and Energy

2.3 Solve problems on Work, Power and Energy in Electrical, Mechanical and Thermal units

2.4 Mention the typical power ratings of home appliances like Electric lamps(Incandescent, fluorescent, CFL & LED), Water heater, Electric Iron, Fans, Refrigerators, Air and Water coolers, Television sets, Air Conditioners, Water Pumps, Computers, Printers etc.

2.5 Calculate Electricity bill of domestic consumers as per the Electricity Tariff

3.0 Understand the Heating effects of Electric Current

3.1 State the heat produced due to flow of current

3.2 Derive the expression for conversion of Electrical Energy into equivalent Heat energy in Kilo calories (Joule's law)

3.3 Define Thermal efficiency

3.4 Solve problems on Electric heating

3.5 Explain the applications of heat produced due to Electric current in
(i) Metal Filament lamps (ii)Electric kettle (iii) Electric Cooker (iv) Electric Iron
(v) Space heater (vi) Geyser (vii) Infrared lamp.

3.6 Mention the merits of CFL and LED lamps over Incandescent lamps from power consumption point of view.

4.0 Understand the Magnetic effects of Electric Current

4.1 State Coulombs laws of Magnetism

4.2 Define the terms Absolute and Relative Permeability of medium

4.3 Give the relation between Absolute and Relative Permeability

4.4 Explain the concept of lines of force & magnetic field

4.5 State Right hand thumb rule

4.6 Draw and explain the field patterns due to

(i) Straight current carrying conductor (ii) Solenoid (iii) Toroid

4.7 Explain Work law and its applications

4.8 State Laplace law (Biot-Savart's Law)

4.9 Give expressions for field strength (No derivation)

i) Around a Straight conductor
ii) At the Centre of a circular conductor
iii) At any point on the axis of a circular conductor
iv) On the axis of a solenoid

4.10 Explain the Mechanical force on a current carrying Conductor placed inside a Magnetic field.

4.11 Derive an expression for the magnitude of the force on a current carrying conductor inside a magnetic field.

4.12 State Fleming's Left Hand Rule

4.13 Derive an expression for the force between two parallel current carrying conductors

4.14 State the nature of force with different directions of the currents

4.15 Define Ampere

4.16 Solve problems on the above

4.17 Understand the concept of the Magnetic circuit

4.18 Define MMF, Flux and Reluctance

4.19 Compare Magnetic circuit with Electric circuit

4.20 Explain the effect of air gap in a magnetic circuit

4.21 Explain the terms leakage flux and leakage co-efficient

4.22 Solve problems on simple Magnetic circuits

5.0 Explain Electro Magnetic Induction

5.1 State Faraday's laws of Electro - Magnetic Induction

5.2 Explain Dynamically and Statically induced E.M.F.

5.3 State Lenz's law

5.4 Explain Fleming's Right Hand rule

5.5 Explain the concept of Self and Mutual inductance

5.6 Derive an expression for Self and Mutual inductance

5.7 State Co-efficient of coupling

5.8 Explain the total inductance with series connections with reference to direction of flux

5.9 Develop an expression for the Energy stored in a magnetic field

5.10 Develop an expression for the Energy stored per unit volume in a magnetic field

5.11 Develop an expression for Lifting power of a magnet.

5.12 Solve problems on the above.

6.0 Comprehend Electric Charge and Electrostatic Field

6.1 State Coulomb's laws of Electrostatics and define unit charge

6.2 Define Absolute and Relative permittivity

6.3 Solve problems on the above

6.4 Explain Electrostatic field

6.5 Plot electrostatic Field due to

i) Isolated positive charge
ii) Isolated negative charge
iii) Unlike charges placed side by side
iv) Like charges placed side by side

6.6 State electric Flux, electric Flux density and Field intensity

6.7 Compare Electrostatic and Magnetic circuits

6.8 State Gauss theorem

6.9 Explain the concept of electric potential and potential difference

6.10 Explain Di-electric strength and Di-electric constant

6.11 Give the permittivity of commonly used Di-electric materials

6.12 Define Capacitance and state its unit

6.13 Derive the formula for capacitance of a parallel plate capacitor

6.14 Explain charging and discharging of a capacitor

6.15 Mention the factors affecting the capacitance of a capacitor

6.16 State different types of capacitors

6.17 Give uses of different capacitors

6.16 Explain equivalent capacitance of

i) Capacitors connected in series;
ii) Capacitors connected in parallel

6.17 Derive an expression for the Energy stored in a capacitor

6.18 Solve problems on the above

COURSE CONTENTS

1. Basic Principles of Electricity

Conductor, Insulator , Semiconductor - Electric Potential – Ohm's law – Resistance – Specific Resistance – Conductivity – Temperature coefficient of Resistance – Resistance in series, parallel and series - parallel combinations.

2. Work, Power & Energy

Units of Work, Power and Energy.– Ratings of different Domestic Appliances- Conversion of Units–Efficiency- Electricity bill of Domestic Consumer.

3. Heating Effects of Electrical Current

Mechanical Equivalent of Heat - Heat produced due to flow of Current in Metal Filament lamps, Electrical Kettle, Electric Cooker, Electric Iron, Space Heater, Geyser, Infrared lamp- Merits of CFL and LED lamps over Filament lamps.

4. Magnetic Effects of Electric Current

Lines of force - Field pattern due to long straight current carrying conductor-Field pattern of solenoid and Toroid -Work Law and its applications –Biot-Savart's Law(Laplace Law) -Field strength at centre and any point on the axis of a circular current carrying conductor- Field Strength around a straight current carrying conductor- Field strength on the axis of a solenoid-Mechanical force on a current carrying conductor placed inside a magnetic field - Direction of force - Fleming's Left Hand rule -Force between two parallel current carrying conductors – Ampere - Magnetic circuit- Magnetizing force – Permeability - Flux - Reluctance - Comparison of Magnetic circuit withElectric circuit - Magnetic leakage flux and leakage Co-efficient..

5. Electro Magnetic Induction

Faraday's laws - Dynamically and Statically induced E.M.F -Lenz's Law & Fleming's Right Hand rule -Self and Mutual inductance - Co-efficient of coupling - Inductances in series -Energy stored in a magnetic field - Energy stored per unit volume - Lifting power of magnet.

6. Electrostatics and Capacitance

Laws of Electrostatics – Coulomb - Permittivity - Electrostatic induction -Electrostatic field - Lines of force -Comparison of Electrostatic and Magnetic lines of force - Strength of electric field- Flux density -Gauss theorem - Concept of Electric potential and Potential difference –Di-electric strength – Di-electric constant - Capacitance – Charging and Discharging of Capacitor- Factors affecting the Capacitance of Capacitor –Types of Capacitors- Uses - Capacitors in Series and Parallel- Energy stored in a Capacitor.

REFERENCES

1. B.L.Theraja -Electrical Technology Vol.I- S.Chand&co.
2. T.K.Nagsarkar&M.S.Sukhija -Basic Electrical Engineering– Oxford.
3. Hughes-Electrical Technology.
4. J.B.Gupta -Electrical TechologyVol.I
5. D C Kulshreshtha.-Basic Electrical Engineering.
6. D.P.Kothari&I.J.Nagarath -Theory and Problems of Basic Electrical Engineering–PHI.
7. AbhijitChakrabarthi,Sudiptanath, Chandan Kumar Chada -Basic Electrical Engineering.
8. P S Dhogal – Basic Electrical Engineering – Volume I – TMH.

ENGINEERING DRAWING

Subject Title : Engineering Drawing

Subject Code : 107 (Common to all Branches)

Periods/Week : 06

Periods Per Year : 180

Time Schedule

Sno	Major Topics	No. of Periods	Weightage of marks	Short Answer Questions	Essay type Questions
1	Importance of Engineering Drawing	01	-	-	-
2	Engineering Drawing Instruments	05	-	-	-
3	Free hand lettering & Numbering	06	5	1	-
4	Dimensioning Practice	09	5	1	-
5	Geometrical Constructions	21	15	1	1
6	Projection of points, Lines, Planes & Solids	21	10	-	1
7	Auxiliary views	06	5	1	-
8	Sectional views	27	10	-	1
9	Orthographic Projection	33	10	-	1
10	Pictorial drawing	30	10	-	1
11	Development of surfaces	21	10	-	1
	Total	**180**	**80**	**04**	**06**

The course is aimed at developing basic graphic skills so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation

OBJECTIVES

Upon completion of the subject the student shall be able to

1) **Understand the basic concepts of Engineering Drawing**
   a) State the importance of drawing as an engineering communication medium
   b) State the necessity of B.I.S. Code of practice for Engineering Drawing
   c) Explain the linkages between Engineering drawing and other subjects of study in diploma course

2) **Use of Engineering Drawing Instruments**
   a) Select the correct instruments and draw lines of different orientation
   b) Select the correct instruments and draw small and large Circles
   c) Select the correct instruments for measuring distances on the drawing
   d) Use correct grade of pencil for different types of lines, thickness and given function
   e) Select and use appropriate scales for a given application
   f) Identify different drawing sheet sizes as per I.S. and Standard Layouts
   g) Prepare Title block as per B.I.S. Specifications
   h) Identify the steps to be taken to keep the drawing clean and tidy

3) **Write Free Hand Lettering and Numbers**
   a) Write titles using slanting letters and numerals of 7mm, 10mm and 14mm height
   b) Write titles using vertical letters and numerals of 7mm, 10mm and 14mm height
   c) Select suitable sizes of lettering for different layouts and applications

4) **Understand Dimensioning Practice**
   a) Define “Dimensioning”
   b) State the need of dimensioning the drawing according to accepted standards
   c) Identify notations of Dimensioning used in dimensioned drawing
   d) Identify the system of placement of dimensions in the given dimensioned drawing
   e) Dimension a given drawing using standard notations and desired system of dimensioning
   f) Dimension standard features applying necessary rules
   g) Arrange dimensions in a desired method for a given drawing
   h) Identify the departures if any made in the given dimensioned drawing with reference to SP-46-1988, and dimension the same correctly

5) **Apply Principles of Geometric Constructions**
   a) Divide a given line into desired number of equal parts internally
   b) Draw tangent lines and arcs
   c) Use General method to construct any polygon
   d) Explain the importance of conics
   e) Construct ellipse by concentric circles method
   f) Construct parabola by rectangle method
   g) Construct rectangular hyperbola from the given data
   h) Construct involute from the given data
   i) Construct cycloid and helix from the given data
   j) State the applications of the above constructions in engineering practice

6) **Apply Principles of Projection of points, lines, planes & solids**
   a) Visualize the objects
   b) Explain the I-angle and III-angle projections

c) Practice the I-angle projections
d) Draw the projection of a point with respect to reference planes (HP&VP)
e) Draw the projections of straight lines with respect to two reference planes (cases of lines parallel to one plane and inclined to other plane only)
f) Draw the projections of planes (cases of planes perpendicular to one plane and inclined to other plane only)
g) Draw the projections of solids (cases of axis perpendicular to one plane and inclined to other plane only)

7) Understand the need of auxiliary views
a) State the need of Auxiliary views for a given engineering drawing
b) Draw the auxiliary views of a given engineering component
c) Differentiate between auxiliary view and apparent view

8) Appreciate the need of Sectional Views
a) Explain the need to draw sectional views
b) Select the section plane for a given component to reveal maximum information
c) Explain the positions of section plane with respect to reference planes
d) Differentiate between true shape and apparent shape of section
e) Draw sectional views and true sections of regular solids discussed in chapter-6 above
f) Apply principles of hatching

9) Apply principles of orthographic projection
a) Explain the principles of orthographic projection with simple sketches
b) Draw the orthographic view of an object from its pictorial drawing
c) Draw the minimum number of views needed to represent a given object fully

10) Prepare pictorial drawings
a) State the need of pictorial drawings
b) Differentiate between isometric scale and true scale
c) Prepare Isometric views for the given orthographic drawings

11) Interpret Development of surfaces of different solids
a) State the need for preparing development drawing
b) Prepare development of simple engineering objects (cubes, prisms, cylinders, cones, pyramids) using parallel line and radial line methods
c) Prepare development of surface of engineering components like trays, funnels, 90^0 elbows & rectangular ducts

COURSE CONTENT

NOTE

1) **B.I.S Specifications should invariably be followed in all the topics.**
2) **A-3 Size Drawing Sheets are to be used for all Drawing Practice Exercises.**
3) **First Angle Projection is to be followed for all Orthographic projection exercises**

1) The importance of Engineering Drawing

Explanation of the scope and objectives of the subject of Engineering Drawing, Its importance as a graphic communication -Need for preparing drawing as per standards – SP-46–1988 – Mention B.I.S - Role of drawing in engineering education – Link between Engineering drawing and other subjects of study

2) Engineering drawing Instruments

Classification: Basic tools, tools for drawing straight lines, tools for curved lines, tools for measuring distances and special tools like mini drafter & drafting machine – Mention the names under each classification and their brief description -Scales: Recommended scales reduced & enlarged scales-Lines: Types of lines, selection of line thickness - Selection of Pencils -Sheet Sizes: A0, A1, A2, A3, A4, A5, Layout of drawing sheets in respect of A0, A1, A3 sizes, Sizes of the Title block and its contents - Care and maintenance of Drawing Sheet

Drawing Plate 1: Consisting of two exercises on use of drawing instruments

3) Free hand lettering & numbering

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

Drawing plate 2: Consisting of five to six exercises on freehand Lettering & Numbering

4) Dimensioning practice

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

Drawing Plate 3: Consisting of 8 exercises on Dimensioning methods and rules

5) Geometric Constructions

Division of a line: to divide a straight line into given number of equal parts internally and it's examples in engineering applications. Construction of tangent lines: to draw tangent lines touching circles internally and externally. Construction of tangent arcs i) To draw tangent arc of given radius to touch two lines inclined at given angle (acute, right and obtuse angles) ii) Tangent arc of given radius touching a circle or an arc and a given line iii) Tangent arcs of radius R, touching two given circles internally and externally Construction of polygon: Construction of any regular polygon of given side using general method. Conical Curves: Explanation of Ellipse, Parabola, Hyperbola, as sections of a double cone and loci of a moving point, Eccentricity of above curves – Their Engg. applications viz. Projectiles, reflectors, P-V Diagram of a Hyperbolic process - Construction of ellipse by concentric circles method - Construction of parabola by rectangle method - Construction of rectangular hyperbola - General Curves: Involute, Cycloid and Helix, explanations as locus of a moving point, their engineering applications, viz, Gear tooth profile, screw threads, springs etc. - their construction.

Drawing Plate 4: Consisting of eight exercises on construction of polygons

Drawing Plate 5: Consisting of eight exercises on construction of conics

Drawing Plate 6: Consisting of eight exercises on involute, cycloid and helix

6) Projection of points, lines, planes & solids

Projecting a point on two planes of projection -Projecting a point on three planes of projection -Projection of straight line i) Parallel to both the planes ii) Perpendicular to one of the planes iii) Inclined to one plane and parallel to other plane - Projection of regular planes- i) Plane perpendicular to HP and parallel to VP and vice versa ii) Plane perpendicular to HP and inclined to VP and vice versa - Projection of regular solids with i) Axis perpendicular to one of the planes ii) Axis parallel to VP and inclined to HP and vice versa

Drawing Plate 7: Consisting of eight exercises on projection of points and Lines

Drawing Plate 8: Consisting of eight exercises on projection of planes

Drawing Plate 9: Consisting of eight exercises on projection of solids

7) **Auxiliary views**

Need for drawing auxiliary views - Explanation of the basic principles of drawing auxiliary views, explanation of reference plane and auxiliary plane - Partial auxiliary view.

Drawing plate 10: Consisting of four exercises on auxiliary views

8) **Sectional views**

Need for drawing sectional views – what is a sectional view - Location of cutting plane – Purpose of cutting plane line – Selection of cutting plane to give maximum information (vertical and offset planes) - Hatching – Section of regular solids inclined to one plane and parallel to other plane

Drawing Plate 11: Consisting of six exercises on sections of solids

9) **Orthographic Projections**

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

Drawing Plate 12: Consisting of 12 exercises on orthographic projections of engineering objects

10) **Pictorial Drawings**

Brief description of different types of pictorial drawing viz., Isometric, oblique, and perspective and their use - Isometric drawings: Iso axis, angle between them, meaning of visual distortion in dimensions - Need for an isometric scale, difference between Isometric scale, and ordinary scale- difference between Isometric view and Isometric projection - Isometric and Non-isometric lines -Isometric drawing of common features like rectangles, circular shapes, non-isometric lines - Use of box and offset methods

Drawing plate 13: Consisting of 12 exercises on Isometric views of engineering objects

11) **Development of Surfaces**

Need for preparing development of surface with reference to sheet metal work -Concept of true length of a line with reference to its orthographic projection when the line is (i) parallel to the plane of projection (ii) inclined to one principal plane and parallel to the other - Development of simple solids like cubes, prisms, cylinders, cones, pyramids -Types of development: Parallel line and radial line development -Procedure of drawing development - drawings of trays, funnels, 90^0 elbow pipes and rectangular ducts.

Drawing plate 14: Consisting of 5 exercises on development problems

REFERENCE BOOKS

Engineering Graphics by P I Varghese – (McGraw-hill)

Engineering Drawing by Basant Agarwal & C.M Agarwal - (McGraw-hill)

Engineering Drawing by N.D.Bhatt.

T.S.M. & S.S.M on " Technical Drawing" prepared by T.T.T.I., Madras.

SP-46-1998 – Bureau of Indian Standards.

BASIC ELECTRICAL & ELECTRONICS LABORATORY

Subject Title : **Basic Electrical & Electronics Laboratory**

Subject Code : **EE-108**

Periods/Week : **06**

Periods/Year : **180**

TIME SCHEDULE

S. No.	Major Topics	No. of Periods
1.	Wiring tools and Accessories	15
2.	Electrical Wiring Joints	21
3.	Lamp Circuits	33
4.	Soldering Practice	15
5.	AC and DC circuits	21
6.	Resistance Measurement	21
7.	Capacitance Measurement	21
8.	Battery voltage measurement	15
9.	Piping and Thread cutting skills	18
	Total	180

OBJECTIVES

Upon completion of the practice the student shall be able to

1.0 Handle the Wiring Tools and Accessories

1.1 Identify the following electrical Wiring tools with respect to

i)Size ii)Shape iii)Purpose iv)Speedv) Usage

a) Screw drivers
b) Pliers
c) Drilling machines & Drilling Bits.
d) Rawl plug jumper, and poker
e) Voltage/line tester

f) Splicers (insulation remover)
g) Standard Wire gauge

1.2 Identify different types of Electrical Wiring accessories with respect to

i) Size ii) Shapeiii) Purpose iv) Use.

a) Switches
b) Ceiling roses
c) Lamp Holders and Adopters
d) Sockets
e) Plug
f) Fuses

1.3 Identify different types of main switches with respect to

i)Rating ii)Purpose iii)Use.

SP,DP mains, TP,ICDP, ICTP, SPDT, DPDT, TPDT, Changeover-Knife type/globular, Rotary, Micro, Modular switches.

1.4 Study of 2-pole and 3-pole MCB's with respect to rating, purpose anduse etc.

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

2.0 Prepare Electrical Wiring Joints

2.1 Prepare Straight joint/ Married joint

2.2 Prepare T joint

2.3 Prepare Western union joint

2.4 Prepare Pigtail joint

3.0 Practice Lamp Circuits

3.1 Make a circuit with One lamp controlled by one switch with PVC surface conduit system

3.2 Make a circuit with Two lamps controlled by two switches with PVC surface conduit system

3.3 Make a circuit with One lamp controlled by one switch and provision of 2/3-pin socket.

3.4 Make a circuit for Stair Case wiring

3.5 Make a circuit for Godown wiring

3.6 Make a circuit for Electrical bell connection.

4.0 Practice Soldering

4.1 Get familiarized to use of various soldering tools and components

4.2 Solder simple electronic circuits with P.C.B.

5.0 Demonstrate difference between AC and DC.

5.1 Demonstrate unidirectional current flow with 12 V batteries
5.2 Determine polarity using a Voltmeter /LED
5.3 Demonstrate reversal of current using battery and DPDT switch
5.4 Make an Electromagnet and test it on DC power supply
5.5 Demonstrate AC using a Low voltage Transformer
5.6 Practice Series and Parallel connection of Lamps
5.7 Practice Bright and Dim light arrangement (using a series Lamp / using a Diode)

6.0 Practice Resistance measurement
6.1 Identify different types of resistors
6.2 Calculate Resistance by its color code
6.3 Measuring the resistance using multimeter
6.4 Connecting resistors in series and parallel and measuring the resistance using multimeter
6.5 Practice Rheostat connections

7.0 Practice Capacitor measurement
7.1 Identify different types of capacitors
7.2 Find the value and specifications of capacitor from Color code and Value printed
7.3 Demonstrate that capacitor can hold charge and, charging and discharging of Capacitor require a specific time.
7.4 Investigate the effect of connecting capacitors in series and parallel

7.5 Testing the capacitor usingmultimeter,

8.0 Practice Battery Voltage Measurement
8.1 Measurement of Battery Voltage using Voltmeter and Multimeter

8.2 Connecting batteries in series and parallel and observing the output voltage using Voltmeter and DMM

8.3 Measurement of current supplied by Battery usingAmmeter and Multimeter with Rheostat as load

9.0 Develop Piping and Thread cutting skills

9.1 Cut a metal conduit G.I.Pipe and solid using Hack Saw

9.2 Practice Thread cutting on G.I.Pipe, metal conduit, and solid rod using Die- set

9.3 Practice Thread cutting using Tap- set reamers

9.4 Practice Thread Cleaning

9.5 Make a Hexagonal nut from a round rod

9.6 Practice External Thread cutting on, PVC pipe,and metal conduit using Die- set.

9.7 Practice Internal thread cutting using Tap- set reamers

Competencies to be achieved by the Student

S.No	Experiment title	Competencies
1	Handle the different wiring a) tools and accessories b) select switches, and MCB's c) Identify wires and cables as per the requirements of the load.	• Identify the size and specifications of various tools used for electrical wiring. • Understand the usage of the standard wire gauge. • Identify the type, size and specifications of DP mains,
2.1	To prepare a Straight joint/Married joint using a 7/20 Al. Cable	• Identify the size of the cable • Perform splicing of Insulation properly. • Perform Straight joint/Married joint
2.2	To prepare a T joint using a 7/20 Al. Cable	• Insert the leads of the wires properly as per the sketches. • Twist the wires properly.
2.3	To prepare a Western union joint using a single strand Al. Cable	• Overlap the two wires properly • Twist the binding wires properly
2.4	To prepare a Pig tail joint using a single strand Copper Cable	• Place the wires in V-shape. • Twist the wires in clock wise direction.
3.1	To control one lamp by one 1-way switch with PVC surface conduit wiring system	• Draw wiring diagram • Identify the size of cable, PVC pipe, type of1-way switch and lamp holder. • Make Connections as per Wiring Diagram
3.2	To control two lamps by two 1-way switches with PVC surface conduit wiring system	• Draw wiring diagram • Handle the screw driver, electrician Knife, line tester to fix the PVC pipe using saddles and junction boxes. • Select colour and length of wire for phase and neutral • Switch on the supply after making of the connections • Disconnect the circuit after testing.
3.3	To control one lamp and 2/3 pin socket by two1-way switches with PVC surface conduit wiring system	• Connect 2/3 pin socket properly with respect to phase, neutral and earth. • Connect phase wire through switches.
3.4	Stair-case wiring	• Select two 2-way switches • Connect 2- way switches as per circuit diagram. • Test with 1-phase, 230V, 50 Hz supply to the circuit connected through ICDP switch.

3.5	Godown wiring scheme	• Draw wiring diagram • Connect the circuit as per the diagram. • Observe sequence of operation of switches • Test with 1-phase,230 V,50 Hz supply to the circuit, neutral wire to the bottom point of the 1-way switch and phase to the first point of lamp holder
3.6	To control Electric Bell	• Connect the bell through ceiling rose properly. • Make ceiling rose connections properly
4.0	Soldering Practice Of Simple Electronic Circuits	• Proper use of Lead and Flux • Maintain proper temperature of soldering iron.
5.0	Demonstrate difference between AC and DC	• Connect DC source and measure V & I • Connect proper AC source and measure V &I • Make inferences.
6.0	Practice Resistance measurement	• Identifying resistor based on the colour code. • Measuring resistance using Multimeter.
7.0	Practice Capacitor measurement	• Identifying capacitor based on the colour code. • Handling Multimeter.
8.0	Practice Battery voltage measurement	• Handling Multimeter • Handling Rheostats
9.0	Develop Piping and Thread cutting skills	• Identify the size of the rods to be joined. • Perform thread cutting as per the order • Perform thread Cleaning

References

1. Electrical work shop By R.P.Singh

2. Experiments in Basic Electrical Engineering by S.K.Bhattacharya, Rastogi –NAI

PHYSICS LABORATORY

Subject Title : Physics Laboratory
Subject Code : Common -109
Periods per week : 03
Total periods per year : 45

TIME SCHEDULE

S.No	Name of the Experiment	No. of Periods
1.	Hands on practice on Vernier Calipers	03
2.	Hands on practice on Screw gauge	03
3.	Verification of Parallelogram law of forces and Triangle law of forces	03
4.	Simple pendulum	03
5.	Velocity of sound in air – (Resonance method)	03
6.	Focal length and Focal power of convex lens (Separate & Combination)	03
7.	Refractive index of solid using traveling microscope	03
8.	Surface tension of liquid using traveling microscope	03
9.	Coefficient of viscosity by capillary method	03
10.	Boyle's law verification	03
11.	Meter bridge	03
12.	Mapping of magnet lines of force	03
	Revision	06
	Test	03
	Total:	**45**

Objectives:

Upon completion of the course the student shall be able to

1.0 Practise with Vernier calipers to determine the volumes and areas of a cylinder and sphere and their comparison etc .
2.0 Practise with Screw gauge to determine thickness of a glass plate, cross sectional area of a wire and volumes of sphere and also their comparison etc
3.0 Verify the parallelogram law and Triangle law
4.0 Determine the value of acceleration due to gravity using Simple Pendulum
5.0 Determine the velocity of sound in air at room temperature and its value at zero degree centigrade
6.0 Calculate the Focal length and focal power of convex lenses using distant object method , U-V method , U-V graph and 1 / U – 1 / V graph methods and their comparison,
7.0 Determine the refractive index of a solid using travelling microscope
8.0 Determine the surface tension of a liquid using travelling microscope
9.0 Determine the viscosity of a liquid using capillary method
10.0 Verify the Boyle's law employing a Quill tube
11.0 Determine the specific resistance of material of a wirel using Meter Bridge
12.0 Drawing magnetic lines of force under N-S and N-N methods and locate null points

Competencies and Key competencies to be achieved by the student

Name of the Experiment (No of Periods)	Competencies	Key competencies
1. Hands on practice on Vernier Calipers(03)	• Find the Least count • Fix the specimen in posit • Read the scales • Calculate the physical quantities of given object	• Read the scales • Calculate the requisite physical quantities of given objects
2. Hands on practice on Screw gauge(03)	• Find the Least count • Fix the specimen in posit • Read the scales • Calculate thickness of glass place and cross section of wire and other quantities	• Read the scales • Calculate thickness of given glass plate • Calculate cross section of wire and other quantities
3. Verification of Parallelogram law of forces and Triangle law of forces(03)	• Fix suitable weights • Note the positions of threads on drawing sheet • Find the angle at equilibrium point • Construct parallelogram • Compare the measured diagonal • Construct triangle • Find the length of sides • Compare the ratios	• Find the angle at equilibrium point • Constructing parallelogram • Construct triangle • Compare the ratios of force and length
4. Simple pendulum(03)	• Fix the simple pendulum to the stand • Adjust the length of pendulum • Find the time for number of oscillations • Find the time period • Calculate the acceleration due to gravity • Draw l-T and l-T^2 graph	• Find the time for number of oscillations • Find the time period • Calculate the acceleration due to gravity • Draw l-T and l-T^2 graph

Name of the Experiment(Periods)	Competencies	Key competencies
5. Velocity of sound in air –Resonance method (03)	• Arrange the resonance apparatus • Adjust the reservoir level for booming sound • Find the first and second resonanting lengths • Calculate velocity of sound	• Adjust the reservoir level • Find the first and second resonanting lengths • Calculate velocity of sound at room temperature • Calculate velocity of sound at 0^0 C
6. Focal length and Focal power of convex lens (Separate & Combination) (03)	• Fix the object distance • Find the Image distance • Calculate the focal length and power of convex lens and combination of convex lenses • Draw u-v and 1/u – 1/v graphs	• Calculate the focal length and power of convex lens • Draw u-v and 1/u – 1/v graphs
7. Refractive index of solid using traveling microscope(03)	• Find the least count of vernier on microscope • Place the graph paper below microscope • Read the scale • Calculate the refractive index of glass slab	• Read the scale • Calculate the refractive index of glass slab
8. Surface tension of liquid using traveling microscope(03)	• Find the least count of vernier on microscope • Focus the microscope to the lower meniscus & bent pin • Read the scale • Calculate height of liquid rise • Calculate the surface tension of water	• Read the scale • Calculate height of liquid rise • Calculate the surface tension of water

Name of the Experiment	Competencies	Key competencies
9. Coefficient of viscosity by capillary method(03)	• Find the least count of vernier • Fix the capillary tube to aspiratory bottle • Find the mass of collected water • Find the pressure head • Calculate rate of volume of liquid collected • Find the radius of capillary tube • Calculate the viscosity of water using capillary method	• Find the pressure head • Calculate rate of volume of liquid collected • Find the radius of capillary tube • Calculate the viscosity of water
10. Boyle's law verification (03)	• Note the atmospheric pressure • Fix the quill tube to retort stand • Find the length of air column • Find the pressure of enclosed air • Find and compare the calculated value P x l	• Find the length of air column • Find the pressure of enclosed air • Find the value P x l
11. Meter bridge(03)	• Make the circuit connections • Find the balancing length • Calculate unknown resistance • Find the radius of wire • Calculate the specific resistance	• Find the balancing length • Calculate unknown resistance • Calculate the specific resistance
12. Mapping of magnet lines of force(03)	• Draw magnetic meridian • Placed the bar magnet in NN and NS directions • Draw magnetic lines of force • Locate the neutral points along equatorial and axial lines	• Draw magnetic lines of force • Locate the neutral points along equatorial and axial lines

CHEMISTRY LABORATORY

Subject Title : Chemistry Laboratory
Subject Code : Common -110
Periods per week : 03
Total periods per year : 45

TIME SCHEDULE

S.No	Name of the Experiment	No. of Periods
1.	Familiarization of methods for Volumetric analysis	03
2.	Preparation of Std Na_2CO_3 and making solutions of different dilution solution.	03
3.	Estimation of HCl solution using Std. Na_2CO_3 solution	03
4.	Estimation of NaOH using Std. HCl solution	03
5.	Estimation of H_2SO_4 using Std. NaOH solution	03
6.	Estimation of Mohr's Salt using Std. $KMnO_4$	03
7.	Determination of acidity of water sample	03
8.	Determination of alkalinity of water sample	03
9.	Determination of total hardness of water using Std. EDTA solution	03
10.	Estimation of Chlorides present in water sample	03
11.	Estimation of Dissolved Oxygen (D.O) in water sample	03
12.	Determination of pH using pH meter	03
13.	Determination of conductivity of water and adjusting ionic strength required level.	03
14.	Determination of turbidity of water	03
15.	Estimation of total solids present in water sample	03
	Total:	**45**

Objectives:

Upon completion of the course the student shall be able to

1.0 Practice volumetric measurements (using pipettes, measuring jars, volumetric flask, burettes) and gravimetric measurements (using different types of balances), making dilutions, etc.
2.0 Practice making standard solutions with pre weighed salts and to make solutions of desired dilutions using appropriate techniques.
3.0 Conduct titrations adopting standard procedures and using Std. Na_2CO_3 solution for estimation of HCl
4.0 Conduct titrations adopting standard procedures and using Std. HCl solution for estimation of NaOH
5.0 Conduct titrations adopting standard procedures and using Std. NaOH solution for estimation of H_2SO_4
6.0 Conduct titrations adopting standard procedures and using Std. $KMnO_4$ solution for estimation of Mohr's Salt
7.0 Conduct titrations adopting standard procedures to determine the acidity of given samples of water (One

ground water and one surface / tap water, and rain water if available)

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

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

10.0 Conduct titrations adopting standard procedures to determine the chlorides present in the given samples of water and wastewater (One ground water and one surface / tap water)

11.0 Conduct the test using titrometric / electrometric method to determine Dissolved Oxygen (D.O) in given water samples (One sample from closed container and one from open container / tap water)

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

13.0 Conduct the test on given samples of water / solutions

a) To determine conductivity

b) To adjust the ionic strength of the sample to the desired value

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

15.0 Conduct titrations adopting standard procedures to determine the total solids present in given samples of water (One ground water and one surface / tap water)

Competencies and Key competencies to be achieved by the student

Name of the Experiment (No of Periods)	**Competencies**	**Key competencies**
Familiarization of methods for Volumetric analysis (03)	--	--
Preparation of Std Na_2CO_3 and making solutions of different dilution (03)	▪ Weighing the salt to the accuracy of .01 mg ▪ Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette ▪ Making appropriate dilutions	▪ Weighing the salt to the accuracy of .01 mg ▪ Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette ▪ Making appropriate dilutions
Name of the Experiment (No of Periods)	**Competencies**	**Key competencies**
Estimation of HCl solution using Std. Na_2CO_3 solution (03)	▪ Cleaning the glassware and rinsing with appropriate solutions ▪ Making standard solutions ▪ Measuring accurately the standard	▪ Making standard solutions ▪ Measuring accurately the standard solutions and titrants ▪ Effectively Controlling the flow of
Estimation of NaOH using Std. HCl solution (03)		

Estimation of H_2SO_4 using Std. NaOH solution (03) Estimation of Mohr's Salt using Std. $KMnO_4$ (03) Determination of acidity of water sample (03) Determination of alkalinity of water sample (03) Determination of total hardness of water using Std. EDTA solution (03) Estimation of Chlorides present in water sample (03) Estimation of Dissolved Oxygen (D.O) in water sample (By titration method) (03)	solutions and titrants ▪ Filling the burette with titrant ▪ Fixing the burette to the stand ▪ Effectively Controlling the flow of the titrant ▪ Identifying the end point ▪ Making accurate observations ▪ Calculating the results	the titrant ▪ Identifying the end point ▪ Making accurate observations
Estimation of Dissolved Oxygen (D.O) in water sample (By electrometric method) (03) Determination of pH using pH meter (03) Determination of conductivity of water and adjusting ionic strength to required level (03) Determination of turbidity of water (03)	▪ Familiarize with instrument ▪ Choose appropriate 'Mode' / 'Unit' ▪ Prepare standard solutions / buffers, etc. ▪ Standardize the instrument with appropriate standard solutions ▪ Plot the standard curve ▪ Make measurements accurately ▪ Follow Safety precautions	▪ Prepare standard solutions / buffers, etc. ▪ Standardize the instrument with appropriate standard solutions ▪ Plot the standard curve ▪ Make measurements accurately
Name of the Experiment (No of Periods)	**Competencies**	**Key competencies**

Estimation of total solids present in water sample (03)	▪ Measuring the accurate volume and weight of sample ▪ Filtering and air drying without losing any filtrate ▪ Accurately weighing the filter paper, crucible and filtrate ▪ Drying the crucible in an oven	▪ Measuring the accurate volume and weight of sample ▪ Filtering and air drying without losing any filtrate ▪ Accurately weighing the filter paper, crucible and filtrate

COMPUTER FUNDEMENTALS LABORATORY

(Common to all Branches)

Subject Title : Computer Fundamentals Laboratory
Subject Code : EE-111
Periods/Week : 03
Periods/Year : 90

Time Schedule

S. No.	Major Topics	No. of sessions each of 3 periods duration	No. of Periods
I.	Computer hardware Basics	02	06
II.	Windows Operating System	02	06
III.	MS Word	08	24
IV.	MS Excel	09	27
V.	MS PowerPoint	09	27
	Total	30	90

Rationale: The knowledge of Computer usage has become a must for everyone, due to wide spread computer usage and related applications in all fields. This laboratory is designed to give the students hands on practice of Windows Operating System and MS Office to enable the students to use these skills in future courses.

I. Computer Hardware Basics (Not for end examination)

1. a) To familiarize with a Computer System and its hardware connections.

   b) To start and Shutdown a Computer correctly.
   c) To check the software details of the computer
   d) To practice Internal and External DOS commands
2. To check the hardware present in your computer.

II. Windows's operating system (Not for end examination)

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

III. Practice with MS-WORD

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

11. To use Mail Merge feature of MS Word
12. To use Equations and symbols features

IV. Practice with MS-EXCEL

13. To familiarize with MS-EXCEL layout
14. To access and Enter data in the cells
15. To edit a spread sheet- Copy, Cut, Paste, and selecting Cells
16. To use built in functions and Formatting Data
17. To create Excel Functions, Filling Cells
18. To enter a Formula for automatic calculations
19. To practice Excel Graphs and Charts
20. To format a Worksheet in Excel, Page Setup and Print

V. Practice with MS-POWERPOINT

21. To familiarize with Ribbon layout features of PowerPoint 2007.
22. To create a simple PowerPoint Presentation
23. To set up a Master Slide in PowerPoint
24. To insert Text and Objects
25. To insert a Flow Charts
26. To insert a Table
27. To insert a Charts/Graphs
28. To insert video and audio
29. To practice Animating text and objects
30. To Review presentation

Competencies and Key Competencies to be achieved by the students

Exp No.	Name of the Experiment	Competencies	Key Competencies
1 (a).	To familiarize with Computer system and hardware connections	a. Identify the Parts of a Computer system a). CPU b) Monitor c) CD/DVD Drive d) Power Switch e) Start Button f) Reset Button b. Identify and connect various peripherals c. Identify and connect the cables used with computer system d. Identify various ports on CPU and connect Keyboard & Mouse	Connect cables to external hardware and operate the computer
1 (b).	To Start and Shut down Computer correctly	a. Log in using the password b. Start and shut down the computer c. Use Mouse and Keyboard	a. Login and logout as per the standard procedure b. Operate mouse & Keyboard
1 (c).	To explore Windows Desktop	a. Familiarize with Start Menu, Taskbar, Icons and Shortcuts b. Access application programs using Start menu, Task manager c. Use Help support	a. Access application programs using Start menu b. Use taskbar and Task manager
1(d).	To practice Internal and External DOS commands	a. Practice Internal commands b. Practice External commands	Familiarize with MS-DOS Commands

2.	To check the software details of the computer	c. Find the details of Operating System being used d. Find the details of Service Pack installed	Access the properties of computer and find the details
3.	To check the hardware present in your computer	a. Find the CPU name and clock speed b. Find the details of RAM and Hard disk present c. Access Device manager using Control Panel and check the status of devices like mouse and key board d. Use My Computer to check the details of Hard Disk Drives and partitions e. Use the Taskbar	a. Access device manager and find the details b. Type /Navigate the correct path and Select icon related to the details required
4.	Working with Files and Folders	a. Create folders and organizing files in different folders b. Use copy / paste or move commands to organize files and folders	a. Create files and folders rename , arrange and search for the required folder/file

Exp No.	Name of the Experiment	Competencies	Key Competencies
	Working with Files and Folders Continued....	c. Arrange icons – name wise, size, type, Modified d. Search a file or folder and find its path e. Create shortcut for files and folders (in other folders) on Desktop f. Familiarize with the use of My Documents g. Familiarize with the use of Recycle Bin	b. Restore deleted files from Recycle bin
5.	To use Windows Accessories: Calculator – Notepad – WordPad – MS Paint	a. Familiarize with the use of Calculator b. Access Calculator using Run command c. Create Text Files using Notepad and WordPad and observe the difference in file size d. Use MS paint and create .jpeg, .bmp files using MS Paint	a. Use windows accessories and select correct text editor based on the situation. b. Use MS Paint to create /Edit pictures and save in the required format.
6.	To familiarize with Ribbon layout of MS Word. – Home – Insert- Page Layout- References-Review-View	a. Create/Open a document b. Use Save and Save as features c. Work on two documents simultaneously d. Choose correct Paper size and Printing options	a. Create a Document and name appropriately and save b. Set paper size and print options
7.	To practice Word Processing Basics	a. Typing text b. Keyboard usage c. Use mouse (Left click / Right click / Scroll) d. Use Keyboard shortcuts e. Use Find and Replace features in MS-word f. Use Undo and Redo Features g. Use spell check to correct Spellings and Grammar	a. Use keyboard and mouse to enter/edit text in the document. b. Use shortcuts c. Use spell check/ Grammar features for auto corrections.
8.	To practice Formatting techniques	a. Formatting Text b. Formatting Paragraphs c. Setting Tabs d. Formatting Pages e. The Styles of Word f. Insert bullets and numbers g. Themes and Templates h. Insert page numbers, header and footer	a. Format Text and paragraphs and use various text styles. b. Use bullets and numbers to create lists c. Use Templates /Themes d. Insert page numbers date, headers and footers

Exp No.	Name of the Experiment	Competencies	Key Competencies
9.	To insert a table of required number of rows and columns	a. Edit the table by adding the fields – Deleting rows and columns –inserting sub table –marking borders. Merging and splitting of cells in a Table b. Changing the background colour of the table c. Use table design tools d. Use auto fit – fixed row/ column height/length – Even distribution of rows / columns features e. Convert Text to table and Table to Text f. Use Sort feature of the Table to arrange data in ascending/descending order	a. Insert table in the word document and edit b. Use sort option for arranging data.
10.	To Insert objects, clipart and Hyperlinks	a. Create a 2-page document. &Insert hyperlinks and Bookmarks. b. Create an organization chart c. Practice examples like preparing an Examination schedule notice with a hyperlink to Exam schedule table.	a. Insert hyperlinks &Bookmarks b. Create organization charts/flow charts
11.	To Use Mail merge feature of MS Word	a. Use mail merge to prepare individually addressed letters b. Use mail merge to print envelopes.	Use Mail merge feature
12.	To use Equations and symbols features.	a. Explore various symbols available in MS Word b. Insert a symbol in the text c. Insert mathematical equations in the document	Enter Mathematical symbols and Equations in the word document
13.	To Practice with MS-EXCEL	a. Open /create an MS Excel spreadsheet and familiarize with MS Excel 2007 layout like MS office Button- b. Use Quick Access Toolbar- Title Bar-Ribbon-Worksheets- Formula Bar-Status Bar	a. Familiarize with excel layout and use b. Use various features available in toolbar
14.	To access and Enter data in the cells	a. Move around a Worksheet- Quick access -Select Cells b. Enter Data-Edit a Cell-Wrap Text-Delete a Cell Entry-Save a File-Close Excel	a. Access and select the required cells by various addressing methods b. Enter data and edit

Exp No.	Name of the Experiment	Competencies	Key Competencies
15.	To edit spread sheet Copy, Cut, Paste, and selecting cells	a. Insert and Delete Columns and Rows-Create Borders-Merge and Center b. Add Background Color-Change the Font, Font Size, and Font Color c. Format text with Bold, Italicize, and Underline-Work with Long Text-Change a Column's Width	Format the excel sheet
16.	To use built in functions and Formatting Data	a. Sort and filter data in a worksheet b. Perform Mathematical Calculations verify -AutoSum c. Perform Automatic Calculations-Align Cell Entries	Use built in functions in Excel
17.	To enter a Formula for automatic calculations	a. Enter formula b. Use Cell References in Formulae c. Use Automatic updating function of Excel Formulae d. Use Mathematical Operators in Formulae e. Use Excel Error Message and Help	Enter formula for automatic calculations
18.	To Create Excel Functions, Filling Cells	a. Use Reference Operators b. Work with sum, Sum if , Count and Count If Functions c. Fill Cells Automatically	a. Create Excel sheets involving cross references and equations b. Use the advanced functions for conditional calculations
19.	To Practice Excel Graphs and Charts	a. Produce an Excel Pie Chart b. Produce an Excel Column Chart c. Practice creating any Chart	a. Use data in Excel sheet to Create technical charts and graphs Produce Excel Line Graph b. Produce a Pictograph in Excel
20.	To format a Worksheet in Excel, page setup and print	a. Shade alternate rows of data b. Add currency and percent symbols c. Change height of a row and width of a column d. Change data alignment e. Insert Headers and Footers f. Set Print Options and Print	a. Format Excel sheet b. Insert headers &footers and print
21.	To familiarize with Ribbon layout &features of PowerPoint 2007.	Use various options in Home, insert, design, animation , slideshow, Review &View in the PowerPoint	Access required options in the tool bar

Exp No.	Name of the Experiment	Competencies	Key Competencies
22.	To create a simple PowerPoint Presentation	a. Insert a New Slide into PowerPoint b. Change the Title of a PowerPoint Slide c. PowerPoint Bullets d. Add an Image to a PowerPoint Slide e. Add a Textbox to a PowerPoint slide	a. Create simple PowerPoint presentation with photographs/ClipArt and text boxes b. Use bullets option
23.	To Set up a Master Slide in PowerPoint and add notes	a. Create a PowerPoint Design Template b. Modify themes c. Switch between Slide master view and Normal view d. Format a Design Template Master Slide e. Add a Title Slide to a Design Template f. The Slide Show Footer in PowerPoint f. Add Notes to a PowerPoint Presentation	a. Setup Masterslide and format b. Add notes
24.	To Insert Text and Objects	a. Insert Text and objects b. Set Indents and line spacing c. Insert pictures/ clipart d. Format pictures e. Insert shapes and WordArt f. Use 3d features g. Arrange objects	Inset Text and Objects Use 3d features
25.	To insert a Flow Chart / Organizational Charts	a. Create a Flow Chart in PowerPoint b. Group and Ungroup Shapes c. Use smart art	Create organizational charts and flow charts using smart art
26.	To insert a Table	a. PowerPoint Tables b. Format the Table Data c. Change Table Background d. Format Series Legend	Insert tables and format
27.	To insert a Charts/Graphs	a. Create 3D Bar Graphs in PowerPoint b. Work with the PowerPoint Datasheet c. Format a PowerPoint Chart Axis d. Format the Bars of a Chart e. Create PowerPoint Pie Charts f. Use Pie Chart Segments g. Create 2D Bar Charts in PowerPoint h. Format the 2D Chart e. Format a Chart Background	Create charts and Bar graphs, Pie Charts and format.

Exp No.	Name of the Experiment	Competencies	Key Competencies
28.	To Insert audio &video, Hyperlinks in a slide Add narration to the slide	a. Insert sounds in the slide and hide the audio symbol b. Adjust the volume in the settings c. Insert video file in the format supported by PowerPoint in a slide d. Use automatic and on click options e. Add narration to the slide f. Insert Hyperlinks	a. Insert Sounds and Video in appropriate format. b. Add narration to the slide c. Use hyperlinks to switch to different slides and files
29.	To Practice Animation effects	a. Apply transitions to slides b. To explore and practice special animation effects like *Entrance, Emphasis, Motion Paths &Exit*	Add animation effects
30.	Reviewing presentation	a. Checking spelling and grammar b. Previewing presentation c. Set up slide show d. Set up resolution e. Exercise with Rehearse Timings feature in PowerPoint f. Use PowerPoint Pen Tool during slide show g. Saving h. Printing presentation (a) Slides (b) Handout	a. Use Spell check and Grammar feature b. Setup slide show c. Add timing to the slides d. Setup automatic slide show

SCHEME OF INSTRUCTIONS AND EXAMINATIONS
(THIRD 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
THEORY								
EE-301	ENGG MATHEMATICS -II	5		75	3	20	80	100
EE-302	D.C. MACHINES & MEASURING INSTRUMENTS	5		75	3	20	80	100
EE-303	ELECTRICAL CIRCUITS	5		75	3	20	80	100
EE-304	GENERAL MECHANICAL ENGG	5		75	3	20	80	100
EE-305	ELECTRONICS ENGG - I	4		60	3	20	80	100
PRACTICAL								
EE-306	DC MACHINES & MEASUREMENTS LAB		6	90	3	40	60	100
EE-307	ELECTRICAL WIRING & MAINTENANCE LAB		6	90	3	40	60	100
EE-308	C-LANGUAGE LAB		3	45	3	40	60	100
EE-309	ELECTRONICS ENGG LAB - I		3	45	3	40	60	100
TOTAL		24	18	630	27	260	640	900

ENGINEERING MATHEMATICS – II

(Common to all Branches)

Subject Title : Engineering Mathematics-II
Subject Code : EE-301
Periods per week : 05
Periods per Semester : 75

Blue print

S. No	Major Topic	No of Periods	Weightage of Marks	Short Type			Essay Type		
	Unit - I			R	U	App	R	U	App
1	**Indefinite Integration**	15	21	1	1	0	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
	Unit - II								
2	**Definite Integration and its applications**	35	60	1	1	3	1	1	$2\frac{1}{2}$
	Unit - III								
3	**Differential Equations**	25	29	2	1	0	1	1	0
	Total	75	110	4	3	3	$2\frac{1}{2}$	$2\frac{1}{2}$	30
			Marks:	12	9	9	25	25	30

R: Remembering type 37 marks
U: Understanding type 34 marks
App: Application type 39 marks

Upon completion of the subject the student shall be able to

OBJECTIVES

Unit-I

1.0 Indefinite Integration

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

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

1.3 Solve integration problems involving standard functions using the above rules.

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

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

ii) $\int [f(x)]^n f'(x)\,dx$

iii) $\int f'(x)/[f(x)]\,dx$

iv) $\int f\{g(x)\}\, g'(x)\,dx$

1.5 Find the Integrals of *tan x, cot x, sec x* and *cosec x* using the above.

1.6 Evaluate the integrals of the form $\int Sin^m\theta\ Cos^n\theta.\, d\theta$ where m and n are positive integers.

1.7 Evaluate integrals of powers of *tan x* and *sec x*.

1.8 Evaluate the Standard Integrals of the functions of the type

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

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

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

1.9 Evaluate the integrals of the type

$$\int \frac{1}{a \pm bSin\theta} d\theta, \int \frac{1}{a \pm b\cos\theta} d\theta \text{ and } \int \frac{1}{a\cos\theta \pm b\sin\theta \pm c} d\theta\ .$$

1.10 Evaluate integrals using decomposition method.

1.11 Evaluate integrals using integration by parts with examples.

1.12 State the Bernoulli's rule for evaluating the integrals of the form $\int u.v dx$.

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

Unit-II

(a) Understand definite integral and its properties

2.1 State the fundamental theorem of integral calculus

2.2 Explain the concept of definite integral.

2.3 Calculate the definite integral over an interval.

2.4 State various properties of definite integrals.

2.5 Evaluate simple problems on definite integrals using the above properties.

(b) Real life applications of definite integrals

2.6 Explain definite integral as a limit of sum by considering an area.

2.7 Find the areas under plane curves and area enclosed between two curves using integration.

2.8 Obtain the volumes of solids of revolution.

2.9 Obtain the mean value and root mean square value of the functions in any given interval.

2.10 Explain the Trapezoidal rule, Simpson's 1/3 rules for approximation of integrals and provide some examples.

(c) Certain special integrals: Laplace Transforms

2.11 Write the definition of Laplace Transform and explain sufficient conditions for its existence.

2.12 Provide formulae for Laplace transforms of standard functions.

2.13 State Linear property, First shifting property, Change of Scale property for Laplace transforms. Solve simple problems using these properties.

2.14 Write formulae for Laplace transform of $t^n f(t)$, $\frac{f(t)}{t}$, $f^{(n)}(t)$, $\int_0^t f(u)\,du$ in terms of Laplace transform of $f(t)$. Provide simple examples on these functions.

2.15 Define unit step function and write the Laplace Transform of unit step function.

State second shifting property.

2.16 Define inverse Laplace Transform and write inverse Laplace Transform of standard functions. Solve simple problems.

2.17 Write first shifting property of inverse Laplace Transform with examples

2.18 Define convolution of two functions and state convolution theorem with few examples for understanding only.

(d) Understand the Fourier series expansion of functions

2.19 Define Fourier series of a function on the interval $(c, c+2l)$ and state sufficient conditions for its existence. Write the Euler's formulae for determining the Fourier coefficients.

2.20 Find Fourier series of simple functions in the range $(0,2l), (0,2\pi), (-l,l)\ and\ (-\pi,\pi)$.

2.21 Find Fourier coefficients for even and odd functions in the interval $(-l,l)\ and\ (-\pi,\pi)$ in simple examples.

2.22 Define half range Fourier sine and cosine series of a function over the interval $(0,\ l)$ with examples.

3.0 Introduction to Differential Equations

3.1 Define a Differential equation, its order, degree

3.2 Form a differential equation by eliminating arbitrary constants.

3.3 Solve the first order first degree differential equations by the following methods:

i. Variables Separable.
ii. Homogeneous Equations.
iii. Exact Differential Equations
iv. Linear differential equation of the form dy/dx + Py = Q, where P and Q are functions of x or constants.
iv. Bernoulli's Equation (Reducible to linear form.)

3.4 Solve Differential equations of the type $(aD^2 + bD + c)y = 0$ when the roots of the auxiliary equation are real and different, real and repeated, Complex conjugates.

3.5 Solve the higher order homogeneous differential equations with constant coefficients.

3.6 Explain the concept of complementary function, particular Integral and general solution of a differential equation.

3.7 Solve n^{th} order differential equation of the type $f(D)\ y = X$ where $f(D)$ is a polynomial of nth order and X is a function of the form $k, e^{ax}, Sinax, Cosax, x^n$.

3.8 Solve simple problems leading to engineering applications

COURSE CONTENT

Unit-I
Indefinite Integration:

1. Integration regarded as anti- derivative – Indefinite integral of standard functions. Properties of indefinite integral. Integration by substitution or change of variable. Integrals of the form $\sin^m\theta.\cos^n\theta$. where m and n are positive integers. Integrals of tan x, cot x, sec x, cosec x and powers of tan x, sec x by substitution.

Evaluation of integrals which are reducible to the following forms :

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

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

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

Integration by decomposition of the integrand into simple rational, algebraic functions. Integration by parts, Bernoulli's rule.

Unit-II
Definite Integral and its applications:

Definite integral-fundamental theorem of integral calculus, properties of definite integrals, evaluation of simple definite integrals. Definite integral as the limit of a sum. Area under plane curves – Area enclosed between two curves. Volumes of solids of revolution. Mean and RMS values of a function on a given interval. Trapezoidal rule, Simpson's 1/3 rule to evaluate an approximate value of a define integral.

Definition, sufficient conditions for existence of Laplace Transform (LT), LT of elementary functions, linearity property, scale change property, first shifting property, multiplication by t^n, division by t, LT of derivatives and integrals, unit step function, LT of unit step function, second shifting theorem, inverse Laplace transforms-

shifting theorems and change of scale property, multiplication by s^n and division by s – examples of inverse LT using partial fractions – convolution theorem (no proof).

Representation of a function in Fourier series over the interval $(c, c+2l)$, Give sufficient conditions for existence of Fourier series. Euler's formulae for Fourier coefficients, Finding Fourier coefficients for simple functions, elementary even and odd functions. Define half range Fourier series.

Unit -III

Differential Equations:

Definition of a differential equation-order and degree of a differential equation- formation of differential equations-solution of differential equation of first order, first degree: variable-separable, homogeneous, exact, linear differential equation, Bernoulli's equation.

Homogenous linear differential equations with constant coefficients of order two and higher with emphasis on second order.

Non-homogenous linear differential equations with constant coefficients of the form f(D)y = X, where X is in the form k, e^{ax}, sin ax, cos ax, x^n, (n= 1,2) – complimentary function, particular integral and general solution.

Reference Books:

1. Integral Calculus Vol.I, by M.Pillai and Shanti Narayan
2. Thomas' Calculus, Pearson Addison –Wesley Publishers
3. A Text book of Engg. Mathematics by B.S.Grawel
4. A Text book of Engg. Mathematics by B.V.Ramana- T.Mc Graw Hill Publishers

D.C. MACHINES & MEASURING INSTRUMENTS

Subject Title : **D.C. Machines & Measuring Instruments**

Subject Code : **EE-302**

Periods/Week : **05**

Periods/Semester : **75**

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage	Short Questions	Essay Questions
1.	Basics of D.C Generators	**20**	**29**	**03**	**02**
2.	Fundamentals of D.C Motors	**12**	**18**	**01**	**1 1/2**
3.	Speed Control, Starters and Testing of D.C Motors	**15**	**21**	**02**	**1 1/2**
4.	Basics of Electromechanical Measuring Instruments	**16**	**24**	**03**	**1 1/2**
5.	Basics of Electronic & Digital Instruments	**12**	**18**	**01**	**1 1/2**
	TOTAL	**75**	**110**	**10**	**08**

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Comprehend the Basics of D.C Generators

1.1 Explain electromechanical energy conversion.

1.2 Explain the working of simple loop generator.

1.3 Understand the conversion of AC to DC by Split ring.

1.4 Describe the constructional features of a D.C generator with a legible sketch.

1.5 List various material used for each part of DC Generator.

1.6 State the functions of each part of D.C generator.

1.7 Explain the working of D.C generator.

1.8 List the types of windings -- (i) Lap (ii) Wave.(Single layer only).

1.9 Define Pole pitch, Y_b, Y_f, Y_R in terms of armature slots.

1.10 Compare Lap and Wave windings in different aspects.

1.11 Derive the E.M.F equation of D.C generator in terms of ϕ, Z, N, P and A.

1.12 Classify D.C Generators based on excitation.

1.13 Draw the equivalent circuit of various DC generators based on excitation by giving their voltage and current equations

1.14 Solve simple problems based on the above equations.

1.15 State the various losses incurred in a D.C Generator.

1.16 Define the mechanical, electrical and overall efficiencies of DC Generator.

1.17 Derive the condition for maximum efficiency of a DC generator.

1.18 Solve Problems on efficiencies.

1.19 Define Armature reaction.

1.20 Explain Armature reaction with legible sketches

1.21 Explain the phenomenon of
i)Demagnetization ii) Cross magnetization.

1.22 Derive the formula for i)AT_d / pole ii) AT_c / Pole.

1.23 Define Commutation.

1.24 Explain Commutation

1.25 List the different methods of improving commutation.

1.26 Explain the interpole method of improving commutation.

1.27 Plot and Explain i)Open Circuit Characteristics ii)Internal characteristics and iii)External characteristics of the following types of D.C.Generators:

(a) Separately excited (b) Shunt

(c) Series (d) Compound

1.28 State the critical field resistance and critical speed of DC generators

1.29 State the conditions for Buildup of E.M.F.of DC generator.

1.30 State the necessity & Conditions for parallel operation of generators.(No Problems)

1.31 Understand the use of Equalizer rings in parallel Operation.

1.32 List the applications of D.C generators.

2.0 Comprehend the Fundamentals of D.C Motors

2.1 Appreciate the usage of the DC machine as a generator and as a motor.

2.2 State & explain Fleming's left hand rule.

2.3 Explain the working of D.C motor.

2.4 Explain the significance of back E.M.F by stating its formula.

2.5 Classify DC motors.

2.6 Write the formulae for Back e.m.f for different D.C Motors with equivalent circuits.

2.7 Solve Problems on Back E.M.F.

2.8 Define Torque

2.9 Derive Torque equation of a D.C motor.

2.10 Develop the formulae for

i) Armature torque (T_a) ii)Shaft torque (T_{sh}) iii) Loss torque.

2.11 List the different losses in a D.C motor.

2.12 Explain the Power Stages in D.C. motor.

2.13 Solve Problems on the above.

2.14 Plot and Explain the i)Electrical characteristics and ii) Mechanical characteristics of the following types of D.C.Motors

a)Shunt b)Series c) Compound

2.15 List any three applications of the various D.C motors.

3.0 Comprehend the Speed Control of D.C Motors, Starters and Testing of D.C motors

3.1 Explain the necessity of speed control of DC Motors.

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

3.3 State the advantages and disadvantages of the three methods of speed control

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

3.5 State the necessity of a starter.

3.6 List different types of Starters for DC motors.

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

3.8 Explain the working of 4-point starter with legible sketch.

3.9 Describe the direct and indirect methods of testing of the D.C. Motors.

3.10 List different tests of D.C. Motors.

3.11 Explain the method of conducting brake test on different types of D.C motors.

3.12 Explain the method of conducting Swinburne's test.

4.0 Comprehend the Basics of Electromechanical measuring instruments.

4.1 Mention the names of the instruments to measure the various electrical quantities.

4.2 Classify the instruments on the basis of their construction and output as analog(electromechanical and analog electronic) and digital instruments .

4.3 Classify the electromechanical instruments according to Principle of Working.

4.4 Classify the instruments on the basis of method of measuring the value as absolute and secondary instruments

4.5 Distinguish between Absolute and Secondary instruments

4.6 State the types of secondary instruments (indicating, integrating and recording).by giving suitable examples.

4.7 State the purpose of obtaining deflecting, controlling and damping torques in indicating instruments.

4.8 Explain the methods of obtaining i)deflecting torque ii) controlling torque and iii) Damping torque in indicating instruments.

4.9 Define the following terms related to measuring Instruments accuracy ii) precision iii) error iv) resolution v) sensitivity

4.10 Describe the construction of Permanent Magnet Moving Coil Instrument.

4.11 Explain the working of Permanent Magnet Moving Coil Instrument (Voltmeter/Ammeter) .

4.12 State advantages and disadvantages of M.C Instruments.

4.13 List the applications of M.C Instruments

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

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

4.16 Compare M.C. and M.I. instruments.

4.17 Describe the method of extending the range of moving coil ammeter with the help of shunt.

4.18 Describe the method of extending the range of moving coil voltmeter with the help of Multiplier.

4.19 Describe the construction of a dynamometer type instrument

4.20 Explain the working of a dynamometer type Instrument.

4.21 List the advantages and disadvantages of dynamometer instruments.

4.22 State the need for instrument transformers (Current Transformer – CT and Potential Transformers - PT) .

4.23 List the applications of CT and PT.

4.24 State the precaution to be taken while using CT.

4.25 Describe the construction of a 1-phase induction type Energy meter

4.26 Explain the working of a 1-phase induction type Energy meter.

4.27 State the common errors and their remedies in 1- phase energy meter

4.28 Describe the construction of Weston synchroscope.

4.29 Explain the working of Weston synchroscope

5.0 Comprehend the Basics of Electronic & Digital instruments.

5.1 List the basic components of analog electronic Instruments.

5.2 List analog electronic Instruments.

5.3 Explain the working of Rectifier type voltmeter and ammeter.

5.4 List the basic components of Digital (Digital electronic) instruments.

5.5 List the advantages of Digital Instruments over Analog Instruments.

5.6 List the types of digital Voltmeters.

5.7 Mention the specifications of digital voltmeter.

5.8 Explain the Working of Digital Multimeter by giving its specifications.

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

5.10 Explain the Working of Three Phase Digital Energy meter with block diagram.

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

5.12 State the uses of Tong tester (clamp meter).

COURSE CONTENT

1.Fundamentals of D.C Generators

Electromechanical energy conversion - simple loop generator - principle of D.C generator- functions of each part of D.C generator with legible sketches- windings (i) Lap (ii) Wave -Classification of generators based on excitation- E.M.F equation - losses incurred in the D.C machines -Voltage and Current equations for different types of D.C Generators - efficiency calculation.- condition for maximum efficiency -simple problems. Armature reaction, Demagnetization & Cross magnetization-Derive for AT_d, AT_c / Pole – Commutation – interpole methods of improving commutation.-O.C.C of Separately excited, Shunt, Series and Compound generators- Conditions for (i) Building up of E.M.F.- Critical field resistance and critical speed - parallel operation of generators - Applications of D.C generators.

2. Fundamentals of D.C Motors

Usage of a DC machine as a generator and a motor-Fleming's left hand rule - working of D.C motors – classification - significance of back E.M.F- Formula for back E.M.F for different D.C motors-Problems on E.M.F equation – Torque- Torque equation of DC motor - Armature torque (T_a) , shaft torque (T_{sh}) and loss torque - Different losses - electrical and mechanical characteristics of D.C Shunt, Series and compound motors. Applications of D.C motors.

3. Speed Control, Starters and testing of D.C Motors

Necessity of speed control- Direct and Indirect methods of speed control-different methods (Flux, Armature and Voltage) of speed controls for D.C shunt motors-State the advantages and disadvantages of above methods-different methods of speed control for series motors- necessity of starter- 3-point starter, 4-point starter. Performance curves- brake test on different types of D.C motors-Swinburne's test.

4. ***Basics of Electro mechanical Measuring Instruments*****:**

List of important instruments to measure electrical quantities - Classification of instruments - different types of torques(Deflection ,Controlling and Damping torques) in the indicating instruments-definitions of accuracy ,precision ,error, resolution and sensitivity- M.C. and M.I types of Ammeters and Voltmeters - their Construction and working, comparison- shunts and multipliers for M.C instruments – Dynamometer type Ammeter, Voltmeter and Wattmeter – construction, working, - use of Instrument transformers- Measurement of energy –single phase Induction type energy meter- Construction working and adjustments - Construction and working of Weston Synchroscope.

5. Basics of Electronic & Digital Instruments :

Basic components of analog electronic Instruments - Working of Rectifier type Voltmeter and Ammeter- basic components of Digital (Digital electronic) instruments- advantages of Digital Instruments over Analog Instruments-

types of digital Voltmeters- specifications of digital voltmeter -working of digital multi meter and its specifications- working of single phase digital energy meter with block diagram-- working of three phase digital energy meter with block diagram- Working of Digital frequency meter with block diagram-use of tong tester(clamp meter).

REFERENCES

1. B.L. Theraja -Electrical Technology - Vol - I – S.Chand&co.
2. B.L. Theraja -Electrical Technology - Vol –II - S.Chand&co.
3. P.S. Bhimbhra -Electrical machines
4. M.V.Deshpande -Electrical Machines
5. D.P.Kothari, J.Nagarath - Electric Machines– TMH
6. Khandpur -Modern Electronic Equipment
7. J.B. Gupta -Electrical and Electronic measuring instruments.
8. Harris -Electrical measurements

ELECTRICAL CIRCUITS

Subject Title : Electrical Circuits
Subject code : EE-303
Periods/Week : 05
Periods/semester : 75

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage	Short Questions	Essay Questions
1.	Resistance Measuring circuits	08	13	01	01
2.	D.C. Circuits	12	16	02	01
3.	Network Theorems	06	08	01	1/2
4.	Fundamental of A.C.	09	13	01	01
5.	Single phase A.C. circuits	17	26	02	02
6.	Single Phase Parallel circuits	08	13	01	01
7.	Poly phase circuits	15	21	02	1 1/2
	Total	75	110	10	08

OBJECTIVES

On completion of the course the student shall be able to

1.0 Explain the methods of measurement of resistance.

1.1 Classify the resistance into Low ,Medium and High Values giving examples for each.
1.2 List the methods of measurement of
i) Low resistance ii) Medium resistance and iii) High resistance
1.3 Draw the circuit diagram of basic Ohm-meter.
1.4 Explain the working of basic Ohm-meter.
1.5 Describe the two types of Ohm-meters (series and shunt).
1.6 Distinguish between shunt and series Ohm-meters
1.7 Describe the construction of Megger
1.8 Explain the working of Megger
1.9 Explain the method of measurement of earth resistance using Earth Megger.
(Construction and Working of Earth Megger is **not** required).
1.10 State the working principle of basic Potentiometer.
1.11 Describe the Construction of basic Potentiometer with a legible sketch
1.12 Explain the working of basic Potentiometer with a legible sketch
1.13 Explain the measurement of unknown resistance using Potentiometer.
1.14 List the applications of Potentiometer.

2.0 Understand Kirchhoff's laws and star delta Transformations.

2.1 Differentiate between active and passive circuits.
2.2 Explain junction, branch and loop in circuits
2.3 Understand the insufficiency of Ohm's law to solve complex circuits.
2.4 State i) Kirchhoff's current law (KCL) ii) Kirchhoff's voltage law.(KVL)
2.5 Solve problems by applying KVL and KCL
2.6 Explain star and delta circuits
2.7 Explain the concept of circuit transformation and equivalent circuits

2.8 Develop transformation formulae for star- delta transformations and vice-versa
2.9 Solve problems on the above

3.0 Understand Network Theorems

3.1 Explain ideal voltage source & ideal current source
3.2 Explain Source transformation technique
3.3 State Super position theorem.
3.4 State Thevenin's theorem.
3.5 State Norton's theorem
3.6 State Maximum power transfer theorem.
(All the theorems with reference to D.C only)
3.7 Solve simple problems on the above theorems

4.0 Comprehend the relationship between the various Electrical quantities connected with alternating current.

4.1 Explain the concept of simple loop generator
4.2 State the relationship between θ_m & θ_e
4.3 State the relation between poles, speed and frequency
4.4 Define the instantaneous value, maximum value, frequency, time period, Average value, R.M.S value, Form factor and Peak factor of an A.C quantity.
4.5 Calculate the above for different alternating waveforms viz. Half wave, full wave rectified sine wave, triangular wave and square wave forms.
4.6 Explain the terms phase and phase difference of an A.C quantity.
4.7 Understand j operator
4.8 Convert polar quantities into rectangular quantities and Vice-versa.

5.0 Comprehend the single phase A.C. Series circuits

5.1 Define the terms resistance, inductance and capacitance
5.2 Derive relationship between voltage and current in a
i) Pure resistive circuit ii) Pure inductive circuit iii) Pure capacitive circuit.
5.3 Calculate the impedance, current, phase angle, power and power factor in
i) R-L series circuit ii) R-C series circuits
iii) L-C series circuits iii) R-L-C series circuits.
5.4 Solve Problems on Series Circuits
5.5 Define Resonance in series circuits
5.6 Derive a formula for resonant frequency of a R-L-C series circuit.
5.7 Define Q- factor
5.8 Explain the importance of Q-factor.
5.9 Solve simple problems on Series Resonance.

6.0 Comprehend the single phase A.C. Parallel Circuits

6.1 Solve Parallel Circuits by
i) Vector method
ii) Admittance method
iii) J- notation method
6.2 Solve Problems on above (i) and (iii) (No admittance method).
6.3 State the condition for resonance in a parallel circuit.

7.0 Understand Poly Phase Circuits

7.1 Define the term `Poly Phase'.
7.2 Explain the methods of generation of 2 phase and 3 phase emfs.

7.3 Write the expressions for Poly phase emfs and represent them by phasor diagram.
7.4 Understand the concept of phase sequence.
7.5 Derive the relation between line and phase values of current and voltage in 3 phase i)star circuits and ii)delta circuits.
7.6 Derive the equation for power in 3 phase circuit.
7.7 Solve numerical examples in balanced loads.
7.8 Derive the formulae for measurement of 3 phase power by using two watt meters.
7.9 Calculate the power factor of the load by the above method.
7.10 List any 6 advantages of 3 phase system over single phase system.
7.11 Solve simple problems on the above

COURSE CONTENT

1. Measurement of resistance:

Classification of resistance- List of methods of measurement of resistance- explanation of basic Ohm meter circuit – difference in series and shunt type ohmmeters- Construction and working of Megger – method of measuring earth resistance using earth Megger – working principle, construction and applications of Potentiometer.

2. Kirchhoff's Laws and Star - Delta Transformation

Active and Passive circuits - Junction, branch and loop in circuits -Insufficiency of Ohm's law to solve complex circuits, Kirchhoff's laws - Star - Delta configurations, star-delta transformations .

3. **Network Theorems**

Ideal Voltage source , Ideal current source - Source transformation technique- Super position theorem- Thevenin's Theorem -Norton's Theorem- Maximum power transfer theorem with reference to D.C.- Problems on the above.

4. Fundamentals of A.C.

Simple loop Generator –Relation between θ_m & θ_e -Relation between poles, speed and frequency**-** Definition of Alternating quantity, cycle, period, frequency, amplitude, instantaneous value and angular velocity **-** Average value - effective value/R.M.S value definitions and derivations - calculations of these values for half wave rectified sine wave, full wave rectified Sine wave, Triangular and Square wave forms-form factor- peak factor **-** Representation of alternating quantities by equation, graphs and phasor diagrams **-** Phase and phase difference **–** Understanding of `J' notation for alternating quantities ,transformation from polar to rectanglar notations and Vice-versa

5. Single phase A.C. Series Circuits

Resistance, inductance and capacitance as circuit elements - concept of reactance, purely inductive and purely capacitive circuits - Derivation of voltage , current, power relations including phase relationships, wave forms and phasor diagrams **-** R-L, R-C , L-C & R-L-C series circuits - Derivation of relation between voltage, current, impedance, power including wave forms and phasor diagrams. Impedance triangle, phase angle, power factor, active and reactive components of current and power in above circuits – Definition of Resonance in series circuits and expression for resonant frequency- Q-factor-Importance of Q- factor- Problems on series circuits and series resonance.

6. Single phase A.C. Parallel Circuits

Simple Parallel circuits - solution by vector method and by `J' notation – problems **-** Resonant circuit – Condition for resonance in parallel circuit.

7. Poly phase circuits

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

REFERENCES

1. B.L. Theraja -Electrical Technology - Vol - I S.Chand &co.
2. A. K.SAWHNEY -Electrical and Electronic measuring instruments –- Dhanpat Rai & Sons.
3. E.W. Golding and F.C. Widdis,Electrical Measurements and measuring instruments – Wheelers publishers.
4. Hughes -Electrical Technology.
5. Parker Smith -Problems in Electrical Engg.
6. William Hayt and JackE,kemmerly -Engineering Circuit analysis -TMH
7. A.Chakrabarthy -Electrical Circuits - Dhanapat Rai and Sons
8. D. Roy Chowdary -Network and Systems - New age international publishers
9. K. Rajeshwaran -Electric Circuit Theory - Pearson educations,2004
10. Vanvalkanburg -Network Analysis - PHI.
11. Joseph Edminister -Electrical Circuits - Schaum series
12. Alexander Sadiku -Fundamentals of Electric circuits –- TMH
13. Mahmood Nahvi, Joseph A Edminister -Electric circuits -TMH.
14. Basic Electronics Engg By V.K.Mehta

GENERAL MECHANICAL ENGINEERING

Subject Title : General Mechanical Engineering

Subject code : EE-304

Periods/Week : 05

Periods/Semester : 75

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of Marks	SAQ	EAQ	Unit Test Bifurcation
1.	Simple Stresses and Strains	13	16	2	1	
2.	Torsion in Shafts	10	16	2	1	
3.	I.C. Engines	16	26	2	2	
4.	Boilers and Turbines	16	26	2	2	
5.	Pumps	20	26	2	2	
	Total	75	110	10	08	

OBJECTIVES

Upon completion of the course the student shall be able to

1. Simple Stresses and Strains

1.1. Definitions of Tensile stress, Compressive stress, Shear stress, Linear strain, lateral strain and, Poisson's ratio, elastic limit, Identify the different types of stresses and strains
1.2. State Hooke's law
1.3. Draw stress-strain curves for ductile and brittle materials under tension
1.4. Define working stress, ultimate stress, yield stress and factor of safety
1.5. State the factors to be considered in selecting factor of safety
1.6. Define Young's modulus, Modulus of rigidity, Bulk modulus
1.7. State the relationship between the three modulii of elasticity
1.8. Solve simple problems on the three modulii of elasticity
1.9. Solve simple problems on uniform bars subjected to loads
1.10. Solve simple problems on stepped bars subjected to loads
1.11. Define composite section
1.12. Define thermal stress

2. Appreciate the theory of Torsion

2.1. State the function of shafts
2.2. Classify shafts
2.3. Specify the standard sizes of shafts
2.4. Write the torsion equations with usual notations
2.5. State the procedural steps in design of shaft
2.6. Design a shaft from given data on the basis of strength
2.7. Design a shaft from given data on the basis of stiffness

3. I.C.ENGINES

3.1. Classify I.C.Engines
3.2. Illustrate the working of four stroke petrol engine
3.3. Illustrate the working of four stroke diesel engine
3.4. Illustrate the working of two stroke petrol engine
3.5. Compare four stroke and two stroke engines
3.6. Compare petrol engine and diesel engine
3.7. Illustrate the working of a Zenith carburetor
3.8. Illustrate the working of a fuel injection pump with governor

4. Boilers and Steam turbines

4.1. Classify steam boilers
4.2. Compare fire tube and water tube boilers
4.3. Differentiate between boiler mountings and accessories
4.4. List out popular boiler mountings
4.5. List out popular boiler accessories
4.6. Illustrate the working of Lamont boiler
4.7. State the principle of working of steam turbine
4.8. Classify steam turbines
4.9. Compare impulse and reaction turbines
4.10. Illustrate the working of De-Laval turbine
4.11. Illustrate the working of Parson's reaction turbine

5. Hydraulic turbines and pumps

5.1. Classify hydraulic turbines
5.2. Illustrate the working of Pelton wheel
5.3. Illustrate the working of Francis turbine
5.4. Illustrate the working of Kaplan turbine
5.5. Classify hydraulic pumps
5.6. Compare between centrifugal and reciprocating pumps
5.7. Illustrate the working of a double acting reciprocating pump
5.8. Illustrate the working of a single stage centrifugal pump
5.9. Illustrate the working of a jet pump
5.10. Illustrate the working of a submersible pump

COURSE CONTENT

1. Simple stress and strains

1.1. Definitions of Tensile stress, Compressive stress, Shear stress, Linear strain, lateral strain and, Poisson's ratio, elastic limit,
1.2. Hook's law - stress-strain diagram for ductile and brittle materials under tension - Working stress, Ultimate stress, yield stress - Factor of safety – selection of factor of safety
1.3. Young's modulus, Modulus of rigidity, Bulk modulus, relationship between the three (without proof) – simple problems
1.4. Simple problems on bars of uniform section subjected to external loading
1.5. Simple problems on bars of stepped section subjected to external loading
1.6. Concept of stresses in composite sections (problems omitted)
1.7. Concept of thermal stresses (problems omitted)

2. Torsion in shafts

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

3. I.C. Engines.

3.1. Classification of I.C Engines
3.2. Sketch and description of four stroke petrol engine
3.3. Sketch and description of four stroke diesel engine
3.4. Sketch and description of two stroke petrol engine
3.5. Comparison between petrol and diesel engine
3.6. Comparison between two stoke and four stroke engines
3.7. Sketch and description of a Zenith carburetor
3.8. Sketch and description of a fuel injection pump with governor

4. Boilers and Steam turbines

4.1. Classification of boilers
4.2. Comparison between fire tube-water tube boilers
4.3. Difference between Mountings and Accessories – functions of popular mountings and accessories (without sketches)
4.4. Sketch and description of Lamont high pressure boiler
4.5. Working principle of Steam turbine - Classification of steam turbines
4.6. Comparison between impulse and reaction turbines
4.7. Sketch and description of a De-Laval impulse turbine
4.8. Sketch and description of Parson's reaction turbine

5. Hydraulic turbines and pumps

5.1. Classification of hydraulic turbines
5.2. Sketch and description of Pelton wheel
5.3. Sketch and description of Francis turbine
5.4. Sketch and description of Kaplan turbine
5.5. Classification of pumps
5.6. Comparison between Centrifugal and Reciprocating pumps
5.7. Sketch and description of a double acting reciprocating pump
5.8. Sketch and description of single stage centrifugal pump
5.9. Sketch and explanation of a jet pump
5.10. Sketch and explanation of a submersible pump

Note : 1. This subject is to be taught by Mechanical faculty

2. Paper setting and paper evaluation is also to be done by Mechanical Faculty.

REFERENCES

1. Ramamrutham -Strength of materials
2. Surender Singh-Strength of materials
3. S.B.Junarker-Strength of materials
4. Jagadishalal-Hydraulic Machinery
5. R.S. Kurmi-Strength of Materials

ELECTRONICS – I

Subject Title : **Electronics - I**

Subject code : **EE-305**

Periods/Week : **04**

Periods/Semester : **60**

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of Marks	Short Questions	Essay Questions
1.	Semi Conductor devices	10	16	02	01
2.	Power supplies	08	16	02	01
3.	Special devices	12	26	02	02
4.	Introduction to Amplifiers	10	18	01	1 1/2
5.	Small Signal Amplifiers.	10	18	01	1 1/2
6.	Feed Back amplifiers	10	16	02	01
	Total	**60**	**110**	**10**	**08**

OBJECTIVES

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

1.0 Comprehend the Semi-Conductor Devices

1.1 State the electrical characteristics of
i) insulators ii) conductors iii) semi-conductors

1.2 Distinguish between intrinsic and extrinsic semi-conductors
1.3 Distinguish between P type and N type semi-conductors.
1.4 Explain the working of PN Junction diode with no bias, forward bias and reverse bias
1.5 Explain the operation of Zener diode.
1.6 Draw the characteristics of Zener diode.
1.7 Explain formation of PNP transistors

1.8 Explain formation of NPN transistors
1.9 State the different transistor configurations
1.10 Plot the Input / Output characteristics of a transistor in CB, CE configurations.
1.11 Compare the performance characteristics of a transistor in CB and CE configurations.
1.12 List the manufacturer specifications of
i) PN junction diode ii) Zener diode iii)Transistor.

2.0 Explain the working Principle of Power supply circuits

2.1 Draw the following circuits using P.N. junction diodes.
i) half wave ii) full wave iii) bridge rectifier

2.2 Explain the working principle of the following with waveforms.
i) half wave ii) full wave iii) bridge rectifier.

2.3 State the need for filter.

2.4 List the different types of filters.

2.5 Explain the function of Zener diode as a Voltage regulator in a power supply.

2.6 Explain the function of voltage regulated power supply.

2.0 Describe the Performance of Special Devices

3.1 Describe the construction of special devices i)UJT ii)FET iii)LEDs iv) LCD v)SCR vi)Solar cell vii) Opto-coupler viii) Photo diode and ix) photo transistor.

3.2 Explain the working of special devices: i) UJT ii)FET iii)LEDs iv) LCD v)SCR vi)Solar cell vii) Opto -coupler viii) Photo diode and ix) photo transistor.

3.3 Plot the V/I characteristics of above devices

3.4 List the applications of the special devices

4.0 Explain the principle of Working of Amplifiers.

4.1 Explain the operation of transistor as an amplifier.

4.2 State the necessity of proper biasing for amplifier action.

4.3 List the causes for instability of bias in transistor amplifier.

4.4 Explain different biasing methods such as collector to base bias, potential divider bias.

4.5 Determine the operating point on the set of characteristics.

5.0 Understand the Principle of Working of Small Signal Amplifiers.

5.1 Classify amplifiers on the basis of i) frequency ii) function iii)type of load iv) Period of Conduction v)Number of stages.

5.2 List the different types of coupling methods in amplifiers

5.3 Draw the circuit of i) RC coupled CE amplifier ii) Transformer coupled CE amplifier

5.4 State the function of each component of the above circuits.

5.5 Draw the frequency response characteristics of each circuit, indicate the gain band width, upper cut-off and lower cut-off frequencies.

5.6 Explain the necessity of cascading of amplifiers

5.7 Define `gain' in terms of decibel and define `band width'

5.8 List the applications of amplifiers

6.0 Comprehend the Working of Amplifiers.

6.1 Explain the need for power amplifier
6.2 Distinguish between voltage and power amplifier
6.3 Explain the working principle of a single tuned amplifier
6.4 Define i) feedback and ii) feedback factor
6.5 Draw the block diagrams of Voltage Series ,Voltage Shunt, current series and current shunt feedback amplifiers.
6.6 Explain the effect of feedback on gain, band width distortion, noise
6.7 Explain the performance characteristics of emitter follower.
6.8 List the applications of emitter follower.
6.9 Explain the differences between degenerative and regenerative feedback.
6.10 List the advantages of Negative feedback.

COURSE CONTENTS

1. Semi-conductor Devices

Insulators- Semi-conductors-conductor materials- Intrinsic and extrinsic semi-conductors, `P' and `n' type materials, PN Junction, forward and reverse bias- Zener diode, Zener diode characteristics - formation of PNP and NPN transistors- Transistor configurations- CB, CE - Input and output characteristics of CB,CE - comparison of CB,CE, configurations.

2. Power supplies

Half - wave, Full wave and bridge rectifiers. types of Filters, Voltage regulated power supply using Zener Diode,

3. Special Devices

UJT, FET, LED, LCD, SCR, Solar cell, Optocoupler, Photo diode, Photo transistor- characteristics and their applications.

4. Introduction to Amplifiers

Principles of Operation- Biasing and stabilization technique-Operating point and Load line Characteristics.

5. Small Signal Amplifiers

Classification of Amplifiers, Coupling methods, Frequency Response of R.C coupled, transformer coupled and Cascade Amplifiers and their applications.

6. Feed Back Amplifiers

Power amplifier-single tuned amplifier- feedback- Voltage Series and Voltage Shunt, current series and current shunt feedback amplifiers- emitter follower- Degenerative and regenerative feedback- Advantages of Negative feed back

REFERENCES

1. V.K. Mehta Principles of Electronics, S Chand& Co.
2. Bhargava-Basic Electronics and Linear circuits -TMH Publishers
3. Malvino -Electronic Principle
4. Mathur, Chada & Kulashrestha -Electronic devices and circuits
5. G.K. Mithal -Industrial Electronics
6. G.K. Mithal -Applied Electronics

DC MACHINES & MEASUREMENTS LAB

Subject Title : DC Machines & Measurements Lab
Subject Code : EE-306
Periods/Week : 06
Periods/Semester : 90

TIME SCHEDULE

S. No.	Major Topics	No. of Periods
1.	**Speed control & Testing of DC motors**	**24**
2.	**Characteristics of DC Generators**	**15**
3.	**Verification of Network Theorems & calibration of Instruments.**	**18**
4.	**1-Ø , A.C. Circuit Parameters.**	**12**
5.	**Measurement of Resistance and Power.**	**21**

OBJECTIVES:

Upon completion of the Practice, the student shall be able to

1.0 SPEED CONTROL AND TESTING OF DC MOTORS

1.1 Speed control of DC Shunt Motor by
(a) Rheostatic control method
(b) Field control method

1.2 Obtain the performance of a DC Shunt Motor by conducting Swinburne's test.
Obtain performance characteristics by conducting Brake Test on DC Shunt Motor

1.3 Obtain performance characteristics by conducting Brake Test on DC Series Motor.

1.4 Obtain performance characteristics by conducting Brake Test on DC Compound Motor.

2.0 CHARACTERSTICS OF DC GENERATORS

2.1 Obtain OCC of a DC shunt Generator at rated speed.

2.2 Obtain Internal and External characteristics of DC Shunt Generator.

3.0. Verification of Theorems & Calibration of Instruments

3.1 Verification of Super position theorem

3.2 Verification of Thevenin's theorem

3.3 Calibration of Dynamometer type of wattmeter

3.4 Calibration of single phase Energy meter

4.0 1-Ø , A.C. Circuit Parameters.

4.1 Determination of Idle & Energy components of current in a single phase Inductive circuit

5.0 Measurement of Resistance and Power.

5.1 Measure the resistance Using Megger
(a) Earth Resistance (b). Insulation Resistance.

5.2. Measurement of power in 1 -Ø circuit by a) 3-Voltmeter method b) 3-Ammeter method

5.3 Measurement of power in 3 -Ø balanced circuit by 2-Wattmeter method

Competencies to be achieved by the student

S.No	Experiment title	Competencies
1	Speed control of DC Shunt Motor by (a)Rheostatic control method (b) Field control method	• Select the proper DC supply voltage • Choose the proper range of voltmeter, ammeter and rheostat. • Connect the circuit as per the circuit diagram. • Ensure that all the instruments are connected in proper polarity. • Handle the 3- point Starter • Set the Field Resistance of the motor by gradually moving the knob on the rheostat coil. • Record the readings of Ammeter and Tachometer by gradually increasing the resistance in the Field rheostat. • Draw the graph speed Vs Field current. • Observe the graph and write the conclusions.
2,3,4&5	Performance characteristics of DC (Shunt ,Series, Compound)Motors. by conducting Brake Test	• Select the proper DC supply voltage • Choose the proper range of voltmeter, ammeter and rheostat. • Connect the circuit as per the circuit diagram. • Ensure that all the instruments are connected in proper polarity. • Start the Motor with the starter. • Note the readings of speed N, current I and spring balance for a particular load. • Pour water in the break drum carefully. • Check the speed and maintain it constant by means of field regulator before taking every reading. • Note readings by varying loads on the motor upto rated current. • Calculate the torque,input, output and efficiency. • Draw performance curves of motor
6	OCC of a DC shunt Generator at rated speeds.	• Draw the relevant circuit diagram for OCC test. • Select the proper DC supply voltage. • Choose the proper range of voltmeter, ammeter and rheostat. • Make the connections according to circuit diagram. • Ensure that all the instruments are connected in proper polarity. • Check the speed and maintain it constant by means of field regulator before taking every reading. • Observe and note the readings in a tabular form. • Draw the graph between I_f Vs E_g.

7	Obtain Internal and External characteristics of DC (Shunt)	• Select the proper DC supply voltage • Choose the proper range of voltmeter, ammeter and rheostat. • Connect the circuit as per the circuit diagram. • Ensure that all the instruments are connected in proper polarity. • Adjust the motor rheostat to minimum position • Adjust the Generator rheostat to maximum position • Adjust the speed of the motor to its rated value • Setting the Field Rheostat of the motor. • Gradually increase the Load current by operating the Load switches. • Measure the terminal voltage. • Measure the load current and armature current. • Measure the Armature resistance by DC Resistance method. • Calculate I_aR_a drop. • Draw the graph for External Characteristics • Draw the graph for Internal Characteristics • Observe the difference between the Graphs of Internal and External characteristics.
8&9	Verification of Network Theorems	• Draw the relevant circuit diagram • Select proper supply and load. • Select proper meters with proper ranges • Select proper wires to make connections as per circuit diagram • Ensure that all the meters are connected with proper polarity • Perform the experiment by carefully following the experimental procedure and precautions • Observe the readings without any scope for errors and tabulate
10&11	Calibration of meters	• Short M & C terminals of wattmeter • Connect for proper Current range. • Calculate Multiplication factor • Calculate P, Error, %Error • Draw graph between W and % Error
12	Measurement of Idle & Energy components of current in a 1-Ø Inductive circuit	• Select proper supply and load. • Select proper meters with proper ranges • Calculate I_X, Iy, sin Ø • Draw the vector diagram(I_y Vs I_x) • Vary resistance to change the load
13	Measurement of Resistance	• Select proper meters with proper ranges • Make connections as per circuit diagram • Read the values properly. • Calculate the value of Power

14	Measurement of Power	• Select proper supply and load. • Select proper meters with proper ranges • Make connections as per circuit diagram • Calculate the value of Power and power factor
15	Measurement of power in 3- Ø circuit using the two wattmeter method	• Short M & C Terminals of wattmeters and connect for proper current coil range • Find out the M.F of Wattmeter • Reverse wattmeter terminals for negative readings (Lead values) • Calculate P, power factor(cos Ø)

REFERENCES

1. Electrical Technology - Vol - I by B.L. Theraja – S.Chand&co.
2. Electrical Technology - Vol –II by B.L. Theraja - S.Chand&co.
3. Electrical machines by P.S. Bhimbhra
4. Electrical Machines by M.V.Deshpande
5. Electric Machines by D.P.Kothari, J.Nagarath – TMH

ELECTRICAL WIRING & MAINTENANCE LAB

Subject Title : Electrical Wiring & Maintenance Lab
Subject Code : EE - 307
Periods/Week : 06
Periods/Year : 90

TIME SCHEDULE

S. No.	Major Topics	No. of Periods
1.	Special Lamp Connections	12
2.	Wiring Practice for Power Loads	18
3.	Motor Connections	09
4.	Earthing	06
5.	Testing and repair of Domestic appliances	12
6.	Identification of terminals of DC motors	12
7	Overhauling of DC Machine	6
8	Overhauling of AC Machine	6
9	Practice on Motor winding	9
	Total	90

OBJECTIVES(LIST OF EXPERIMENTS)

Upon completion of the course the student shall be able to

1. Control two Lamps by Series - Parallel connection using one 1-way switch & two 2-way switches with PVC surface conduit system
2. Control and practice the wiring for Fluorescent Lamp
3. Control and practice the wiring for LED Lamp
4. Control two sub- circuits through Energy meter, MCB's and two 1-way switches.
5. Connect the Inverter to power supply through 2/3 pin socket and 1-way switch (Back up)
6. Connect Computer by main switch board with a miniature circuit breaker.
7. Prepare switch Board with DOL starter, MCB,1-phase Preventer and Pilot lamps for 3 phase motor
8. Prepare switch board with star delta starter, MCB, Pilot lamps for 3 phase motor
9. Prepare Pipe Earthing.
10. Prepare Plate Earthing.
11. Test and repair the Domestic appliances

12. Identify the terminals of given DC motors
13. Perform the Overhauling of DC Machine.
14. Perform the Overhauling of AC Machine.
15. Practice on Motor winding.

Note: 1. Every student has to bring insulated tool kit and follow the general safety precautions throughout the lab sessions

2. Should not touch the live terminals.

Competencies to be achieved by the student

S.No	Experiment title	Competencies
1	Series-Parallel connection	• Select colour and length of wire for phase and neutral. • Make connections as per wiring diagram. • Draw wire through PVC pipe properly • Observe glow intensity of lamps for series and parallel connections
2	Wiring practice of fluorescent lamp	• Make connections as per wiring diagram. • Connect top point and bottom point of the choke to tube light properly. • Note the importance and working of starter.
3	Wiring practice of L.E.D lamp	• Identify the size of cable, type of 1-way switch. • Read the specifications of LED. Lamp. • Measure the power across the lamp.
4	Control two sub circuits through Energy meter, MCB's and two 1-way switches	• Draw wiring diagram. • Identify the size of cable,1-way switch, PVC pipe, MCB, capacity of Inverter and Socket • Read the specifications of MCB, capacity of Inverter and Socket • Make connections as per wiring diagram. • Draw wire through PVC pipe properly. • Connect supply to Inverter through MCB properly. • Select appropriate socket with switch control. • Make earth wire connections for required points.
5	Connect the inverter to power supply through 2/3 pin socket and 1-way switch	• Draw wiring diagram. • Select the size of cable,1-way switch, PVC pipe, MCB, capacity of Inverter and Socket as per specifications. • Make connections as per wiring diagram. • Draw wire through PVC pipe properly. • Connect supply to Inverter through MCB properly. • Select appropriate socket with switch control. • Make earth wire connections for require points

6	Connect computer by main switch board with a miniature circuit breaker.	• Draw wiring diagram. • Identify the size of cable, 1-way switch, PVC pipe, MCB and Sockets • Read the specifications of MCB and Sockets • Make connections as per wiring diagram. • Connect supply to Computer through MCB properly. • Select appropriate sockets with 1-way switch control. • Make earth wire connections for require points.
7	Prepare switch Board with DOL starter, MCB and Pilot lamps for 3 phase Motor	• Draw wiring diagram. • Select the size of cable, PVC pipe, star-delta starter, MCB and lamp holder as per specifications. • Make connections as per wiring diagram. • Draw wire through PVC pipe properly. • Draw wire of the 3-phase to the motor through star-delta starter. • Observe star-delta starter and motor connections. • Observe output terminals of star-delta starter (six) • Test with 3-phase, 415 V, 50 Hz supply to the circuit connected through ICDP switch. • Test by changing any two phases of input supply.
8	Prepare switch board with star delta starter, MCB, Pilot lamps for 3 phase motor	• Select the size of cable, PVC pipe, star-delta starter, MCB and lamp holder • Make connections as per wiring diagram. • Draw wire through PVC pipe properly. • Draw wire of the 3-phase to the motor through star-delta starter. • Test with 3-phase, 415 V, 50 Hz supply to the circuit connected through ICDP switch. • Test by changing any two phases of input supply
9	Prepare Pipe Earthing	• Draw earthing diagram with specifications. • Select suitable GI pipes ,GI wire reducing socket and funnel with wire mesh. • Prepare the earth pit of 2.5 m below the surface of the ground. • Place Earth pipe in vertical position. • Draw GI wire to the earthing pipe fastened with bolts & nuts. • Fix the funnel with wire mesh at the top of GI pipe. • Pour sand, char coal and salt in alternate layers of about 15 cm around the earth pipe. • Test the earth resistance with Megger
10	Prepare Plate Earthing	• Draw Earthing diagram with specifications • Select suitable GI plate, GI wire and funnel with wire mesh • Prepare the earth pit of 1.5 m below the surface of the ground • Place Earth plate in vertical position • Draw GI wire to the GI pipe fastened to GI plate / copper plate with bolts & nuts. • Pour sand, char coal and salt in alternate layers of about 15 cm around the earth pipe. • Test the earth resistance with Megger. • Verify the earth resistance.
11	Testing and repair of domestic appliances	• Inspect the appliance visually. • Check for any discrepancies. • Perform the disassembling operation • Test the inner parts for any faults

		• Rectify the faults if any . • Replace the parts if necessary. • Perform the assembling. • Test theDomestic appliance for proper functioning.
12	Identify the terminals of the following DC Machines (a)DC Shunt motor (b)DC Series Motor (c)DC Compound Motor.	• Note down the name plate details. • Locate the different terminals of a DC Shunt Motor / DC Series Motor./. DC Compound Motor. • Measure the resistance across different terminals using multimeter. • Record the resistance values of the terminals. • Identify the armature and shunt field / series field resistance according to resistance values observed.
13	Overhauling of DC Machine	✓ Note the type of given DC machine. ✓ Disassemble the End covers. ✓ Remove the Armature. ✓ Remove the Bearing using Bearing pullers. ✓ Test the condition of winding and commutator using electric growler. ✓ Test the insulation resistance of the armature and field resistance using megger. ✓ Observe the bearings, clean and apply grease. ✓ Increase the insulation resistance of the winding by coating/ applying varnish (if insulation resistance is low). ✓ Heat the winding to absorb the moisture using Electric Oven/ High wattage lamps (to improve insulation resistance). ✓ Note the condition of Mica insulation between two commutator segments. ✓ Gently clean the surface of the commutator. ✓ Record the condition of the brushes and brush holders. ✓ Reassemble the machine. ✓ Record the speed, noise, output and temperature raise of the machine.
14	Overhauling of AC Machine Continued….	✓ Note the type of given AC machine. ✓ Disassemble the End covers. ✓ Remove the Armature. ✓ Remove the Bearing using Bearing pullers. ✓ Note the condition of armature winding using electric growler. ✓ Record the insulation resistance of the stator and rotor using megger. ✓ Record the condition of bearings, clean and apply grease as per the condition. ✓ Improve the insulation resistance of the winding by coating/ applying varnish (if insulation resistance is low) ✓ Heat the winding to using Electric Oven/ High wattage lamps to absorb the moisture (to improve insulation resistance) ✓ Reassemble the machine. ✓ Record the running condition of the machine both mechanical & electrical aspects

15	Practice on Motor winding	✓ Note the type and rating of the given motor. ✓ Record the type of bearings employed in the motor. ✓ Identify and test the condition of windings using test lamp / megger. ✓ Note the gauge of the winding coil used. ✓ Record the class of insulation used. ✓ Note the fault in a given machine. ✓ Draw the winding diagram according to its construction. ✓ Estimate the quantity and cost of material required. ✓ Prepare the coils using coil winding machine ✓ Insulate the slots by using slot insulating material (Milmen paper, Wooden strips). ✓ Insert the coils in to slots and make end connections , insulate the coils using tape and varnish the winding.

REFERENCE

1. Electrical work shop By R.P.Singh
2. Electrical Design Estimating And Costing By K.B. RAINA & S.K.BHATTA CHARYA
3. Residential and Commercial Industrial Electrical systems Vol.2 by Joshi-TMH
4. Residential and Commercial Industrial Electrical systems Vol.3 by Joshi-TMH
5. Industrial Safety management by Deshmukh –TMH
6. Operation & Maintenanceof Electrical Machines Vol – I by B V S Rao
7. Preventive Maintenanceby C.J. Hubert

C- LANGUAGE LAB

Subject Title : **C LANGUAGE LAB**

Subject code : **EE- 308**

Periods/Week : **03**

Periods/Semester : **45**

TIME SCHEDULE

Sl. No	Major Topics	Periods
1.	C Programming Basics	6
2.	Decision & Loop Control Statements	9
3.	Exercises on functions	6
4.	Arrays, Strings and Pointers in C	18
5.	Structures, Unions & Preprocessor Directives	6
	Total	45

OBJECTIVES (LIST OF EXPERIMENTS)

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

I. C Programming Basics

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

II. Decision & Loop Control Statements

3. Exercises on Selective Structures (if, if – else, else if statements).
4. Exercises on Selective Structures (switch statements and conditional operator).
5. Exercises on Repetitive Structures (while, do – while and for statements).

III. Exercises on functions

6. Exercises on functions to demonstrate prototyping, parameter passing, function returning values.
7. Exercises on recursion.

IV. Arrays, Strings and Pointers in C

8. Exercises on one dimensional arrays.
9. Exercises on two dimensional arrays.
10. Exercises on arrays and functions.
11. Exercises on Strings handling functions comparison, copying and concatenation.
12. Exercises to demonstrate use of Pointers, pointers as function arguments, functions returning pointers.
13. Exercises on arrays and pointers.

V. Structures, Unions & Preprocessor Directives

14. Exercise on structures.
15. Exercises on unions and C preprocessor Directives.

ELECTRONICS Engineering Lab – I

Subject Title	**:**	**Electronics Engineering Lab- I**
Subject Code	**:**	**EE-309**
Periods/Week	**:**	**03**
Periods/Semester	**:**	**45**

TIME SCHEDULE

S. No.	Major Topics	No. of Periods
1.	**Characteristics of electronic devices**	**21**
2.	**Circuits**	**24**
	Total	**45**

List of Experiments

Characteristics of Electronic Devices

1. Draw the forward & reverse characteristics of Silicon diode
2. Draw the forward & reverse characteristics of Zener diode and determine Breakdown Voltage
3. Draw Input and output characteristics of NPN Transistor

   a) in CB configuration and b) in CE configuration

4. Drain the input and output characteristics of JFET and determine pinchoff voltage and transconductance.

Circuits

5. Implementing Half wave rectifier with and without filter
6. Implementing Full wave rectifier with and without filter
7. Implementing Bridge rectifier with and without filter
8. build a Regulated power supply and draw the regulation characteristics

   i) using Zener diode ii) using 3 Terminal +ve Regulator IC

9. Implement a –ve 3 Terminal Regulator IC and draw the regulation characteristics
10. Show that a FET can be used as a constant current source with appropriate bias

IV SEMESTER

(FOURTH 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
THEORY								
EE-401	A.C.MACHINES -I	5		75	3	20	80	100
EE-402	POWER SYSTEMS –I (G&P)	5		75	3	20	80	100
EE-403	ELECTRICAL UTILISATION & TRACTION	5		75	3	20	80	100
EE-404	ELECTRICAL INSTALLATION & ESTIMATION	4		60	3	20	80	100
EE-405	ELECTRONICS ENGG - II	5		75	3	20	80	100
PRACTICAL								
EE-406	ELECTRICAL ENGG DRAWING		7	105	3	40	60	100
EE-407	A.C.MACHINES -I LABORATORY		4	60	3	40	60	100
EE-408	COMMUNICATION SKILLS LAB		3	45	3	40	60	100
EE-409	ELECTRONICS LAB - II		4	60	3	40	60	100
TOTAL		24	18	630	27	260	640	900

A.C MACHINES - I

Subject Title : A.C. MACHINES - I
Subject code : EE-401
Periods/Week : 05
Periods/semester : 75

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage	Short Questions	Essay Questions
1.	Single phase Transformers	35	52	04	04
2.	Three phase Transformers	10	16	02	01
3.	Alternators	20	29	03	02
4.	Parallel Operation of Alternators	10	13	01	01
	Total	75	110	10	08

OBJECTIVES

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

1.0 Understand the working of single phase transformer and 3 phase transformers

1.1 Define the word `Transformer'.
1.2 Explain the working of single-phase transformer.
1.3 Classify the transformers based on
i) Number of phases ii) construction iii) function.
1.4 Describe the constructional details of transformers.
1.5 State the function of each part of the transformer with legible sketch.
1.6 Distinguish between shell type and core type transformers.
1.7 Derive the E.M.F equation of a single power transformer.
1.8 Define 'transformation' ratio.
1.9 Draw Vector diagram for a transformer working on no load.
1.10 Calculate the core loss.
1.11 Explain the procedure for finding R_o and X_o from no load test.
1.12 Develop the vector diagram of a transformer on load for
(i) Unity power factor
(ii) Lagging power factor
(iii) Leading power factor
1.13 State the effects of leakage reactance of primary and secondary windings.
1.14 Draw the equivalent circuit of a transformer by approximation.
1.15 Determine the equivalent circuit constants from no-load test and short circuit test data.
1.16 Derive the approximate equation for regulation for transformer.
1.17 Calculate regulation of a Single Phase Transformer for
(i) Unity power factor
(ii) Lagging power factor
(iii) Leading power factor
1.18 List the losses taking place in a transformer.
1.19 Derive the condition for maximum efficiency of a transformer.
1.20 Solve simple numerical problems.
1.21 State the reason for transformer rating in KVA.
1.22 Calculate the all day efficiency for a given load cycle.
1.23 Differentiate between distribution transformer and power transformer.
1.24 Explain the polarity test on single-phase transformer.
1.25 State the need for parallel operation of transformer.
1.26 Mention the conditions for paralleling and load sharing of transformers.

2.0 Understand Three Phase Transformers

2.1 State the advantages of 3 phase transformer over single phase transformer.
2.2 List the different types of three phase transformers by giving their symbolic representation and voltage relationships.
2.3 State the applications of i) star-star ii) delta-star iii) star-delta iv) delta-delta connected transformers.
2.4 State the conditions for parallel operation of 3 phase transformers.
2.5 List the special transformers.
2.6 State the advantages and disadvantages of autotransformers
2.7 State the expression for saving of copper in auto transformer.
2.8 State the necessity of cooling of power transformers.
2.9 Explain the methods of cooling of power transformer.
2.10 Draw a legible sketch of a power transformer
2.11 Explain the function of each part of a power transformer.
2.12 Explain the `on load' and `off load' tap changing.
2.13 Explain the procedure for tap changing for on load and no load tap changer.

3.0 Understand the classification, construction, working and testing of alternators

3.1 Explain the Principle of working of Alternators.
3.2 Describe the Constructional details of Alternators with legible sketch.
3.3 Classify the Alternators based on rotor construction.
3.4 Explain the working of the of Alternator having
i) Cylindrical Rotor ii) Salient Pole Rotor
3.5 State the advantage of Stationary Armature.
3.6 List the main parts of Alternator along with materials used.
3.7 State the effect of Chording and Distribution factor
3.8 Derive expressions for Chording factor and Distribution factor
3.9 Derive EMF equation of an alternator taking into account distribution factor and pitch factor
3.10 Solve simple problems on E.M.F equation
3.11 State the need for an exciter in an Alternator.
3.12 List the various types of exciters (main, pilot and static)
3.13 Explain Armature Reaction of Alternator at different P.F's.
3.14 State the reasons for voltage variations on Load.
3.15 Define the term synchronous impedance.
3.16 State the effects of synchronous impedance on the operation of the Alternator.
3.17 Draw the vector diagram of voltages and currents for different power factors.
3.18 Define regulation of an alternator
3.19 List the different methods of finding the regulation of alternator.
3.20 Calculate the regulation by synchronous impedance method

4.0 Comprehend the procedure for voltage control and synchronisation

4.1 Explain the necessity for parallel operation of alternators
4.2 State the conditions for synchronisation
4.3 Explain the procedure of synchronisation by using lamps and synchroscope methods.
4.4 Explain the method for adjusting the loads shared by two alternators (or one alternator with infinite bus bar).
4.5 Explain the effect of change in input and excitation of an alternator connected to infinite bus.
4.6 Problems on above topics.

COURSE CONTENT

1. Transformers

Classifications of transformers, Construction of transformers, Theory of an ideal transformer - emf equation derivation - Ratio of transformation and relation between turn ratio - Voltage ratio and current ratio, Transformer on no load - No load current components and no load power factor -Transformer on load - Equivalent circuit of transformer - Equivalent circuit constants by transformation, Short circuits test - Regulation of transformer - definition and derivation of approximate equation for regulation based on vector diagram for lagging ,leading, unity power factor - determination of regulation from S.C. Test data , Losses in transformer -determination from O.C. and S.C. tests data- efficiency, condition for maximum efficiency – rating of transformer-All day efficiency definition - Calculation for a given load cycle- problems, Polarity test - Efficiency calculation, Parallel operation of single phase transformers - necessity - conditions for paralleling-load sharing of single phase transformers

2. Three phase transformer

Descriptive treatment of star-star, delta-delta, star-delta and delta-star, voltage current and phase relation for the above groups-conditions to be fulfilled for paralleling 3 phase transformer, open delta working of 3 phase transformers, Auto-transformers –expression for copper saving – applications, Necessity of cooling - Methods of cooling - Sketch of power transformer indicating parts and explain their functions - Tap changing gear - no load and on load tap changing procedure.

3. Alternators

Classification of low, medium and high speed alternators - Brief description of parts with sketches and function of each part, construction, Assembly - Exciter and pilot exciter – Stationary armature type construction – Advantages**,** Concentrated and distributed windings - short pitch and full pitch coils - Effect of chording and distribution factors - EMF equation - Derivation – Problems**,** Cause for variation of voltage on load - Resistance, leakage reactance - Armature reaction - Synchronous reactance and synchronous impedance concepts - phasor diagram for unity, lagging and leading power factor loads, Regulation - definition - derivation of relation between no load voltage and on load voltage for different power factors – Different methods of finding regulation- Calculation of regulation by synchronous impedance method.

4. Parallel operation of alternators

Necessity for parallel Operation - condition to be fulfilled for synchronisation, Synchronisation by lamps & synchroscope methods - Load sharing – simple problems-Effect of change in excitation and input of an alternator connected to infinite.

REFERENCES:

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2. M.G Say -AC machines
3. DP Kothari, IJ Nagrath – Electric Machines- Mc.Graw.Hill
3. P.S. Bhimbra -Electrical machines - Khanna Publishers
4. A.E. Fritzgerald, C. Kingsley and S. Umans Electrical machinery-Mc Graw Hill
5. MV Deshpande-Electric machines –, Wheeler publishing.
6. BR Gupta and Vandana singhal Fundamentals of Electric machines

POWER SYSTEMS – I

Subject Title : POWER SYSTEMS – I (GENERATION & PROTECTION)
Subject Code : EE – 402
Periods / Week : 05
Periods / Semester : 75

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of Marks	Short Questions	Essay Questions
1.	Sources of Energy	05	06	02	--
2.	Thermal Power Station	08	13	01	01
3.	Hydro Electric Power Station	08	13	01	01
4.	Nuclear Power Station	08	13	01	01
5.	Renewable Energy Sources	08	13	01	01
6.	Combined Operation and Economics	14	18	01	01 1/2
7.	Switch Gear and Circuit Breakers	09	13	01	01
8.	Protection of Alternators and Transformers	08	13	01	01
9.	Relays & Lightning arrestors	07	08	01	1/2
	Total	75	110	10	08

OBJECTIVES:

Upon completion of the course the student shall be able to

1.0 Appreciate the various sources of power generation.

1.1 List the different sources of energy
1.2 Classify the sources of energy into conventional and non-conventional types.
1.3 State necessity of developing non-conventional methods of power generation.
1.4 Explain the method of generating electrical energy from (i) Tidal Power (ii) Bio-Mass (iii)Geo-thermal Power
1.5 State the relative merits and limitations of Conventional and Non-Conventional types of sources.
1.6 State the need of energy conservation.
1.7 List the different methods of energy conservation.

2.0 Comprehend the working of thermal power station.

2.1 Explain the general principle of working of thermal power stations.
2.2 List the requirements for setting up of Thermal Power Station.
2.3 Mention the requirement for site selection of thermal power plant.
2.4 Explain the principle of working of each component of thermal power station with line diagram.
2.5 State the necessity of cooling towers in thermal power plant
2.6 List the types of cooling towers in thermal power plants.
2.7 Mention the causes of pollution
2.8 List the methods to control Pollution.

3.0 Comprehend the working of hydroelectric power stations.

3.1 Explain the principle of working of Hydro power station.
3.2 List the requirements for setting up of Hydro Electric Power (HEP).Station.
3.3 Mention the requirement and factors for site selection of Hydro Electric Power Plant.
3.4 Classify the H.E.P's based upon

i) Head ii) Duty iii) Location and iv) Hydraulic considerations.

3.5 Explain with layout diagram working of the following Power Stations
ii) High Head, ii) Medium Head, iii) Low Head.

3.6 State the need of i) Surge Tank, ii) Fore bay, iii) Spill gates.

4.0 Comprehend the working of Nuclear Power Stations.

4.1 State the importance of nuclear energy
4.2 Explain fission and fusion reactions.
4.3 State the merits of using nuclear energy
4.4 List the various risks involved in using nuclear energy
4.5 Mention the various nuclear fuels used in nuclear power station by giving their properties.
4.6 List the types of reactors used in Nuclear power stations.
4.7 Explain the working of reactors in Nuclear power stations
4.8 State the merits and demerits of reactors in Nuclear power stations.
4.9 Explain the working of a moderate type nuclear power station with a block diagram.
4.10 Mention the materials used for i) Coolant ii) Reflector and iii) Control rods
4.11 State the need & explain the working of i) Coolant ii) Reflector and iii) Control rods.

5.0 Appreciate the Renewable energy sources of Power Generation.

5.1 State the amount of solar radiation reaching the earth surface.
5.2 State the Principle of Conversion of solar radiation in to heat.
5.3 State the different methods of Storing Solar Energy.
5.4 State the Principle of Photo-Voltaic Conversion.
5.5 Explain the function of Flat Plate Collector.
5.6 State the Working Principle of Solar Cell.
5.7 Explain the working of Solar water heater, Solar street Light and Solar Pump Set with block diagram.
5.8 Explain the Working of Roof Top Solar Power Generation with block diagram.
5.9 Mention the Power available in the wind and the force caused by it on the blades.
5.10 State the collection of wind data and estimate the energy.
5.11 State the different considerations for site selection for installing Wind Mill.
5.12 List the basic components of wind Mill.
5.13 Describe the constructional details of wind Mill.
5.14 Explain the working Principle of wind mill.

6.0 Appreciate the combined operation and economics of power stations.

6.1 State the need for reliability of electrical energy.
6.2 Differentiate between isolated operation and integrated operation of power stations.
6.3 List the merits of integrated operation.
6.4 Explain the process of integrated operation and need for grid at various levels
6.5 List the various Charges and expenses in power station
6.6 Classify the Charges as fixed and running.
6.7 Define the terms i) Load curve ii) Load factor
iii) Diversity factor iv) Maximum demand.
6.8 Discuss the effects of load factor and diversity factor on the cost of generation
6.9 Solve numerical problems on the above.
6.10 Explain various types of consumer tariffs and compare them.
6.11 Solve numerical problems on the above.
6.12 Discuss the effects of P.F on electricity charges
6.13 Mention the methods to improve Power Factor.
6.14 Solve numerical problems on electricity charges
6.15 Discuss the need for energy management.

7.0 Comprehend Switch Gear and Circuit Breakers.

7.1 State the types of faults in power system and their effects.
7.2 Define and classify switch gear
7.3 State the purpose of isolators, air break switches and knife switches.
7.4 Explain the phenomenon of arc, arc voltage, arc current and its effects.
7.5 State factors responsible for arc formation.
7.6 Describe the methods of arc quenching.
7.7 Classify the circuit breakers based upon medium of arc quenching.
7.8 State the principle of Bulk oil circuit breaker(B.O.C.B)
7.9 List the types of BOCB.
7.10 Explain the working of each type of B.O.C.B.
7.11 State the principle of Minimum oil circuit breaker M.O.C.B
7.12 Explain the working of MOCB.
7.13 Compare B.O.C.B and M.O.C.B
7.14 State the properties of SF_6 gas
7.15 State the principle of working of SF_6 circuit breakers.
7.16 Explain the working of SF_6 CB .
7.17 Explain the principle and working of Air break circuit breaker (A.B.C.B.)
7.18 Compare OCB, SF_6 CB and A.B.C.B.

8.0 Understand the Protection of Alternators and Transformer.

8.1 List the probable faults in Alternator Stator and Rotor
8.2 State the effects of faults on Alternator Stator and Rotor.
8.3 Describe the scheme of protection against excessive heating of stator and rotor.
8.4 Explain the differential protection for alternator stator.
8.5 Explain the earth fault protection for rotor.
8.6 Explain the split phase protection of alternator against inter-turn short circuits.
8.7 Explain the need and working of field suppression protection.
8.8 List the possible faults in a transformer by mentioning their effects.
8.9 List the precautions to be taken for applying differential protection to transformers.
8.10 Explain differential protection of transformer.
8.11 Explain the working of Buchholz relay and its protection scheme for transformer.

9.0 Comprehend Relays and Lightning Arrestors.

9.1 Define relay and State the basic requirements.
9.2 State the important features of relays.
9.3 List the different types of relays and classify them.
9.4 Define surge.
9.5 List the types of surges.
9.6 Give reasons for the cause of surges..
9.7 Explain the scheme of surge protection with diagram.
9.8 Explain the types of lightning arrestors or surge diverters.
9.9 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.
9.10 Explain the working of the above lightning arrestors

COURSE CONTENT

1. Introduction

Different sources of energy - Conventional and Non-conventional sources - Need for Non-Conventional Energy based power generation - Methods of generation of energy from different sources of power such as Wind, Tidal, Bio-mass and Geo-Thermal - Merits and Limitations of Conventional and Non-conventional sources - Need for energy conservation and their methods.

2. Thermal Power Station

Thermal Power Station - Principle of working - Factors for selection of site - Thermal power station - Components and principles of working- Cooling towers and their types - Causes of pollution and methods to control them.

3. Hydroelectric Power Stations

Hydro Electric Power Station - Factors for site selection and limitations in location and operation – Classification of hydroelectric power stations based on head, duty, location and hydraulic considerations - Layout diagram of High Head ii) Medium Head iii) Low Head Power Stations - Working of surge tank, fore bay, spill gates.

4. Nuclear Power Stations

Nuclear energy, fission and fusion reactions - Merits and risks in using nuclear energy. Nuclear fuels and their properties - Working of reactors with merits and demerits - Working of moderated type nuclear power station with a block diagram - Need and working of coolant, reflector, control rods – Materials used for them - Power control by control rods.

5 . Renewable Energy Sources of Power Generation.

Amount of Solar Radiation reaching the Earth- Conversion Principle- Methods of Storing solar Energy- Photo-Voltaic Conversion – Principle – Working of Flat Plate Collector- Working Principle of Solar Cell – Working of Solar Water heater- Solar street Light- Solar Pump set- Roof Top Solar Power Generation - Power available in Wind- collection of wind data- Energy estimate- Selection of Site for wind power mill- Basic Components of Wind Mill- Construction details – Working Principle.

6. Combined Operation and economics of Power Stations

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

7. 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_6 gas and principles of SF_6 circuit breakers – Working of A.B.C.B, O.C.B, SF_6 CB and their comparisons.

8. 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,

9. Relays and Lightning arrestors.

Requirements, activities of relays – Classifications based on duty, principle of operation and time of operation – Need for Surge Protection and its methods – 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.

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3. A.T.Starr -Generation, Transmission and Utilisation
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5. Renewable Energy Sources ..NEDCAP

ELECTRICAL UTILISATION & TRACTION

Subject Title	**:**	**ELECTRICAL UTILISATION & TRACTION**
Subject Code	**:**	**EE-403**
Periods/Week	**:**	**05**
Periods/semester	**:**	**75**

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of marks	Short questions	Essay questions
1.	Electric Lighting	**16**	**26**	**2**	**2**
2.	Electric heating	**14**	**21**	**2**	**1 1/2**
3.	Energy saving devices	**10**	**16**	**2**	**1**
4.	Electric Traction – Properties and equipment	**20**	**26**	**2**	**2**
5	Traction supply systems and Train lighting systems	**15**	**21**	**2**	**1 1/2**
	Total	**75**	**110**	**10**	**8**

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 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 xii) wave length
xiii) glare

1.3 Explain the production of light by

i) Excitation ii) Ionisation
iii) Fluorescence and phosphorescence

1.4 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

1.5 State the requirements of good lighting
1.6 List the lamp fittings used in domestic and Industrial applications
1.7 Draw different lamp fittings
1.8 State the uses and advantages of each type of Lamp fittings.
1.9 State and explain the laws of illumination.
1.10 Solve Problems on Illumination
1.11 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
1.12 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 Appreciate the Concept of Electric Power saving Devices

3.1 State the need of power saving devices.
3.2 Draw Automatic temperature control circuits for (coolers, geysers, air conditioners, and iron boxes)
3.3 Draw Automatic illumination control circuits using LDR's.
3.4 List the advantages of CF Lamps.
3.5 List the advantages of LED lamps over other types of lamps.
3.6 Compare LED lamps with tungsten filament lamps.
3.7 Use of LED lamps in energy Conservation for various applications like Street, Flood, domestic and hotels etc

3.8 Explain the working of magnetic Induction lamps.
3.9 List the advantages of Remote operated Power devices like TV, Fan, lamps and motors.
3.10 State the principles of Energy efficient systems.
3.11 List the advantages of using energy efficient systems for Electric motors, transformers and Power factor improvement devices.
3.12 Explain the concept of energy auditing and Management.
3.13 Factors considered for STAR ratings of various electrical appliances.

4.0 Appreciate the Electric Traction Properties and equipment

4.1 Describe single-phase A.C. and Composite systems
4.2 List the types of services (main line, suburban, Metro and urban)
4.3 Sketch the speed-time curves for the above services
4.4 State each stage of the speed-time curve with appropriate speeds.
4.5 State the importance of speed-time curves
4.6 Define Maximum speed, average speed and scheduled speed
4.7 List the factors affecting the scheduled speed
4.8 sketch the simplified speed-time curves and state their practical importance
4.9 Derive the expression for i) maximum speed ii) acceleration and retardation for a) Trapezoidal speed time curve & b) Quadrilateral speed time curve.
4.10 Solve numerical examples on above speed time curves
4.11 Explain the tractive effort
4.12 Derive the expression for tractive effort for acceleration to overcome gravity pull and train resistance.
4.13 Calculate the tractive effort under given conditions
4.14 Explain the mechanics of transfer of power from motor to driving wheel
4.15 Define `Coefficient of adhesion'
4.16 List the factors affecting the coefficient of adhesion
4.17 solve problems on calculation of number of axels required.
4.18 State the methods of improving the coefficient of adhesion
4.19 Explain the term specific energy consumption
4.20 Derive the formulae for energy output of drive to
   a. Accelerate
   b. To overcome friction
   c. To overcome gradient
4.21 List the factors affecting specific energy consumption
4.22 Solve simple problems on specific energy calculation under given conditions.
4.23 List the various Overhead Equipments (OHE) in Traction.
4.24 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.
4.25 State the importance of Neutral Section.
4.26 State the importance of Section Insulator.
4.27 State the importance of an Isolator.
4.28 List the different types of signal boards of OHE.
4.29 State the important requirements of traction motor
4.30 Explain the suitability of different motors D.C,1-ϕA.C, 3-ϕ A.C. ,Composite & Kando systems for traction
4.31 Explain with legible sketch the control of traction motor by autotransformer method in single phase 25 kv system

4.32 State the need for Booster Transformer

5.0 Explain the Traction supply systems and Train lighting systems

5.1 List the various constituents of Supply systems in traction Substations.

5.2 Describe the various constituents of Supply systems

i) Feeding Posts. II) Feeding and Sectioning Arrangements.

iii) Sectioning and Paralleling Post. vi) Sub sectioning and Paralleling Post.

v) Sub sectioning Post. vi) Elementary Section.

vii) Miscellaneous Equipments at Control Post or Switching Stations.

5.3 Describe the Major Equipment at traction Substation.

i) Transformer.
ii) Circuit Breaker.
iii) Interrupter.

5.4 Explain the importance of Location and Spacing of Substations.

5.5 Explain End on Generation.

5.6 Explain Mid on Generation

5.7 State the requirements of Train lighting.

5.8 Describe the method of obtaining Unidirectional polarity.

5.9 Describe the method of obtaining constant output.

5.10 Explain i) single battery system ii) Double battery parallel block system

5.11 Mention the requirements of railway coach air conditioning.

COURSE CONTENT

1. **Electric Lighting**

Nature of light and its production, electromagnetic spectrum physical spectrum - units of wave length - Terms and definitions plane and solid angle, luminous flux, Lumen, C.P, glare, 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. **Electric 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. **Energy 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 LED lamps with tungsten filament lamps-Advantages of Remote operated Power utility devices -Principles of Energy efficient systems- Use of LED lamps in energy conservation- Working of magnetic induction lamp-

Advantages of using energy efficient systems for Electric motors, transformers and Power factor improvement devices- Concept of energy auditing and Management- Factors considered for STAR rating of various electrical appliances..

4. Electric Traction properties and equipment

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. Overhead Equipments (OHE).- Principles of Design of OHE:- Neutral Section - Section Insulator.- Isolator - Different types of signal boards of OHE.- State the important requirements of traction motor - suitability of different motors D.C, 1-ϕA.C, 3-ϕ A.C. ,Composite & Kando systems for traction - Control of traction motor by autotransformer method in single phase 25 kv system - Need of Booster Transformer.

5. Traction supply systems and Train lighting systems

Substations - Feeding Post – types - Miscellaneous Equipments at Control Post or Switching Stations.- Major Equipments at traction Substation. - Transformer Protection and 25 KV Catenary Protection - Location and Spacing of Substations - End on Generation- Mid on Generation-Requirements of Train lighting- Unidirectional polarity – Methods of obtaining constant output -single battery system -Double battery parallel block system- requirements of railway coach air conditioning.

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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 by K.B.Bhatia.
8. Beuro of Energy Efficiency Standards(www.bee-india.nic.in)

ELECTRICAL INSTALLATION AND ESTIMATION

Subject Title : ELECTRICAL INSTALLATION AND ESTIMATION
Subject code : EE- 404
Periods/Week : 04
Periods/Semester : 60

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of Marks	Short Questions	Essay Questions
1.	Wiring Systems and Safety Procedures	**08**	**19**	**03**	**01**
2.	Estimation of Lighting and Power Loads	**22**	**39**	**03**	**03**
3.	Estimation of OH Lines and Earthing	**18**	**36**	**02**	**03**
4.	Departmental Test, APERC and Indian Electricity Act 2003,	**12**	**16**	**02**	**01**
	Total	**60**	**110**	**10**	**08**

OBJECTIVES

Upon completion of the course the student shall be able to

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

1.1 Compare VIR, CTS, PVC, Lead Sheathed, Weather proof aluminium and copper wires.
1.2 Mention the uses of cables LV,HV, EHV and oil filled H types, SL, HSL and types of 3-phase cables
1.3 State the uses of standard wire gauge.
1.4 Specify the gauge of wire and number of strands in a multi strand by giving its current carrying capacity
1.5 Explain (i) C.T.S system (ii) T.R.S. system,
(iii) Surface conduit system (iv) Concealed wiring system.
1.6 List the Main Switches as: i) Double pole iron clad (DPIC)
ii) Triple pole iron clad (TPIC)
iii)Triple pole iron clad with neutral link (TPICN) iv)Distribution fuse board Ironclad
v) MCB types with specifications, MCCB,ELCB and RCCB and specify their applications.
1.7 List the different types of fuses as
i) Rewirable fuses ii) Open type fuses
iii) Kit kat type fuses iv) Cartridge fuses
and specify the fuse carrier material used, ratings and their usage.
1.8 State the reasons for fire accidents in Electrical system.
1.9 Discuss the reasons for not using fuse in Neutral wire
1.10 Describe the procedure of first aid for shock treatment to an electrocuted person.
1.11 Explain the effects of shocks and electrocution.

2.0 Estimate Lighting and Power loads

2.1 Explain different types of service mains
2.2 Select the service main suited to the given situation
2.3 State the merits and demerits of different systems of interior wiring.
2.4 Select the type of wiring system suitable to the given situation
2.5 List the electrical material used in wiring the service mains.
2.6 List the schedule of rates used in preparing estimate
2.7 Estimate the material requirement for indoor wiring given the plan of a building.
2.8 Draw the wiring layout for a big office building
2.9 Draw the wiring layout for a workshop/ Electrical Laboratory
2.10 Draw the wiring layout of a Big industry.
2.11 Draw wiring layout of a Big Hotel with lift arrangement
2.12 Draw the wiring layout and estimate the material required for a Residential Building with 2 bed room house.
2.13 Prepare layout and draw single line wiring diagrams as per standard practise for a given set of machines in a workshop.
2.14 Select type of wiring system and lighting requirements
2.15 Calculate the wire sizes for various circuits
2.16 Specify important materials used under given condition
2.17 Calculate the quantities of all materials required for the above.
2.18 Prepare the estimate of the complete installation as per standard practice
2.19 Select the type of wiring and service mains used for the irrigation pump set.
2.20 Specify the material used in the execution of the irrigation pump set installation.
2.21 Prepare an estimate for electrifying the irrigation pump set scheme
2.22 Prepare an estimation for submersible pump installation

3.0 Estimate the type of material and quantity required for OH Lines and Earthing

3.1 Calculate the total number of insulators required for the given scheme
3.2 Select the type of insulators to be used for over head lines.
3.3 Select the type size and number of cross arms required for the overhead line
3.4 Determine the size and total length of overhead conductor required for the line giving due consideration for the sag to be allowed
3.5 Estimate the quantity of all materials required for given 11 KV and 400 v overhead lines as per standard practice followed by NEC
3.6 Estimate the quantity of material required for the following transformer substations i)pole mounted ii)plinth mounted
3.7 Select supporting poles of suitable size and height to install a given transformer as per standard practice in NEC
3.8 Draw plinth and Pole Mounted transformer substation and estimate the quantity of materials required in each case.
3.9 Estimate the quantity of all the electrical accessories and components required for the given i)Pole mounted transformer i)Plinth mounted transformer including the operating mechanism as per standard practice in NEC
3.10 State the purpose of Earthing and types that are normally used.
3.11 Select the suitable type of Earthing for a given installation as per IS3043.
3.12 Specify the different components used in electrical Earthing of a given installation
3.13 List the materials that are to be used in the earth pit surrounding the earth electrode
3.14 Prepare the estimate for pipe and plate Earthing

4.0 Departmental Test, APERC and Indian Electricity Act - 2003

4.1 Describe the departmental procedure for obtaining a service connection

4.2 Specify insulation resistance desirable for a given electrical installation
4.3 Specify the value of earth resistance to be maintained for a given electrical installations
4.4 Describe the test procedure for continuity of wiring in an electrical installation.
4.5 Explain the procedure for conducting insulation test of domestic wiring
4.6 Survey the load particulars in a village for
i)Domestic ii) Industrial iii) Agricultural loads.
4.7 Calculate the capacity of a transformer required assuming suitable diversity factor
4.8 Determine the location point of transformer and calculate the tail end voltage regulations as per the practice in NEC.
4.9 Determine the economic feasibility of the scheme as per the standard norms fixed by APERC to execute the scheme.
4.10 State major rules applicable to electrical installations as per Indian Electricity act 2003
4.11 Write as per the Indian Electricity act 2003, the rules and procedures to be adopted during execution of the following electrical installations.
i) Domestic & Industrial Lighting ii) Power (iii) Agriculture (iv) Earthing
4.12 State the standards and code of practice followed by NEC in respect of electrical installations and OH lines of 11 KV and 400V pole mounted and Plinth mounted transformers.
4.13 State new Indian Electricity Act 2003 Statutory Rules relating to Electrical safety and electric supply.

COURSE CONTENT

1. Wiring Systems and Safety Procedures

Introduction, size of wires, standard wires, types of wires, CTC, PVC, Lead sheathed .VIR, weather proof wires, flexible wires different types of cable wires – Types and Installation of House Wiring Systems & Wirings Accessories : Methods of installing wiring, clips, screws -round blocks switch boards, sockets socket pins - CTS wiring - Installation of surface conduit wiring - Rigid conduits, flexible conduits - Conduit accessories - elbows bushings - reducers, conduit box saddles, PVC conduit wiring - Concealed wiring - Comparison of various wiring systems -- Distribution fuse boards - Main switches – Different types of fuses and fuse carriers - Safety procedures - Electric shock and first aid, causes for fire hazards in Electrical installations

2.Estimation of Lighting and power loads

Estimation of domestic lighting installation service main - types of wire - specification - quantity of materials required for service main – estimation and selection of interior wiring system suitable to a given building - number of circuits - calculation of length of wire and quantity of accessories required - estimates of materials for execution of the domestic wiring installation as per National Electrical act 2003 .Power wiring installation Drawing wiring layout for a big office building, electrical laboratory, big industry, big hotel with lift arrangement and a residential building with 2 bed room house.- estimation and costing upto 20 kVA calculation of load current based on ratings of various equipment's to be installed - size of wire - length of wire number of circuits - quantity of accessories for execution of work as per standard practice.

Irrigation pump installation - Estimation upto 10 HP service main - type- calculation of size and quantity of wire and other components required - Labour cost for erection - Type of starter and control panel - accessories quantity and estimation Estimate for the installation of submersible pump.

3.Estimation of OH Lines and Earthing

Distribution lines of 11 kV and 400Volt OH lines - estimation only -quantity of materials required for lines of length 1 km - of number of poles - Cross arms clamps - insulators - conductor length and size for a given power transmission Distribution transformer erection- Estimation of quantity of materials required for structures, isolators - HG fuse operating mechanism, isolators, lightening arrestors for pole mounted substation and plinth mounted substation Quantity estimation for materials required in electrical Earthing both for pipe earthling and plate Earthing suitable to the given equipment or transformer substation

4.Departmental Tests and APERC and Indian Electricity Act 2003

Electrical installation testing - departmental procedure for testing before giving service connection - departmental procedure for obtaining service connection - desirable insulation resistance for domestic and power circuits - Tests for measuring insulation resistance - procedure for conducting insulation resistance test and continuity tests, earth continuity test -Design of rural electrification scheme - Load survey-determination of capacity of transformer - estimation of quantity of materials required for the erection of distribution lines and 11 kV feeder from a nearby 11 kV feeder - determining the economic feasibility of the scheme as per the procedure laid out in NEC, - Indian Electricity Act-2003 rules related to domestic and Industrial lighting- power, agricultural and earthing installations, erection of 11 kV, 400 Volt distribution lines - pole mounted transformer – New Indian Electricity act-2003 statutory rules.

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1. S.L.Uppal-Electrical Wiring ,Estimating & costing Electrical wiring,
2. J.B.Gupta -Estimating & costing
3. Balbir Singh-Electrical Drawing
4. Arora -Electrical wiring
5. BVS Rao -Maintenance and Operation of Electrical Equipment –Vol-I-TMH
6. S.Rao -Testing, Commissioning Operation & Maintenance of Electrical equipment -TMH
7. CR Dargar -Electrical Installation design and drawing -New Asian publishers.
8. Indian Electricity Act-2003
9. APERC regulation Act(www.aperc.gov.in)

ELECTRONICS – II

Subject Title : **ELECTRONICS-II**

Subject code : **EE-405**

Periods/Week : **05**

Periods/Semester : **75**

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of Marks	Short Questions	Essay Questions
1.	Oscillators	**15**	**26**	**02**	**02**
2.	Linear ICs	**15**	**26**	**02**	**02**
3.	Modulation and Demodulation	**15**	**16**	**02**	**01**
4.	Electronic instruments	**15**	**16**	**02**	**01**
5.	Transducers & Sensors	**15**	**26**	**02**	**02**
	Total	**75**	**110**	**10**	**08**

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 **Comprehend the working of Oscillators.**

1.1 Define Oscillator.

1.2 Classify different types of oscillators

1.3 State the conditions required for sustained oscillations

1.4 Classify different types of oscillators

1.5 Explain the need for AF Oscillator.

1.6 Explain the working of RC phase shift Oscillator with the help of circuit diagram.

1.7 Explain the need for RF Oscillator.

1.8 Draw the circuit diagram of the following oscillators

i) Hartley ii) Colpitts

1.9 State the need for Square wave Oscillator.

1.10 Explain the working of Transistor multi vibrator circuit.

1.11 Explain UJT relaxation oscillator.

1.12 Mention the different applications of oscillator.

2.0 Comprehend Linear Integrated circuits.

2.1 Explain the operation of Differential Amplifier with the help of a circuit diagram.

2.2 Define CMRR (common mode rejection ratio) of differential amplifier.

2.3 List the advantages of ICs over discrete circuits.

2.4 List the characteristics of an Ideal Operational Amplifier.

2.5 Explain the working of Operational Amplifier with the help of a block diagram.

2.6 Explain the working of OpAmp. inverting amplifier with input and output waveform.

2.7 State the concept of virtual ground.

2.8 Explain Non-inverting amplifier configuration and give its voltage gain.

2.9 List the applications of OPAmps.

2.10 Explain the Operational Amplifier as

i)summer ii)integrator iii)differentiator iv)scale changer and v)invertors.

2.11 Give the Pin out diagram of 741 IC.

2.12 Mention four important specifications of 741 IC.

2.13 State the need of timer.

2.14 Draw and explain the internal block diagram of IC 555 timer.

2.15 Draw the Pin diagram of 555IC.

2.16 Explain the function of each pin of 555 IC.

2.17 Give design rules and circuit for implementing ON-Timer using 555IC.

2.18 Explain the working of astable Multi vibrator using 555 IC. And draw the output wave forms.

2.19 Give formula for frequency of 555 astable Multi vibrator

3.0 Understand Modulation and Demodulation

3.1 State the need of Modulation in communication system.

3.2 Define Modulation and Demodulation.

3.3 Define Amplitude modulation.

3.4 Draw the waveforms of amplitude modulated wave.

3.5 Explain the generation of sidebands.

3.6 Define Band width of AM wave.

3.7 Give the equation for AM wave.

3.8 Mention the different components of AM wave in the equation.

3.9 Explain power distribution in AM wave.

3.10 Define Modulation Index of a AM wave.

3.11 Explain the effect of Over modulation with wave forms.

3.12 Define Frequency modulation

3.13 Draw the waveforms of frequency modulated waves

3.14 Define frequency deviation.

3.15 Mention the bandwidth requirements of FM wave

3.16 Compare AM and FM systems.

4.0 Comprehend the various Electronic Instruments

4.1 State the advantages of Electronic Instruments.

4.2 Explain the need of Cathode Ray Oscilloscope(CRO) as a Laboratory Instrument.

4.3 Explain the functions of various stage of a C.R.O. with the help of a block diagram

4.4 State the necessity of time base voltage

4.5 Mention the use of various front panel controls of a C.R.O.

4.6 List the applications of C.R.O.

4.7 Explain Loading effect of voltmeter with an example.

4.8 State the need for A/D converters.

4.9 State the need for D/A conversion.

4.10 Explain the basic principle of D/A conversion.

4.11 Explain the terms resolution, Accuracy, Monotonicity and settling time of D/A converter.

4.12 Explain D/A conversion using R-2R ladder network.

4.13 Explain A/D conversion using successive approximate method.

4.14 Explain the working of Ramp type Digital Voltmeter with the help of a block diagram

4.15 Explain the digital frequency meter with the help of a block diagram.

4.16 Explain the working principle of function generator

5.0 Comprehend the various Transducers & Sensors

5.1 Define Transducer

5.2 State the need of Transducers in Measurement systems

5.3 Classify transducers

(i). Based on the principle of Transduction form used

(ii) As Primary and Secondary

(iii).As Passive and Active

(iv).As Transducers and Inverse Transducers.

5.4 Explain the factors influencing the choice of Transducers

5.5. State the applications of Transducers.

5.6 Explain the use of Thermo Couple for the measurement of Temperature

5.7 Explain the Measurement of Temperature using Thermister in Bridge circuit

5.8 State the working Principle of Strain Gauge

5.9 Describe the construction of LVDT (Linear Variable Differential Transformer)

5.10 Explain the Working of LVDT

5.11 State the advantages and disadvantages of LVDT

5.12 Explain the Concept of Sensor

5.13 List the applications of Sensors

5.14 Write about Semiconductor Sensors.

COURSE CONTENT

1. Oscillators

Oscillator.-types of oscillators- AF Oscillator- RC phase shift Oscillator- RF Oscillator- Hartley oscillator- Colpittsoscillator-Square wave Oscillator- UJT relaxation oscillator- applications of oscillators.

2. **Linear Integrated circuits.**

Differential Amplifier-CMRR-advantages of ICs-Operational Amplifier- inverting amplifier -Non-inverting amplifier- Gain- summer-integrator-differentiator-scale changer –invertors-741 IC.- IC 555 timer- astable Multi vibrator

3. Modulation and Detection

Principle of Mmodulation & Demodulation - AM and FM-Linear collector modulation- Comparison between AM and FM-super hetrodyne radio receiver.

4. Electronic Instruments

Electronic Instruments.-Advantages-CRO-necessity of time base voltage- Ramp type Digital Voltmeter- Over modulation and Under modulation-digital frequency meter-function generator- A/D converters.- D/A converters.

5. Transducers & Sensors.

Transducer definition- Need- Classification – factors influencing the choice of transducer- Application- Use of ThermoCouple-Thermistors- Working Principle of Strain Guage – Construction & Working of LVDT- Advantages &Disadvantages of LVDT- Sensor- Applications- Semiconductor Sensors.

REFERENCES

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2. David C. Cooper -Electronic Instrumentation
3. G.K.Mithal -Applied electronics
4. M. Ramamurthy -Thyristor Engineering
5. Malvino -Electronic Principles
6. Bhargava -Basic Electronics - TTTI Publishers.
7. V.K. Mehtha -Principles of Electronics
8. Mathur,Chada & Kulakshetra-Electronic devices and circuits
9. George kennedy -Electronic communication systems TMH
10. Mandal -Basic Electronics –TMH.

ELECTRICAL ENGINEERING DRAWING

Subject Title : Electrical Engineering Drawing
Subject code : EE-406
Periods/week : 07
Periods/ Semester : 105

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of marks	Short Questions	Essay Questions
1.	Graphical symbols, view of fuses, Couplings and bearings	09	05	01	--
2.	D.C. Machines	09	05	01	
3.	D.C and A.C. Windings	15	10		½
4.	Transformers	21	20	--	01
5.	Induction Motors	21	20		01
6.	Circuit Breakers, Lightning Arrestors and Cables	09	05	01	
7.	Supporting structures	09	05	01	
8.	Earthing Systems	12	10		½
	Total	105	80	04	03

OBJECTIVES

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

1.0 Comprehend graphical symbols, view of fuses, Couplings and Bearings (No. of plates:3)

1.1 Draw standard symbols of electrical components and fixtures
1.2 Draw Sectional and end view of
  i) Rewirable fuse
  ii) Cartridge fuse
  iii) HRC fuse
1.3 Draw sectional elevation and end views of a flange coupling (protected type).
1.4 Draw end views of end plate with ball bearing.

2.0 Draw the different views of DC machines(No. of plates:3)

2.1 Draw views, including sectional views of yoke and pole assembly
2.2 Draw sectional view of armature of DC machine
2.3 Draw sectional views of commutator of a DC Machine
2.4 Draw Sectional elevation and end view of a DC Machine.
2.5 Draw the assembled end view of D.C.Machine with main parts.
2.6 Face plate of Three Point Starter for DC Shunt Motor
2.7 Face Plate of four Point starter for DC Compound Motor

3.0 Develop D.C.Windings and A.C.Windings (No. of plates:5)

3.1 Draw the winding diagram of a Single Layer Lap connected D.C Machine
3.2 Draw the winding diagram of a Single Layer Wave connected D.C Machine
3.3 Draw winding diagram of a 1-phase, single layer lap winding.
3.4 Draw winding diagram of a 1-phase, single layer wave winding.
3.5 Draw winding diagram of a 3-phase, single layer lap winding.
3.6 Draw winding diagram of a 3-phase, single layer wave winding.

4.0 Draw the views of Transformers(No. of plates:4)

4.1 Draw different core sections of a Transformer.
4.2 Draw sectional views of a single-phase different types of core type transformer from the given data
4.3 Draw sectional views of a 3 phase different types of core type transformers from given data

5.0 Draw the views of Induction Motors (No.of plates-4)

5.1 Draw the assembled views of induction motors.
5.2 Draw the sectional views of different parts of an induction motor (stator, rotor, shaft, end shields and slip rings).
5.3 Draw the sectional views of 3 phase squirrel cage induction motor with the given data.
5.4 Draw the sectional views of 3 phase slip ring induction motor with the given data.
5.5 Draw the wiring diagram of D.O.L. Starter
5.6 Draw the wiring diagram of Autotransformer starter.
5.7 Draw the wiring diagram of Rotor resistance starter.
5.8 Draw the wiring diagram of Star/delta starter.

6.0 Sketch the Circuit Breakers , Lightning arrestors and Cables (No. of plates:3)

6.1 Sketch and label the parts of
(i) Circuit breakers - Minimum oil circuit breaker, Bulk oil circuit breaker, Air blast circuit breaker and SF_6.Circuit breaker.
6.2 Sketch the lightning arrestor and name the parts.
i) Valve type
ii) Thyrite type.
6.3 Draw the cross sectional views of cables
(i) Single core (ii) 3-core belted cable (iii) 4-core cables
(iv) H- type cable (v) SL type cable (vi).HSL type cable

7.0 Draw the sketches of Supporting Structures & guarding sysytems (No. of plates:2)

7.1 Draw the sketches of different stays arrangements.
7.2 Gaurding systems employed for Poles Crossing (i). Roads (ii). Raiiway Lines
7.2 Draw the sketches of the following
i) 132 kV steel towers (single circuit and double circuit)
ii) 220kv steel towers (single circuit and double circuit).

8.0 Draw the sketches of different electrical Earthing system. (No. of plates:2)

8.1 Draw the dimensioned sketch of
i) Pipe Earthing
ii) Plate Earthing
8.2 Draw the dimensioned sketch of
i) Transformer yard Earthing
ii) Sub-station Earthing

COURSE CONTENTS

1. Graphical symbols, views of fuse, switches

Graphical symbols as per ISI standards, Views of fuses, Rewirable fuse, Cartridge fuse, HRC fuse, Shaft coupling, Protected, Bearings.

2. DC machine parts : (Assembled views in section)

Stator yoke and pole assembly, pole and field coil assembly main and interpoles, Armature of a small DC machine, Commutator of DC machine, Face plate type 3 point and 4 point starter,

3. D.C Winding and A.C.Winding.

Single Layer Lap and Wave Windings - Winding tables- -Brush location – Equalizer rings. A.C. 1- phase and 3-ϕ single layer lap and wave winding.

4. Transformers

Core sections, sectional views of single-phase single stepped core type, three phase three stepped core type transformers.

5. Induction Motors

Sectional elevation and end views of 3 – phase Squirrel Cage Induction Motor , 3-Phase Slip Ring Induction motor – Different types of starters used for 3 – phase IM'S.

6. Switch gear, Protection and Cables

Different types C.B's -- Valve type & Thyrite type lightning arresters - single core, 3 core belted cable, 4 core Cables, H type cable , SL type cable and HSL type cable.

7. Supporting structures

Views of - line supports –132kv and 220 KV steel Towers – Stay arrangements for L.V and Gaurding Systems employed for the Poles while crossing the Roads and Railway Lines.

8. Earthing systems

Pipe earthing, plate earthing, Transformer yard earthing ,Substation earthing system.

REFERECES

1. G.B.Bharadwajan.-Electrical Engineering Drawing
2. Dargon.-Electrical Engineering Drawing
3.K.L.Narang.-Electrical Engineering Drawing
4. Surjit singh-Electrical Engineering Drawing

A.C. MACHINES LABORATORY – I

Subject Title : **A.C .Machines Laboratory - I**
Subject Code : **EE- 407**
Periods/Week : **04**
Periods/Year(Sem) : **60**

TIME SCHEDULE

S. No.	Major Topics	No. of Periods
I.	Performance of single phase transformers	15
II.	Sumpner's test and Scott connection	15
III.	Parallel operation of transformers and oil testing kit	15
IV.	Performance of Alternators	15
	Total	60

OBJECTIVES (LIST OF EXPERIMENTS)

Upon completion of the course the student shall be able to

I. Observe the Performance of single phase transformers.

1. Conduct load test on 1-phase Transformer and calculate efficiency and regulation
2. Conduct the following two tests on 1-phase Transformer
   i) O.C. test ii) S.C. tests and from the result
   a) Draw the equivalent circuit.
   b) Calculate efficiency at various loads and p.f.s
   c) find the load at which maximum efficiency occurs.
   d) Calculate All-day efficiency for the given load cycle of 24 hours.

II Conduct Sumpner's test ,Perform Scott connection and load sharing.

3. Obtain the efficiency and regulation of two similar 1-phase transformers by conducting sumpner's test.
4. Conduct scott connection (T- connection) on transformers.
5. Connect two identical 1-ph transformers in parallel and observe the load sharing

III. Observe the Performance of Alternators

6. Conduct (direct) load test on Alternator and obtain voltage regulation.
7. Obtain the regulation of Alternator by using synchronous impedance method.
8. Synchronise the given Alternator with supply mains by using bright lamp method.

Key competencies to be achieved by the student

S.No	Experiment title	competencies	Key competencies
1	Test the given single phase transformer (i) Load test (ii) O.C.test (iii) S.C.test (9)	▪ Draw the required circuit diagram. ▪ Identify the different terminals of the given 1-ph transformer. ▪ Interpret the name plate details. ▪ Select proper supply terminals. ▪ Select proper range and type of meters. ▪ Make connections as per circuit diagram. ▪ Follow the precautions to be taken(ex: Check for loose and/or wrong connections if any and rectify). ▪ Follow the instructions and increase the given load gradually and tabulate the observations. ▪ Draw the efficiency curve and locate the maximum efficiency point.	• Identify the different terminals of 1-ph transformer. • Select proper range and type of meters • Increase the given load gradually.
2	(i)Conduct Sumpner's test (ii)Perform Scott connection (iii) Conduct parallel operation of the given single phase Transformers (9)	▪ Select proper range and type of meters. ▪ Make connections as per circuit diagram. ▪ Follow the instructions and perform sumpner's test by giving required rated voltage on primary side. ▪ Check for series opposition (back to back) connection on secondary side. ▪ Give required reduced voltage on secondary side. ▪ Tabulate observations. ▪ Calculate efficiency and regulation. ▪ Identify main and teaser trans formers and their terminals ▪ Give the required 3-ph supply. ▪ Take readings on both 3-ph and 2-ph side. ▪ Interpret the readings and verify 3-ph to 2-ph transformation. ▪ Conduct polarity test and ascertain the relative polarities of secondary windings for parallel operation of Transformers.	• Give required rated voltage on primary side. • Check for series opposition (back to back) connection on secondary side. ▪ Identify main and teaser trans formers and their terminals

3	Test the Performance of Alternators (6)	▪ Draw the circuit diagram for load test ▪ Identify the different terminals of 3-ph Alternator, exciter and prime mover . ▪ Interpret the name plate details. ▪ Select proper supply for prime mover and exciter. ▪ Select proper range and type of meters. ▪ Make connections as per circuit diagram. ▪ Increase the given load gradually and tabulate the observations. ▪ Calculate regulation at each load. ▪ Select proper supply for armature resistance test. ▪ Make connections for armature resistance test. ▪ Give required voltage , take readings and obtain armature resistance . ▪ Calculate synchronous impedance and regulation. ▪ Give required field current . ▪ For bright lamp method, Synchronise the alternators when all the conditions are satisfied.	▪ Select proper supply for prime mover and exciter. ▪ Select proper supply for armature resistance test ▪ For bright lamp method, Synchronise the alternators

Communication Skills

(Common to all Branches)

Subject title : Communication skills
Subject code : EE-408
Periods per week : 3
Periods per semester : 45
Introduction :

In the context of globalization , competence in speaking skills is the need of the hour The gap between the needs of the industry and the curriculum can be bridged by enabling the students to hone their speaking and listening skills. This course aims at providing opportunities for practicing speaking.

Time Schedule

Sno.	Topic	Periods	Weightage of marks (End Exam)	Sessional marks	Total
1	Listening I	3			
2	Listening II	3	10	10	20
3	Introducing oneself	3			
4	Describing objects	3			
5	Describing events	3			
6	Reporting past incidents	3			
7	Speaking from observation / reading	3	50	30	80
8	JAM	6			
9	Group discussion	6			
10	Mock interviews	6			
11	Making presentations	6			
		45	60	40	100

Objectives :

On completion of the course the students will be able to

- Strengthen their listening skills
- Strengthen their speaking skills

Competencies and key competencies to be achieved by the student

Topic	Teacher's input/ methodology	Students competence
Listening I Listening II	Pre- Listening –eliciting, pictures While - Listening Post –Listening –project , writing	Identifying the main idea, Identifying specific details, Identifying parallel and contradictory ideas Drawing inferences, Reasoning
Introducing oneself	Kinds of introduction --official/ personal, dynamic vocabulary, Body language, Model introduction, Use of line ups	Use of simple present tense, Sequencing, Appropriate vocabulary
Reporting incidents	Group work /pair work, Elicit, Use of past tense, Student presentations	Use of past tense, Relevant vocabulary
Describing objects	Vocabulary , Use of adjectives, Games—I spy, Group presentations	Use of adjectives, Dimensions,shapes Compare and contrast, Sequence
Describing events	Group work/pair work Use of appropriate tense	Use of appropriate tense, Sequencing
Reporting past incidents	Use of past tense, Vocabulary Student presentations	Use of past tense , sequencing
Speaking from	Group work/pair work,	Use of past tense,

observation/reading	Reading techniques ,	Summarising , evaluating, comprehension
JAM	Effective techniques , Good beginning , conclusion, tips, Use of line ups	Vocabulary, Sequencing, Fluency, Thinking spontaneously
Group discussion	Expressing opinion, body language,	Expressing opinion, agree/ disagree, fluency,Persuasive and leadership skills
Mock interview	FAQs , body language	Role play, body language,
Making presentations	Student presentations	Using charts , pictures, interpreting data, sequencing,PPTs

Communicative methodology (CLT) should be used to create an interactive class. Apart from the suggestions given teachers are free to innovate to use any activity to improve the language competence of students . Attention can also be given to improve the accent and intonation of students.

Note:

* This subject is a theory subject.

** The workload should be calculated as theory workload.

***Examinations in the subject will be treated as a practical one.

ELECTRONICS LAB –II

Subject Title : Electronics Lab – II
Subject Code : EE-409
Periods/Week : 03
Periods/Semester : 45

TIME SCHEDULE

S. No.	Major Topics	No. of Periods
1.	Amplifiers and Oscillators	9
2.	Photo Electric Devices	9
3.	Operational Amplifier Circuits	21
4.	555 IC	6
	Total	45

COURSE CONTENT

Amplifiers and Oscillators

1. Plot the frequencyresponse characteristicsof a RC coupled Amplifier, Calculate the gain, f1, f2 and band width from the response.
2. observe the output of Colpitt's oscillator and measure frequency by varying components in the tank circuit
3. observe the output of Hartley oscillator and measure frequency by varying components in the tank circuit
4. observe the output of crystal oscillator and measure frequency

Photo Electric Devices

5. plot the characteristics of a Photo diode.
6. plot the characteristics of a Photo transistor
7. plot the characteristics of a LDR.
8. plot the characteristics of a LED.

Operational Amplifier Circuits

9. Familiarize with Operational amplifier 741 and Quad opamp LM 324
10. Implement and test 741 OpAmp as inverting amplifier
11. Implement and test 741 OpAmp as non-inverting amplifier
12. Implement and test 741 OpAmp as voltage follower

13. Implement and test 741 OpAmp as summer
14. Implement and test 741 OpAmp as subtractor
15. Implement and test 741 OpAmp as scale changer
16. Implement and test 741 OpAmp as Integrator
17. Implement and test 741 OpAmp as Differentiator
18. implement &test Opamp Schmitt trigger and draw charactersistics **555 IC**
19. Implement Monostable multi vibrator using 555 IC and observe waveforms
20. Implement Astable multivibrator using 555 IC and observe waveforms

V SEMESTER

(FIFTH 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
THEORY								
EE-501	INDUSTRIAL MANAGEMENT & SMART TECHNOLOGIES	5		75	3	20	80	100
EE-502	A.C.MACHINES-II	5		75	3	20	80	100
EE-503	POWER SYSTEMS -II (T,D&P)	5		75	3	20	80	100
EE-504	POWER ELECTRONICS & PLC	5		75	3	20	80	100
EE-505	DIGITAL ELECTRONICS & MICRO CONTROLLERS	5		75	3	20	80	100
PRACTICAL								
EE-506	A.C.MACHINES LABORATOTY-II		4	60	3	40	60	100
EE-507	POWER ELECTRONICS & PLC LAB		6	90	3	40	60	100
EE-508	LIFE SKILLS		3	45	3	40	60	100
EE-509	DIGITAL ELECTRONICS & MICRO CONTROLLERS LAB		4	60	3	40	60	100
TOTAL		25	17	630	27	260	640	900

Industrial Management & Smart Technologies

Subject Title : Industrial Management & Smart Technologies
Subject Code : EE-501
Periods/Week : 5
Period/Semester : 75

TIME SCHEDULE

S. No.	Major Topics	Periods	Weightage Of Marks	Short **Answer Questions**	Essay **Type Questions**
1.	Basics of Industrial Management	06	13	1	1
2.	Organisation structure & Organisational behaviour	10	18	1	$1^{1/2}$
3.	Production Management	10	18	1	$1^{1/2}$
4.	Materials Management	08	13	1	1
5	Maintenance management & Industrial Safety	08	13	1	1
6	Entrepreneurship Development	08	13	1	1
7	Total Quality Management	05	06	2	
8	Smart technologies	20	16	2	1
	Total	**75**	**110**	**10**	**08**

1. Basics of Industrial Management

On completion of the course the student will be able to

1.0 Understand the principles of management as applied to industry.

1.1 Define industry, commerce (Trade) and business.
1.2 Know the need for management.
1.3 Understand the evolution of management
1.4 Understand functions of Management.
1.5 Explain the principles of scientific management.
1.6 Explain the principles of management.
1.7 Differentiate between management and administration.
1.8 Understand the nature of management as a profession
1.9 Differentiate between supervisory, middle and Top level management
1.10 Explain the importance of managerial skills (Technical, Human, Conceptual)

2. Organisation Structure & organisational behaviour

Know types of ownerships, the organisation structure of an industry and the behaviour of an individual in an organisation.

2.1 Understand the philosophy and need of organisation structure of an industry.
2.2 Understand the line, staff and Functional organisations
2.3 Understand the Authority and Responsibility Relationships
2.4 Understand the differences between Delegation and decentralization
2.5 Explain the factors of effective organisation.

2.6 Outline the communication process
2.7 State motivation theories.
2.8 State Maslow's Hierarchy of needs.
2.9 List out different leadership models.
2.10 Explain the trait theory of leadership.
2.11 Explain behavioural theory of Leadership.
2.12 Explain the process of decision making.
2.13 Assessing Human resource requirements
2.14 Know the concept of Job analysis, Job description and specifications
2.15 Understand the process of recruitment, selection, training and development
2.16 Understand types of business ownerships
2.17 Differentiate between the business ownerships
2.18 Know the objectives of Employee participation
2.19 Understand the meaning and definition social responsibilities
2.20 Corporate social responsibility

3. **Production management**

Understand the different aspects of production management.

3.1 Identify the factors of Plant Location
3.2 Know the objectives of plant Layout
3.3 Understand the principles of plant Layouts
3.4 Explain the types of plant Layouts
3.5 Relate the production department with other departments.
3.6 State the need for planning and it's advantages.
3.7 Explain the stages of Production, planning and control.
3.8 Know the basic methods demand forecasting
3.9 Explain routing methods.
3.10 Explain scheduling methods.
3.11 Explain dispatching.
3.12 Explain Break Even Analysis
3.13 Define supply chain Management, competitive strategy, Supply chain strategy
3.14 Draw PERT/CPM networks.
3.15 Identify the critical path

4. Materials Management

*Understand the role of materials management industries***.**

4.1 Explain the importance of materials management in Industry.
4.2 Know Functions of Materials Management
4.3 Derive expression for inventory control.
4.4 Explain ABC analysis.
4.5 Define safety stock.
4.6 Define reorder level.
4.7 Derive an expression for economic ordering quantity.
4.8 Know the functions of Stores Management,
4.9 Explain types of store layouts.
4.10 List out stores records.
4.11 Explain the Bin card.
4.12 Describe Cardex method.
4.13 Explain general purchasing procedures
4.14 Explain tendering, E-tendering and E-procurement procedures
4.15 List out purchase records.

4.16 Know the applications of RFID (Radio Frequency Identification Device)
4.17 Understand the applications of RFID in material management

5. Maintenance Management & Industrial Safety

Comprehend the Importance of Maintenance Management & Safety procedures

5.1 Explain the importance of maintenance management in Industry.
5.2 Know the Objectives of maintenance management
5.3 Know the activities of maintenance management
5.4 Understand the importance of Preventive maintenance
5.5 Understand the need for scheduled maintenance
5.6 Differentiate between scheduled and preventive maintenance
5.7 Know the principles of 5 s for good house keeping
5.8 Explain the importance of safety at Work place.
5.9 List out the important provisions related to safety.
5.10 Explain hazard and accident.
5.11 List out different hazards in the Industry.
5.12 Explain the causes of accidents.
5.13 Explain the direct and indirect cost of accidents.
5.14 Understand the types of emission from process Industries, their effects on environment and control
5.15 Understand the principles of solid waste management

6. Entrepreneurship Development.

Understand the role of entrepreneur in economic development and in improving the quality of life.

6.1 Define the word entrepreneur.
6.2 Explain the requirements of an entrepreneur.
6.3 Determine the role of entrepreneurs in promoting Small Scale Industries.
6.4 Describe the details of self-employment schemes.
6.5 Characteristic of successful entrepreneurs
6.6 Explain the method of site selection.
6.7 List the financial assistance programmes.
6.8 List out the organisations that help an entrepreneur
6.9 Know the use of EDP Programmes
6.10 Understand the concept of make in India, Zero defect and zero effect
6.11 Understand the importance for startups
6.12 Explain the conduct of demand surveys
6.13 Explain the conduct of a market survey
6.14 Evaluate Economic and Technical factors.
6.15 Prepare feasibility report study

7. Total Quality Management:

Understand the concepts adopted in total quality management

7.1 Explain the concept of quality.
7.2 List the quality systems and elements of quality systems.
7.3 State the principles of quality Assurance.
7.4 Understand the basic concepts of TQM
7.5 Know the Pillars of TQM
7.6 List the evolution of ISO standards.

7.7 Explain ISO standards and ISO 9000 series of quality systems.
7.8 List the beneficiaries of ISO 9000.
7.9 Explain the concepts of ISO 14000
7.10 Know the overview of PDCA cycle

8. Smart Technologies

8.1 Get an overview of IoT

8.1.1 Define the term IoT
8.1.2 Know how IoT work
8.1.3 List the key features of IoT
8.1.4 List the components of IoT : hardware, software, technology and protocols
8.1.5 List the advantages and disadvantages of IoT

8.2 IoT Applications

8.2.1 Smart Cities
8.2.2 Smart Energy and the Smart Grid
8.2.3 Smart Transportation and Mobility
8.2.4 Smart Home, Smart Buildings and Infrastructure
8.2.5 Smart Factory and Smart Manufacturing
8.2.6 Smart Health
8.2.7 Food and Water Tracking and Security
8.2.8 Social Networks and IoT

Course Content

1. Basics of Industrial Management

Introduction: Industry, Commerce and Business; Definition of management; Characteristics of management; Functions of management - Planning, Organizing, Staffing, Directing, Co-ordination, Controlling, Motivating, Communication, Decision Making; Principles of scientific management: – F.W.Taylor, Principles of Management: Henry Fayol; Administration and management; Nature of management; levels of management; managerial skills;

2. Organisation Structure & organisational behaviour

Organizing - Process of Organizing; Line/Staff and functional Organizations, Decentralization and Delegation, Effective Organizing; Communication, Motivational Theories; Leadership Models; Human resources development; Forms of Business ownerships: Types – Sole proprietorship, Partnership, Joint Stock Companies, Cooperative types of Organizations; Employee participation in management; Corporate Social responsibility;

3. Production management

Definition and importance; Plant location and layout; Types of production -job, batch and mass; production Planning and Control: Demand forecasting, routing, scheduling, dispatching and follow up; Break even analysis; Supply chain Management (Definition, Competitive strategy Vs Supply chain Strategy, Supply chain drivers); Project scheduling; Application of CPM and PERT techniques; simple numerical problems;

4. Materials Management

Materials in industry, Basic inventory control model, ABC Analysis, Safety stock, re-order level, Economic ordering quantity, Stores Management: Stores layout, stores equipment, Stores records, purchasing procedures, e-tendering, e-procurement; purchase records, Bin card, Cardex RFID (Radio Frequency Identification Device)application in materials management;

5. Maintenance Management & Industrial Safety

Objectives and importance of plant maintenance, Different types of maintenance, Nature of maintenance problems, Range of maintenance activities, Schedules of preventive maintenance,

Advantages of preventive maintenance, 5 S principles; Importance of Safety at work places; Causes of accidents-psychological, physiological and other industrial hazards; Domino sequence; methods of promoting safe practices; Pollution control in process industries; Introductory concepts on Solid waste management (General introduction including definitions of solid waste including municipal, hospital and industrial solid waste, Waste reduction at source – municipal and industrial wastes)

6. Entrepreneurship Development.

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

7. Total Quality Management:

Total Quality Management (TQM)- Concept of quality discussed by B. Crosby W. Edward, Deming, Joseph M. Juran, Kooru Ishikawa, Genichi Taguchi, Shigco Shingo. Quality systems – Definitions of the terms used in quality systems like, quality policy, quality management, quality systems, Stages of development of ISO 9000 series , ISO-14000, Deming's PDCA Cycle (Plan, Do, Check and Action). Japanese Quality Management, culture, Kaizen Strategy (continuous improvement).

8. Smart Technologies :

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

REFERENCE BOOKS

1. Industrial Engineering and Management -by O.P Khanna
2. Production Management- by Buffa.
3. Engineering Economics and Management Science - by Banga & Sharma.
4. Personnel Management by Flippo.
5. Production and Operations Management –S.N. Chary
6. Converging_Technologies_for_Smart_Environments_and_Integrated_Ecosystems_IERC_Book_ Open_Access_2013 pages-54-76
7. Supply Chain Management –Sunil Chopra and Meindl, PHI publishers

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A.C. MACHINES – II

Subject Title : **A.C. MACHINES –II**

Subject Code : **EE-502**

Periods/ Week : **05**

Periods /Semester : **75**

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of marks	Short questions	Essay questions
1.	Synchronous motors.	**15**	**21**	**2**	**1 1/2**
2.	3- Phase Induction Motors	**22**	**31**	**2**	**2 1/2**
3.	1- Phase Motors	**18**	**26**	**2**	**2**
4.	Electrical Drives	**10**	**16**	**2**	**1**
5.	Braking of Electrical Motors	**10**	**16**	**2**	**1**
	Total	**75**	**110**	**10**	**8**

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 expression 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 induction motors
2.15 List at least six applications of induction motors
2.15 Compare synchronous motors with induction motors.

3.0 Comprehend the working of 1- Phase motors.
3.1 List the types of 1- phase motors.
3.2 Explain why a Single-phase Induction motor is not a Self starting motor.
3.3 Explain the working principle of 1 – phase Induction motor by
i) Cross field theory ii) Double field revolving theory.
3.4 Explain the construction and working of the following 1-phase induction motors with legible sketch
i)split phase motor ii)capacitor start motor iii) shaded pole motor
3.5 Explain the construction and working of the following types of 1- phase Commutator Motors
i)Commutator motors ii) A.C.Series motors iii)universal motors.
3.6 List the types of Stepper motors.
3.7 Explain the working of the following Stepper motors
i)Permanent magnet ii)variable reluctance I
3.8 List applications of a)1-phase induction motors b) 1-phase Commutator motors c)Stepper motors.

4.0 **Appreciate the different types of Electrical Drives.**
4.1 Define an Electric Drive.
4.2 Explain the concept of Electric Drive.
4.3 List the advantages of Electric Drives.
4.4 Draw the block diagram of an Electric drive.
4.5 State the function of each block in the block diagram of an Electric drive
4.6 List the factors governing the selection of electric drive.
4.7 Classify the drives.
i. i)Based on their operation ii)Based on their application
4.8 State the advantages and disadvantages of different types of drives.
4.9 Distinguish between an AC Drive and a DC Drive.
4.10 State the types of loads for which drives are needed.
4.11 Draw the Load curves for different ratings of motors.
4.12 Solve the Problems on the motor Ratings.
4.13 State the need of load equalization
4.14 State the use of fly wheels

5.0 Understand braking of electric motors.

5.1 State different systems of braking of electric motors.
(i)Mechanical (ii)Compressed air (iii)Vacuum brake
(iv)Magnetic Brake (v) Electric Braking.

5.2 State advantages of electric braking over other forms of brake

5.3 List different methods of electric braking

5.4 Explain the methods of plugging of the following motors.
i)D.C. shunt motors ii)3-phaseInduction Motor.

5.5 Explain the method of Rheostatic braking of the following motors.
i)D.C. shunt motors ii)D.C series motors.

5.6 Describe the method of Regenerative braking of the following motors.
i)D.C series motor iii)3-phase induction motor.

5.7 Solve the Problems on the above.

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 – Construction of Induction motors – Comparison – working principle of three phase Induction motor – working of Induction motor at different conditions (Starting and Running) - Derive the relationship between Torque, Power and slip of Induction motor – Torque-slip characteristics – Generalisation of Induction motor as transformer- Testing of Induction motors – Drawing of Circle diagram - problems .- Starting methods of Induction motors= Types of starters – Construction features of Double cage Induction motors – Methods of speed control of Induction motor – Advantages and applications of Induction motors-Comparison of Induction motor with Synchronous motor.

3. Single phase Motors

Types of 1-phase motors – Reasons for not self starting-working principle of 1-phase induction motors-Cross field and Double field revolving theory-Construction and working of split phase, capacitor start, capacitor run and shaded pole types – Essential parts and Constructional features of A.C series motor – principles of working – Universal motor- parts, constructional features, principle of working- Stepper motors – types- construction and principle of working - permanent magnet and Variable reluctance type motor – Applications of 1-phase motors.

4. 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.

5. Electric Braking

Braking – Types of Braking – Merits & de-merits of Electrical braking – Plugging applied to Shunt and 3-phase Induction Motor – Rheostatic braking applied to Shunt and Series motors – Regenerative braking applied to d.c series and 3-phase Induction motor- Simple Problems of Electric braking.

REFERENCES

1. B.L. Theraja -Electrical Technology– S.Chand &Co.
2. J.B. Gupta -Electrical Technology
3. H. Cotton -Electrical Technology
4. S.K.Pillai-A first course on Electric Drives
5. M.V.Deshpande -Electrical motors applications and control
6. S.L.Uppal -Electrical power

POWER SYSTEMS - II

Subject Title : POWER SYSTEMS – II (Transmission, Distribution & Protection)

Subject Code : EE- 503

periods / week : 05

Periods / Semester : 75

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of marks	Short questions	Essay questions
1.	Transmission lines	23	29	3	2
2.	HVDC transmission	04	3	1	-
3.	Line structures for transmission and Distribution	18	23	1	2
4.	Cables	6	13	1	1
5.	Substations	6	13	1	1
6.	Distribution	8	16	2	1
7.	Protection of Transmission Lines & Feeders	10	13	1	1
	Total	75	110	10	8

OBJECTVES

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

1.11 Explain Kelvin's law

1.12 State the different types of conductors used in transmission lines.

1.13 state expression for inductance of 1- phase system (No derivation)

1.14 Give the expression for the inductance of 3 phase symmetrical and asymmetrically spaced round conductors (No derivation)

1.15 State the need for transposition of overhead lines

1.16 Explain the effects of transposition of overhead lines

1.17 Compute inductance in transposed lines

1.18 Define capacitance

1.19 State the expressions for capacitance of1 phase system (No Derivation)

1.20 Give the expressions for capacitance of 3 phase symmetrically spaced, asymmetrically spaced and transposed lines round conductors (No- Derivation)

1.21 Use the conductors tables for determining the inductance and capacitance of overhead lines of different voltage

1.22 Define short, medium and long lines.

1.23 State the reasons for the constants lumped in short lines and medium transmission lines.

1.24 Define `regulation' and percentage regulation.

1.25 Derive the approximate formula for percentage regulation.

1.26 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

1.27 Solve problems on short lines

1.28 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

1.29 Draw the phasor diagram in the above methods

1.30 Solve problems in medium transmission lines

1.31 Explain the charging current in lines and power loss due to it

1.32 State `Ferranti' effect

1.33 Compute the rise in voltage at the receiving end
1.34 State the factors affecting corona
1.35 Explain corona in transmission lines
1.36 State the disruptive critical voltage and give its formula
1.37 State the empirical formula for power loss due to corona
1.38 State the effect of corona
1.39 Explain the methods of reducing corona
1.40 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) II 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 Explain a method of laying foundation to towers
3.14 Define `sag'
3.15 State the factors affecting the sag
3.16 Derive an equation for the approximate method of calculating sag.
i)when the supports are at the same level
(a) in still air (b) with the effect of wind and ice
ii) when the supports are at different levels
3.17 solve the problems on above.
3.18 State the disadvantages of loose spans(sag more than prescribed value)
3.19 State the purpose of insulators in transmission and distribution lines
3.20 State the requirements of insulators
3.21 State applications of the following insulators.
i) Pin type ii) Strain type iii) Suspension type iv)Shackle type
3.22 Tabulate the relative merits of pin type insulator over suspension type insulators

3.23 Show that the voltage across a string does not distribute uniformly across the individuals discs

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

3.25 Solve problems on distribution of voltage across string

3.26 State the methods of improving string efficiency

- i) By eliminating ground capacitance
- ii) By grading of the units
- iii) Static shielding(guard ring)

3.27 Solve problems on equalization of potential across a string

3.28 State the need for arcing horns and guard rings

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

3.30 Problems on calculation of String efficiency.

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. single phase distributors

6.7 Solve simple problems on voltage drop calculations in A.C. single phase Distributors(single fed systems).

7.0 Understand the Protection of Transmission Lines and feeders

7.1 Explain the different schemes of protection for single and duplicate bus bars.
7.2 Describe the transmission line protection and feeder protection.
7.3 Explain pilot wires and their effects.
7.4 Explain the protection of transmission lines using distance and impedance relays.
7.5 Explain the combined protection by using definite distance and time distance relays.
7.6 Explain protection of radial feeders using time graded fuses.
7.7 Explain protection of parallel feeders using directional relays.
7.8 Explain protection of ring main feeder using directional relays.
7.9 Derive a relation between number of sections and minimum relay time.
7.10 Explain differential protection for parallel feeders of transmission lines.

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-Carona 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, 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 and problems, 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, Firefighting equipment, Bus bar arrangements - Typical sketches Earthing adopted in 132/11KV, 66/11 KV, 33/11 KV and pole mounted and plinth mounted SS, Substation Earthing system

6. Distribution

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

7. 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

Reference Books

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

POWER ELECTRONICS & PLC

Subject Title : **Power Electronics & PLC**

Subject Code : **EE-504**

Periods/Week : **05**

Periods/Semester : **75**

TIME SCHEDULE

S.no	Major Topics	No. of periods	Weightage of marks	Short questions	Essay questions
1	Power Elecronic devices	18	26	2	2
2	Converters, AC Regulators & Choppers	12	18	1	1 1/2
3	Inverters and Cyclo-converters	8	11	2	1/2
4	Applications of Power Electronic circuits	10	16	2	1
5	Basics of Control Engineering	12	18	1	1 1/2
6	PLC and applications	15	21	2	1 1/2
	Total	75	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) Triacs and iii) SCR's.

1.19 Explain the working of the following by giving their V-I characteristics
i)Reverse conducting thyristor (RCT) ii)Asymmetrical SCR (ASCR)
iii)Power BJT iv)Insulated gate Bipolar transistor (IGBT)
v)MOS-controlled thyristors (MCT)
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 Applications of power electronic circuits
4.1 List applications of power electronic circuits.
4.2 Mention the factors affecting the speed of DC Motors.
4.3 Describe speed control for DC Shunt motor using converter.
4.4 Describe speed control for DC Shunt motor using chopper.
4.5 List the factors affecting speed of the AC Motors.
4.6 Explain the speed control of Induction Motor by using AC voltage regulator.
4.7 Explain the speed control of induction motor by using converters and inverters (V/F control).
4.8 Types of disturbances in commercial power supply
4.9 Devices used to suppress spikes in supply system.
4.10 Working of UPS with block diagram.
4.11 Explain the Light dimmer circuit using DIAC/TRIAC with the help of a legible sketch.
4.12 Explain the Burglar alarm circuit using SCR with the help of a diagram.

4.13 Explain the Emergency lamp circuit using SCR with the help of adiagram.
4.14 Explain the Battery charger circuit using SCR with the help of a diagram.

5.0 Understand the Basics of Control Engineering

5.1 State the need for Automation.
5.2 List the advantages of Automation
5.3 Mention the requirements of Automation.
5.4 Explain the importance of control engineering in day to day life and industry
5.5 Give the definition of system and Control system.
5.6 Give the classification of control systems
5.7 Explain an open loop control system with some examples
5.8 Give the list of merits and demerits of open loop control.
5.9 State the need for feedback in a control system
5.10 Understand concepts of types of feed back
5.11 Draw a generalized block diagram of a feed back control system and give the terminology
5.12 List the applications of Closed loop control systems
5.13 Explain the closed loop systems of a)Water level controller b) Speed controller
5.13 Give the comparison between open loop and closed loop control systems.
5.14 Give the definition of Transfer function

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 CONTENTS

1. Power Electronic Devices

Types of power semiconductor devices – SCR, DIAC, 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-pprotection 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 andfull 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. Application of Power Electronic Circuits

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)- Types of disturbances in commercial power supply - Devices used to suppress spikes in supply system.- Working of UPS with block diagram - Light dimmer Circuit- Burglar alarm Circuit- Emergency lamp and Battery charger Circuit using SCR- Advantages of the above circuits.

5. Basics of Control Engineering

Automation-need-advantages-requirements-importance-Definition of system and Control system - open loop control system-merits and demerits of open loop control-closed loop system-block diagram of closed loop system-Applications- Water level controller, Speed controller comparison between open loop and closed loop control systems-Transfer function

6. 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 Jamil Asghar -Power Electronics– PHI, New Delhi.
2 P.C.Sen.-Advanced Power Electronics
3 Harish Rai -Industrial & Power Electronics.
4 R.K.Sugandhi & KK Sugandhi -Thyristor (theory & applications)
5 Nagarath & Gopal- Control Engg
6 S.K.Bhattacharya -Control of Electrical Machines
7 Jon Sterenson-Industrial automation and process control
8 John W.Webb -Programmable Logic controllers

DIGITAL ELECTRONICS & MICROCONTROLLERS

Subject Title	**:**	**DIGITAL ELECTRONICS & MICROCONTROLLERS**
Subject Code	**:**	**EE-505**
Periods/Week	**:**	**5**
Periods/Semester	**:**	**75**

TIME SCHEDULE

Sl	Major topics	No. of periods	Weightage of marks	Short Answer Questions	Essay Questions
1	Basics of Digital Electronics	10	16	2	1
2	Combinational Logic circuits	15	26	2	2
3	Sequential Logic Circuits	20	26	2	2
4	8051 Microcontroller	10	16	2	1
5	8051 instruction set and programming	20	26	2	2
	Total	**75**	**110**	**10**	**8**

OBJECTIVES

1.0 Basics of Digital Electronics

1.1 Explain Binary, Octal, Hexadecimal number systems and compare with Decimal system.
1.2 Perform binary addition, subtraction, Multiplication and Division.
1.3 Write 1's complement and 2's complement numbers for a given binary number
1.4 Perform subtraction of binary numbers in 2's complement method.
1.5 Explain the use of weighted and Un-weighted codes & write Binary equivalent number for a number in 8421, Excess-3 and Gray Code and vice-versa.
1.6 Explain the importance of parity Bit.
1.7 State different postulates and De-Morgan's theorems in Boolean algebra.
1.8 Explain AND, OR, NOT, NAND, NOR and EX-OR gates with truth table.
1.9 Realize AND, OR, NOT operations using NAND, NOR gates.
1.10 Give the classification of digital logic families.

1.11 Explain the characteristics of digital ICs such as logic levels, propagation delay, Noise margin, Fan-in, Fan-out, and Power dissipation.
1.12 Draw and explain TTL NAND gate with open collector and Totem pole output.
1.13 Compare the TTL, CMOS and ECL logic families.
1.14 Give IC numbers of two input Digital IC Logic gates.

2.0 Combinational logic circuits

2.1 Give the concept of combinational logic circuits.
2.2 Draw the Half adder circuit and verify its functionality using truth table.
2.3 Realize a Half-adder using NAND gates only and NOR gates only.
2.4 Draw the full adder circuit and explain its operation with truth table.
2.5 Realize full-adder using two Half-adders and an OR – gate and write truth table
2.6 Draw and explain a 4 Bit parallel adder using full – adders.
2.7 Draw and Explain 2's compliment parallel adder/ subtractor circuit.
2.8 Explain the working of a serial adder with a Block diagram.
2.9 Compare the performance of serial and parallel adder.
2.10 Draw and explain the operation of 4 X 1 Multiplexers
2.11 Draw and explain the operation of 1 to 4 demultiplexer.
2.12 Draw and explain 3 X 8 decoder.
2.13 Draw and explain BCD to decimal decoder.
2.14 List any three applications of multiplexers and decoders.
2.15 Draw and explain One bit digital comparator.

3.0 Sequential logic circuits

3.1 Give the idea of Sequential logic circuits.
3.2 Explain NAND and NOR latches with truth tables
3.3 State the necessity of clock and give the concept of level clocking and edge triggering,
3.4 Draw and explain clocked SR flip flop with preset and clear inputs .
3.5 Construct level clocked JK flip flop using S-R flip-flop and explain with truth table
3.6 Explain race around condition and explain master slave JK flip flop.
3.7 Give the truth tables of edge triggered D and T flip flops and draw their symbols.
3.8 List any four applications of flip flops.
3.9 Define modulus of a counter
3.10 Draw and explain 4-bit asynchronous counter and its timing diagram.
3.11 Draw and explain asynchronous decade counter.
3.12 Draw and explain 4-bit synchronous counter.
3.13 Distinguish between synchronous and asynchronous counters.
3.14 State the need for a Register and list the four types of registers.
3.15 Draw and explain the working of 4 bit shift left and shift right registers
3.16 Draw and explain the working of 4-bit bi-directional shift register.
3.17 Draw and explain parallel in parallel out shift register
3.18 Explain the working of ring counter and list its applications
3.19 State memory read operation, write operation, access time, memory capacity, address lines and word length.
3.20 Classify various types of memories based on principle of operation, physical characteristics, accessing modes and fabrication technology..
3.21 Explain basic principle of working of diode ROM
3.22 Distinguish between EEPROM and UVEPROM.
3.23 Explain the working of basic dynamic MOS RAM cell.
3.24 Compare static RAM and dynamic RAM

4.0 8051 Micro controller

4.1 Explain the concept of Micro controllers.
4.2 Compare Embedded with External memory devices.
4.3 List the three commonly used Commercial Microcontroller Device families.
4.4 Draw the block diagram of a microcontroller and explain the function of each block.
4.5 Describe the register structure of 8051.
4.6 Explain the functions of various special function registers.
4.7 Draw the pin diagram of 8051 micro controller and specify the purpose of each pin.
4.8 Describe internal memory, external memory and ports of 8051.
4.9 Describe counters & timers in 8051
4.10 Explain serial input/output of 8051
4.11 Explain interrupts in 8051.
4.12 Describe the four timer modes in 8051.

5.0 8051 Instruction set and Programming

5.1 State the need for an instruction set.
5.2 Describe the instruction format of 8051.
5.3 Explain fetch cycle, execution cycle and instruction cycle.
5.4 Define the terms machine language, assembly language, and mnemonics.
5.5 Give the difference between machine level and assembly level programming.
5.6 List the major groups in the instruction set along with examples.
5.7 Explain the terms operation code, operand and illustrate these terms by writing an instruction.
5.8 Explain the data manipulation functions data transfer, arithmetic, logic and branching.
5.9 Classify the 8051 instructions into one byte, two byte and three byte instructions.
5.10 Describe the five addressing modes of 8051.
5.11 Explain data transfer instructions of 8051.
5.12 Explain the arithmetic instructions and recognise the flags that are set or reset for given data conditions.
5.13 Explain the logic instructions and recognize the flags that are set or reset for given data conditions.
5.14 Explain unconditional and conditional jump and how flags are used to change the sequence of program.
5.15 Write programs of instructions to perform single byte, double byte and multi byte addition and subtraction.
5.16 Illustrate the application of jump instruction in the program.
5.17 Define a subroutine and explain its use.
5.18 Explain the sequence of program when subroutine is called and executed.
5.19 Explain how information is exchanged between the program counter and the stack and identify the stack pointer register when a subroutine is called.
5.20 Write program to perform Single byte & Multi byte addition.
5.21 Write program to sum up given ‘N’ numbers.
5.22 Write program to multiply two 8-bit numbers using ‘MUL’ instruction.
5.23 Write program to find biggest data value in given Data array.
5.24 Write program to convert a given ‘HEX’ number to ‘BCD’ number.

COURSE CONTENT

1 Basics of Digital Electronics

Binary, Octal. Hexadecimal number systems- Binary codes, excess-3 and gray codes- Logic gates :AND, OR, NOT, NAND, NOR, Exclusive-OR-Boolean algebra, Boolean expressions. Demorgan's Theorems- Characteristics of digital circuits- TTL NAND gate: open collector, totem pole output- CMOS NAND gate, ECL OR/NOR gate , comparison of TTL,CMOS and ECL logic families.

2 Combinational logic circuits

Implementation of arithmetic circuits, Half adder, Full adder, Serial and parallel Binary adder. Parallel adder/subtractor, Multiplexer, demultiplexer, decoder

3 Sequential logic circuits

Principle of flip-flops operation, Concept of edge triggering, level triggering, RS, D, JK, T, JK Master Slave flip-flops - Applications of flip flops,. Binary counter- ripple counter, synchronous counter, up-down counter-Shift Registers- ring counter and its applications- Memories-terminology related to memories, RAM, ROM, EEPROM, UVEPROM, static RAM, dynamic RAM

4 8051 Micro controller

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

5 8051 Instruction set and Programming

Instruction set of 8051, instruction format, fetch cycle, execution cycle, instruction cycle, machine cycle, timing diagrams, classification of instructions, addressing modes- Groups of instructions, Opcode, operand- Data transfer, subroutines, single and multi byte addition and subtraction, multiplication, conversion

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

7. Mazidi and Mazidi -8051 Micro controller.
8. Kenneth J.Ayala. -8051 Micro controller
9. Myke Predko -Programming customizing the 8051 Microcontroller - TMH

AC MACHINES LABORATORY – II

Subject Title : AC Machines Laboratory - II
Subject Code : EE-506
Periods/Week : 04
Periods/Year : 60

TIME SCHEDULE

S. No.	MAJOR TOPICS	NO OF PERIODS
1.	Tests on 1-phase and 3-phase AC Motors	24
2.	Drawing circle diagram on AC Motors	24
3.	Identify and rectify faults in AC motors and starters	12
	Total	60

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

Competencies & Key competencies to be achieved by the student

S.No	Experiment Title	Competencies	Key competency
1	Brake test on 3-phase squirrel cage induction motor.	▪ Draw the circuit diagram ▪ Identify the different terminals of 3-ph induction motor ▪ Select the suitable starter. ▪ Identify the terminals of the starter. ▪ Select the range and type of the meters ▪ Make the connections as per the circuit diagram ▪ Start the motor using a starter Apply the load up to full load in steps ▪ Pour water in the brake drum ▪ Note down the readings of ammeter and voltmeter for each load. ▪ Calculate the output, torque and efficiency etc ▪ Plot the performance characteristics ▪ Verify the performance of the machine.	▪ Apply the load up to full load in steps ▪ Pour water in the brake drum ▪ Before Switching off the motor remove the load
2	Brake test on 3-phase slip ring induction motor.	▪ Draw the circuit diagram ▪ Interpret the name plate details ▪ Identify the different terminals of the 3-ph induction motor ▪ Select the suitable starter. ▪ Identify the terminals of the starter. ▪ Select the range and type of the meters ▪ Make the connections as per the circuit diagram ▪ Start the motor using a starter ▪ Verify the performance of the machine.	▪ Before giving supply Slip rings must be short circuited ▪ Speed should be measured accurately
3,4	Load test on a)split phase induction motor. b) capacitor type induction motor	▪ Draw the circuit diagram ▪ Identify the different terminals of the 1-ph split phase induction motor /1-ph capacitor type induction motor and the starter ▪ Select the ranges and type of the meters ▪ Make the connections as per circuit diagram ▪ Start the motor using a starter ▪ Apply the load in steps ▪ Record the meter readings ▪ Verify the performance of the machine.	▪ Start the motor using a starter without load ▪ Apply the load up to full load in steps
5	Load test on single-phase Universal motor.	▪ Draw the circuit diagram ▪ Identify the different terminals of the 1-ph universal motor ▪ Select the range and type of the meters ▪ Make the connections as per the circuit diagram ▪ Start the motor using a starter ▪ Apply the brake load lightly ▪ Verify the performance of the machine	▪ Apply the brake load lightly ▪ Take the readings properly

6,7	Conduct suitable tests and draw circle diagram of a)squirrel cage induction motor b)slip ring induction motor	▪ Draw the circuit diagram for No-load test and Blocked rotor test ▪ Make the connections for no-load test and Blocked rotor test as per the circuit diagram ▪ Start the motor without load ▪ Apply the rated voltage to the motor in the no-load test and rated current to the blocked rotor test. ▪ During the Blocked rotor test fully tighten the rotor shaft ▪ Record the meter readings ▪ Calculate the output, torque ,efficiency etc. ▪ Plot the performance characteristics. ▪ Verify the performance of the machine. ▪ Draw the circle diagram on a graph sheet using the test data ▪ Select proper scale to draw the circle diagram	▪ Apply the rated voltage to the motor in the no-load test and rated current to the blocked rotor test. ▪ During the Blocked rotor test fully tighten the rotor
8	Conduct load test on synchronous motor and draw V and inverted V curves	▪ Draw the circuit diagram ▪ Identify different terminals of the 3-ph synchronous motor ▪ Select the range and type of the meters ▪ Make the connections as per the circuit ▪ Start the motor as per the procedure ▪ Switch on the excitation at correct time ▪ Vary the excitation in steps ▪ Pour water in the brake drum for cooling. ▪ Reduce the load to zero gradually. ▪ Switch off the motor. ▪ Disconnect the circuit. ▪ Calculate the output, torque ,efficiency etc. ▪ Plot the performance characteristics. ▪ First switch off the excitation and then only switch off the mains ▪ Draw the V and inverted V curves on a single graph sheet	▪ Switch on the excitation at correct time ▪ Vary the excitation in steps ▪ First switch off the excitation and then only switch off mains
9	Identify and rectify faults in AC motors	▪ Select a faulty motor ▪ Identify the different terminals of ac motors. ▪ Interpret the name plate details. ▪ Identify the different parts of the motor Identify the problems in the motor by physical observation ▪ Verify all the connections of the motor and the starter ▪ Check for burnout fuses. ▪ Identify any loose connections if any to tighten the connections ▪ Check the condition of bearings. ▪ Check the continuity of different windings by using DMM or Test lamp.	▪ Identify the problems in motor by physical observation ▪ check for reversal of phase and Reduce the load to Zero gradually ,If the

		▪ Identify any open or short circuits in the windings. ▪ Check the continuity between windings and body earthing. ▪ Start the motor using a starter without load. ▪ Observe whether the motor is running or not ▪ If running with normal speed no problem in the motor. ▪ If running with low speed check for reversal of phase and Reduce the load to Zero gradually ▪ Switch off the motor ▪ Disconnect the circuit.	Motor is running with low speed
10	Identify and rectify faults in AC starters	▪ Check the input and output terminals of the starter ▪ Check the condition of contactors for opening and closing ▪ Check for open circuit and short circuit in the coils of contactor. ▪ Check the condition of over load relay coil and no volt coil ▪ Check the current setting dial for proper current setting ▪ Check the contactor opening and closing time.	▪ Check the current setting dial for proper current setting

POWER ELECTRONICS AND PLC LABORATORY

Subject Title : **Power Electronics and PLC Laboratory**

Subject Code : **EE - 507**

Periods/Week : **06**

Periods/Year : **90**

TIME SCHEDULE

S. No.	Major Topics	No. of Periods
1.	Characteristics of different Power Electronic Devices	12
2.	Study the working of different Power Electronic circuits	12
3.	Speed control of the DC motor using the Power Electronic Devices	12
4.	Speed control of the single phase motor using SCR	06
5	Execution of the different Ladder Diagrams	18
6	Execution of the Ladder Diagrams with model applications	30
	Total	90

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, DIAC, TRIAC.

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 TRIAC

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 III) GTO,DIAC, IV)TRIAC	• Identify the different Power electronic devices available in the laboratory like SCR, IGBT,GTO,DIAC,TRIAC • Draw the symbols of the above devices. • Identify the different terminals. • Draw the necessary circuit diagram and identify the apparatus required • Make the connections of the circuit as per the circuit diagram of forward bias • Record the different values of voltage and current in forward bias • Change the connections of the circuit as per the circuit diagram of Reverse bias • Record the different values of voltage and current in reverse bias • Plot the forward and reverse characteristics on a graph sheet • Repeat the experiment for IGBT, GTO, DIAC, TRIAC and plot the V-I characteristics.	▪ Identify the different terminals ▪ Make the connections of the circuit as per the circuit diagram of forward bias ad reverse bias.
2	i) Working of single phase half wave converter ii) working of single phase full wave converter (6)	• Draw the circuit diagram for the single phase half wave converter • Identify the different components and apparatus required for the circuit • Make the necessary connections as per the circuit diagram with resistive load. • Verify the waveforms in the CRO at different gate current pulses • Change the R- load with R-L load and observe the waveforms at different gate current pulses • Study the working of the single phase full wave converter with R load and R-L load in similar way as above	▪ Verify the waveforms in the CRO at different gate current pulses

		• Draw the circuit diagram for the single phase full wave converter using SCR's • Identify the different components and apparatus required for the circuit • Make the necessary connections as per the circuit diagram • Verify the waveform in the CRO for different gate pulses	
3	i) Speed Control of DC motor using single phase full converter ii) Speed Control of DC motor using Chopper. (6)	• Draw the circuit diagram for the speed control of the DC motor using the single phase full wave convertor • Identify the different apparatus required from the circuit diagram • Make the necessary connections according to the circuit • Change the triggering angles and Noting down the readings of the speed of the DC motor • Plot the graph Speed Vs Triggering Angles • Perform another experiment in similar way on speed control of the DC motor using a single phase chopper • Change the duty cycle • Note down the readings of the speed of the DC motor • Plot the graph : Speed Vs Duty cycle	▪ Change the triggering angles ▪ Change the duty cycle
4	Speed control of single phase AC motor using SCR. (3)	• Draw the circuit diagram for the speed control of the single phase AC motor using the Silicon controlled Rectifier • Identify the different apparatus required from the circuit • Make the necessary connections according to the given circuit diagram • Note down the readings of the speed of the DC motor by changing the triggering angles • Draw the graph between Speed Vs Triggering Angles	▪ change the triggering angles ▪ Draw the graph between Speed Vs Triggering Angles
5	a) Demonstrate PLC and Ladder diagram b) Execute Ladder diagrams for different Logical Gates c) Execute Ladder diagrams using timers & counters (9)	• Identify the PLC trainer kit, the Personal Computer and Loaded PLC software • Observe the input and output ports of the PLC • Make the interfacing between the PC and the PLC. • Prepare the appropriate ladder diagrams for different logical gates(AND, OR, NOT, NOR,NAND) • Save the ladder diagram with relevant file names • Execute each ladder diagram program and checking for errors • Rectify errors if any then save and again executing the program • Download the LD program into the PLC • Run each program and checking its output logic with relevant inputs. • Prepare simple ladder diagrams using "timers and counters" instructions • Execute ,Run and check the output logic for each	▪ Modify the existing program and design new programs ▪ Test the ladder logic with logic GATES examples ▪ Test the ladder logic with Timer/Counter instructions in ladder diagrams

		program	
6	Execute Ladder diagrams with model applications (i)DOL starter (ii)Star-Delta starter (iii) Stair case lighting (iv) Traffic light controller (15)	• Identify the different available model application kits in the lab ▪ Draw the ladder diagrams for the DOL starter and star/delta starter • Prepare the ladder diagrams in the Computer ,saving and executing the program • Make proper connections of the model application at the output port of PLC and downloading its relevant LD program in PLC • Run the LD program and observing the outputs with the model applications • Execute the Ladder diagrams for other model applications like “Stair case lighting and Traffic signal control model” in the same way as above	▪ Execute the LD programs and observe the performance of starters ▪ Design Ladder Logic for the stair case lighting , Traffic light controller

LIFE SKILLS

Subject Title : Life Skills
Subject Code : EE-508
Scheme : C-16
Periods/ Week : 03
Periods/Semester : 45

TIME SCHEDULE

Sl No.	UNITS	No. of periods Allotted		
		Explanation	Activities	Total
1.	ATTITUDE	1	3	4
2.	ADAPTABILITY	1	3	4
3.	GOAL SETTING	1	3	4
4.	MOTIVATION	1	3	4
5.	TIME MANAGEMENT	1	3	4
6.	CRITICAL THINKING	2	3	5
7.	CREATIVITY	1	3	4
8.	PROBLEM SOLVING	1	3	4
9.	TEAM WORK	1	3	4
10.	LEADERSHIP	1	3	4
11.	STRESS MANAGEMENT	1	3	4
TOTAL		12	33	45

Note: No Written Examination; The total 45 hours are to be considered as Theory hours.

Marks: Internal – 40; External – 60

OBJECTIVES:

Upon the completion of this course, the student shall be able to

1.0 Understand the concept of Attitude

1.1 Define 'Attitude'

1.2 Explain the importance of Attitude

1.3 Distinguish between Positive and Negative Attitudes

1.4 Life Response: Need for change of Attitude

1.5 Positive Attitude: Key to success in Personal and Professional Lives

2.0 Understand the concept of Adaptability

2.1 Define the term 'Adaptability'

2.2 Explain the concept of Adaptability

2.3 Advantages of Adaptability

2.4 Disadvantages of Lack of Adaptability

2.5 Need for positive response to change

3.0 Understand the concept of Goal setting

3.1 Define the terms' Goal' and 'Goal Setting'

3.2 Explain the significance of Goal setting & Long and Short term goals

3.3 Explain the following concepts

a) Wish b) Dream c) Goal

3.4 Explain the reasons for and consequences of not setting goals

3.5 The SMART features in Goal setting

4.0 Understand the concept of Motivation

4.1 Define 'Motivation' ; Inspiration Vs Motivation

4.2 Importance of motivation in Goal setting

4.3 Distinguish between Internal (Self) Motivation and External Motivation

4.4 De-motivating Factors and how to overcome them

4.5 Motivating oneself and others

5.0 Understand Time Management skills

5.1 Define 'Time Management'.

5.2 Comprehend the significance of Time Management.

5.3 Explain the Time Quadrant

5.4 Common Time wasters and how to overcome them.

5.5 How to meet deadlines and targets within time

6.0 Understand Critical Thinking

6.1 Define "Critical Thinking",

6.2 Understand the importance of Critical Thinking

6.3 Distinguish between facts and opinions (assumptions)

6.4 Inculcating different perspectives

6.5 Developing Reasoning abilities and form sound judgments

7.0 Understand Creativity

7.1 Understand the importance of and need for creative ideas

7.2 Distinguish between Linear Thinking and Lateral Thinking

7.3 Distinctive qualities of creative people

7.4 Unusual or creative use of familiar objects

7.5 Creative ways of solving problems

8.0 Understand Problem Solving

8.1. Define the concept of Problem solving

8.2 Viewing the problems as challenges

8.3 Different steps in solving a problem

8.4 Selecting the best solution to solve a problem

8.5 Lateral thinking in Problem solving

9.0 Understand Team Work

9.1 Define Team work

9.2 Develop Team skills

9.3 Advantages of team work

9.4 Understand responsibilities as a team player

9.5 Problems of working in a team and possible solutions

10.0 Understand Leadership

10.1 Define Leadership

10.2 Identify Leadership qualities

10.3 Analyze one's strengths and limitations as a leader

10.4 Types of Leadership: Autocratic and Democratic

10.5 Leadership by example

11.0 Understand Stress Management

11.1 Define Stress

11.2 Explain the causes of stress

11.3 Learn Stress Management skills

11.4 Need for positive thinking and self esteem

11.5 Practice Stress Management strategies

DIGITAL ELECTRONICS & MICROCONTROLLERS LAB

Subject Title : **Digital Electronics & Microcontrollers Lab**

Subject Code : **EE-509**

Periods/Week : **04**

Periods/Semester : **60**

TIME SCHEDULE

S.No.	Major Topics	No. Of Periods
1.	Logic Gates	6
2.	Combinational Logic Circuits	15
3.	Sequential Logic Circuits	18
4.	Micro Controllers	21
	Total	60

LIST OF EXPERIMENTS

Logic Gates

1 Verify the truth tables of basic gates and universal gates.

2. Show NAND gate and NOR gate as Universal gates.

Combinational Logic Circuits

3. Realize a given Boolean function 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 7485 IC.

Sequential Logic Circuits

8. Construct and verify the truth tables of NAND & NOR latches

9 Construct clocked RS FF using NAND gates and Verify its truth table.

10. Verify the truth table of JK FF using 7476 IC.

11. Construct D and T flip flops using 7476 and verify the truth tables.

Micro Controllers

12. Familiarization of 8051 Microcontroller Kit

13. Familiarization of 8051 simulator EDSIM 51 (or similar)

14. Write small ALP to demonstrate different register addressing techniques

15. Write an ALP to demonstrate Addition, subtraction, division and multiplication of 8 bit numbers using immediate data access.

16. Write an ALP to Add and Subtract 16 bit numbers

17. Write an ALP to Square and Cube program

18. Write an ALP to find LCM of given numbers

19. Write an ALP to find HCF of given numbers

DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS

C-16-VI SEMESTER

EE - 601 INDUSTRIAL TRAINING

S.NO	Subject	Duration	Items	Max Marks	Remarks
1	Practical Training in the Industry	6 Months	1.First Assessment (at the end of 3rd month)	100	
			2. Second Assessment (at the end of 6th month)	100	
			3.Training Report a)Log Book b)Record	 30 30	
			4. Seminar	40	
TOTAL		300			

The industrial training shall carry **300** marks and pass marks are **50**%.A candidate failing to secure the minimum marks should complete it at his own expenses. No apprenticeship training stipend is payable in such case

During Industrial training the candidate shall put in a minimum of **90%**attendance.

SEMESTER
EE - 601 INDUSTRIAL TRAINING

OBJECTIVES

On completion of a spell of practical training in a industry, the student will be able to

1.0 Know the organizational set up from top executive to workmen level

1.1 Know the function of each department/section

1.2 Know the inter relationship among various

department/sections

2.0 Know the various raw materials used as feed stock and their source.

2.1 Understand the various intermediates produced and their further processing and / or waste disposal.

2.2 Know the final products, its composition and its commercial importance's, uses and applications.

3.0 Understand the various stages involved in processing, sequential arrangement of different equipment.

3.1 Draw the flow diagram, detail flow diagram of each process

3.2 Understand the arrangement of various equipment and machinery in systematic manner in a less possible area of site.

4.0 Know the various analytical methods used in the quality control department

4.1 Understand the experimental methods to find out the quality of the product

4.2 Understand various tools, instruments used for quality checking.

5.0 Know the trouble shooting in process operation

5.1 Know preventive precautions of each equipment in the plant.

5.2 Startup and shut down procedures for the equipment and plant.

6.0 Know the importance of safety in industries

6.1 Understand the safety about personnel protection, equipment protection

6.2 Know the usage of various safety devices

6.3 Precautionary measures to be taken.

7.0 Know the various pollutants emitted from the plant.

7.1 Understand effects of pollutants.

7.2 Understand treatment method and disposal.

7.3 Know the effective methods pollution control.

COURSE CONTENTS

1. Organizational set up
2. Raw materials, intermediates and end products
3. Process descriptions (Process flow diagrams and line tracing, detailed flow diagrams etc.)
4. Quality control of raw materials, intermediates and end products
5. Operational troubles and preventive measures
6. Safety aspects (personnel, equipment etc.)
7. Pollution control

INDUSTRIAL TRAINING SCHEME

VI SEMESTER

1. A candidate shall be assessed twice in the spell of industrial training i.e. at the end of third month and finally before he/she completes the industrial training
2. The assessment shall be carried out by a committee comprising of

   (a) A representative of the Industry where the candidate is undergoing training

   (b) A staff member of the concerned section of the polytechnic.
3. The assessment at the end of the third month and the end of training shall each carry 100 marks for the progress made during the corresponding period of training.
4. The remaining 100 marks are allotted as follows:

   For the training report (Record) 30 marks,

   For maintenance of log book 30 marks

   For seminar 40 marks.

   These are to be evaluated at the institution at the end of training by a committee consisting following staff members
   (1) Head of Section.
   (2) External Examiner preferably from Industry
   (3) Staff member who assessed the student during the Industrial Training.

5. The progress made during the end of assessment will be evaluated on the basis of the following parameters.

ASSESSMENT SCHEME

S. No.	Name of the Parameter	Max. Marks Allotted for each Parameter
1.	Attendance and punctuality	05
2.	Familiarity with Technical terms	06
3.	Familiarity with tools and material	10
4.	Attitude towards job	07
5.	Manual skills	04
6.	Application of knowledge	10
7.	Problem solving skills	10
8.	Comprehension and observation	04
9.	Safety and Environmental consciousness	03
10.	Human relations	04
11.	Ability to communicate	06
12.	Supervising ability	10
13.	General conduct during the period	06
14.	Maintenance of dairy	15
	Total	**100**