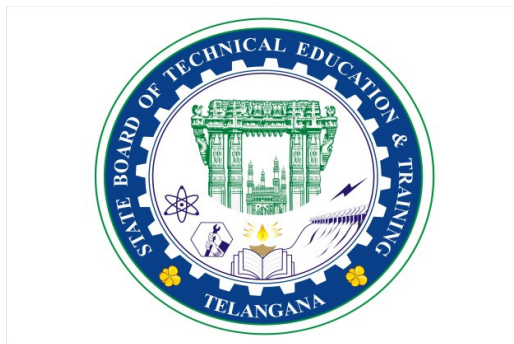


**DRAFT CURRICULUM – 2016  
(C-16)**

**DIPLOMA IN  
MECHANICAL ENGINEERING**



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

# **CURRICULUM (C-16)**

## **FOR DIPLOMA COURSES IN TELANGANA**

### **I. PREAMBLE**

The State Board of Technical Education and Training, **Telangana** under the aegis of the Department of Technical Education, Telangana generally reviews the Curricula to tune up the updated development both in academic and industry side. However, recognizing the changing needs as stated by the user industries, the Board has decided to bring forward the revision of curriculum. Consequently the Board with the assistance of senior faculty the concerned branches performed the evaluation of C-14 Curriculum in force. On finding the merits and demerits of C-14 Curriculum the faculty have made a thorough assessment of the curricular changes that have to be brought in. It was felt that there is an urgent need to improve hands-on experience among the students pursuing diploma courses. Further, the urgency of enhancing communication skills in English was also highlighted in the feedback and suggestions made by the user industries. Keeping these in view, a number of meetings and deliberations were held at state level, with experts from industry, academia and senior faculty of the department. The new Curricula for the different diploma courses have been designed with the active participation of the members of the faculty teaching in the Polytechnics of Telangana, besides reviewed by Expert Committee constituted with eminent academicians.

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

The revised New Curriculum i.e., Curriculum – 2016 or C-16 is planned and designed duly introducing 6 months industrial training in 3<sup>rd</sup> year level (5<sup>th</sup> or 6<sup>th</sup> semester) to have good exposer with industries and it will be implemented from the academic year 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. The policy decisions taken at the State and Central level with regard to environmental science are implemented by including relevant topics in Chemistry. This is also in accordance with the Supreme Court guidelines issued in Sri Mehta's case.
4. Keeping in view the increased need of communication skills which is playing a major role in the success of Diploma Level students in the Industries, emphasis is given for learning and acquiring listening, speaking, reading and writing skills in English. Further as emphasized in the meetings, Communication Skills lab and Life Skills lab are introduced in III and IV semesters respectively for all the branches.
5. 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.

6. CAD specific to the branch has been given more emphasis in the curriculum. Preparing drawings using CAD software has been given more importance.
7. Every student is exposed to the computer lab at the 1<sup>st</sup> year itself in order to familiarize himself with skills required for keyboard/mouse operation, internet usage and e-mailing.
8. The number of teaching hours allotted to a particular topic/chapter has been rationalized keeping in view the past experience
9. Upon reviewing the existing C-14 curriculum, more emphasis is given to the practical content of Laboratories and Workshops, thus strengthening the practical skills.
10. With increased emphasis for the student to acquire Practical skills, the course content in all the subjects is thoroughly reviewed and structured as outcome based than the conventional procedure based. While the course content in certain subjects is reduced, in rest of the subjects the content has been enhanced as per the need.
11. All Practical subjects are independent of each other and the practice of grouping two or more practical subjects is dispensed with.
12. 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.
13. The Members of the working group are grateful to Dr.M.V.Reddy, I.A.S., Director of Technical Education & Chairman, S.B.T.E.T. for his constant guidance and valuable inputs in revising, modifying and updating the curriculum.
14. The Members acknowledge with thanks the cooperation and guidance provided by the Sri. D. Venkateswarlu, Secretary, SBTET, Telangana and other officials of Directorate of Technical Education and the State Board of Technical Education, Telangana, experts from industry, academia from the universities and higher learning institutions and all teaching fraternity from the Polytechnics who are directly and indirectly involved in preparation of the curricula.

## **II. RULES AND REGULATIONS**

### **1. ADMISSION PROCEDURES :**

#### **1.1 DURATION AND PATTERN OF THE COURSES**

All the Diploma programs run at various institutions are of AICTE approved 3 years or 3½ years duration of Academic Instruction.

All the Diploma courses are run on year wise pattern in the First year, and the remaining two or two & half years are run in the semester pattern. In respect of few courses, the training will be in the seventh semester.

#### **12 PROCEDURE FOR ADMISSION INTO THE DIPLOMA COURSES:**

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

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

Only the candidates satisfying the following requirements will be eligible to appear for the Common Entrance Test for admissions into Polytechnics (POLYCET).

- a) The candidates seeking admission should have appeared for the X class examination, conducted by the Board of Secondary Examination, Telangana or equivalent examination thereto, at the time of making application to the Common Entrance Test for Polytechnics for admissions into Polytechnics (POLYCET). In case of candidates who apply pending results of their qualifying examinations, their selection shall be subject to production of proof of their passing the qualifying examination in one attempt or compartmentally at the time of interview for admission.
- b) Admissions are made based on the merit obtained in the Common Entrance Test (POLYCET) and the reservation rules stipulated by the Government of Telangana from time to time.
- c) For admission into the following Diploma Courses for which entry qualification is 10+2, candidates need not appear for POLYCET. A separate notification will be issued for admission into these courses.
- 1). D.H.M.C.T. 2). D.Pharmacy

### **13 MEDIUM OF INSTRUCTION**

The medium of instruction and examination shall be English.

### **14 PERMANENT IDENTIFICATION NUMBER (PIN)**

A cumulative / academic record is to be maintained of the Marks secured in sessional work and end examination of each year for determining the eligibility for promotion etc., a Permanent Identification Number (PIN) will be allotted to each candidate so as to facilitate this work and avoid errors in tabulation of results.

### **15 NUMBER OF WORKING DAYS PER SEMESTER / YEAR:**

- a). The Academic year for all the Courses usually shall be from June 2<sup>nd</sup> week of the year of admission to the 31<sup>st</sup> March of the succeeding year.
- b). The Working days in a week shall be from Monday to Saturday
- c). There shall be 7 periods of 50 minutes duration on all working days.
- d). The minimum number of working days for each semester / year shall be 90 / 180 days excluding examination days. If this prescribed minimum is not achieved due to any reason, special arrangements shall be made to conduct classes to cover the syllabus.

### **16 ELIGIBILITY OF ATTENDANCE TO APPEAR FOR THE END EXAMINATION**

- a). A candidate shall be permitted to appear for the end examination in all subjects, if he or she has attended a minimum of 75% of working days during the year/Semester.
- b). Condonation of shortage of attendance in aggregate upto 10% (65% and above and below 75%) in each semester or 1<sup>st</sup> year may be granted on medical grounds.
- c). Candidates having less than 65% attendance shall be detained.

- d). Students whose shortage of attendance is not condoned in any semester / 1st year are not eligible to take their end examination of that class and their admissions shall stand cancelled. They may seek re-admission for that semester / 1<sup>st</sup> year when offered next.
- e). A stipulated fee shall be payable towards condonation for shortage of attendance.

### 1.7 READMISSION

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

- 1) Within 15 days after commencement of class work in any semester (Except industrial Training).
- 2) Within 30 days after commencement of class work in any year (including D. Pharmacy course or first year course in Engineering and Non Engineering Diploma streams).

Otherwise such cases shall not be considered for readmission for that semester / year and are advised to seek readmission in the next subsequent eligible academic year.

The percentage of attendance of the readmitted candidates shall be calculated from the first day of beginning of the regular class work for that year / Semester, as officially announced by CTE/SBTET but not from the day on which he/she has actually reported to the class work, after readmission is granted.

## 2. SCHEME OF EXAMINATION

### 21 a) First Year

**THEORY EXAMINATION:** Each Subject carries 80% marks with examination of 3 hours duration,

along with 20% marks for internal

evaluation. (Sessional marks). However, there are no minimum marks prescribed for sessionals.

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

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

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

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

## 22 INTERNAL ASSESSMENT SCHEME

- a) Theory Subjects: Theory Subjects carry 20 % sessional marks, Internal examinations will be conducted for awarding sessional marks on the dates specified. **Three unit tests will be conducted for I year students and two Unit Tests for semesters.** Average of marks obtained in all the prescribed tests will be considered for awarding the sessional marks.
- b) Practicals: Student's performance in Laboratories / Workshop shall be assessed during the year of

study for 40% marks in each practical subject. Allotment of marks should be discrete taking into consideration of the students skills, accuracy, recording and performance of the task assigned to him / her. Each student has to write a record / log book for assessment purpose. In the subject of Drawing, which is also considered as a practical paper, the same rules hold good. Drawing exercises are to be filed in seriatum.

- c) Internal assessment in Labs / workshops / Survey field etc., during the course of study shall be done and sessional marks shall be awarded by the concerned Lecturer / Senior Lecturer / Workshop superintendent as the case may be.
- d) For practical examinations, except in drawing, there shall be two examiners. External examiner shall be appointed by the Principal in consultation with respective head of the department preferably choosing a person from an Industry. Internal examiner shall be the person concerned with internal assessment as in (c) above. The end examination shall be held along with all theory papers in respect of drawing.
- e) Question Paper for Practicals: Question paper should cover all the experiments / exercise prescribed.
- f) Records pertaining to internal assessment marks of both theory and practical subjects are to be maintained for official inspection.
- g) **Evaluation and assessment of industrial training**, shall be done and marks be awarded in the following manner.

Industrial assessment : 200 marks (in two spells of 100 marks each)

Maintenance of log book : 30 marks

Record Work : 30 marks

Seminar / viva-voce : 40 marks

TOTAL : 300 marks

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

### 2.3 MINIMUM PASS MARKS

#### THEORY EXAMINATION:

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

#### PRACTICAL EXAMINATION:

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

### 2.4 PROVISION FOR IMPROVEMENT

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, with the condition that the duration including Improvement examination shall not exceed FIVE years from the first admission.
4. No improvement is allowed in Practical / Lab subjects or Project work or Industrial Training assessment. However, improvement is allowed in drawing subject.
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.

### **3 RULES OF PROMOTION TO NEXT LEVEL :**

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

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

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

Puts the required percentage of attendance in the 4<sup>th</sup> semester

4. A candidate shall be promoted to 5<sup>th</sup> semester provided he / she puts the required percentage of attendance in the 4<sup>th</sup> semester and pays the examination fee on fulfilment of 3(i)(ii) clauses stated above. A candidate, who could not pay the 4<sup>th</sup> semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5<sup>th</sup> semester.

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

- i) Puts the required percentage of attendance in the 5<sup>th</sup> semester
- ii) Should not have failed in more than 6 subjects of 1<sup>st</sup> year, 3<sup>rd</sup> & 4<sup>th</sup> semesters put together.

#### **For IVC students.**

- i) Puts the required percentage of attendance in the 5<sup>th</sup> semester
- ii) Should not have failed in more than Four backlog subjects of III & IV Semesters

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

A candidate is eligible to appear for 6<sup>th</sup> semester examination if he/she

- i) Puts the required percentage of attendance in 6<sup>th</sup> semester

**For IVC students**

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

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

- 1) The same rules are applicable on par with other diploma courses with the exception that the Industrial Training is in the 5<sup>th</sup> semester.  
2) A candidate shall be promoted to 5<sup>th</sup> semester (Industrial Training) provided he/she puts the required percentage of attendance in the 4<sup>th</sup> semester and pay the examination fee. A candidate, who could not pay the 4<sup>th</sup> semester examination fee, has to pay the promotion fee as prescribed by the SBTET from time to time before commencement of 5<sup>th</sup> semester (Industrial Training).  
3) A candidate shall be promoted to 6<sup>th</sup> semester of the course provided he/ she has successfully completed the Industrial Training (Passed).

A candidate is eligible to appear for the 6<sup>th</sup> semester examination if he/ she Puts the required percentage of attendance in 6<sup>th</sup> semester.

**For IVC students**

- i. Puts the required percentage of attendance in the 6<sup>th</sup> semester  
ii. Should not have failed in more than 6 subjects of 1<sup>st</sup> year, 3<sup>rd</sup> & 4<sup>th</sup> semesters put together.

**For IVC students.**

- i) Puts the required percentage of attendance in the 6<sup>th</sup> semester

**3.3 For Diploma Courses of 3 ½ Years duration:**

**3.3.1 MET/ CH/ CHPP/ CHPC/ CHOT/ TT**

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

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



- i) Puts the required percentage of attendance in the 4<sup>th</sup> semester
- ii) Should not have failed in more than Four backlog subjects of 1<sup>st</sup> year. **9**
- 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.
- 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 would be 90 % attendance and attends for the VIVA-VOCE examination at the end of training.
- 6. A candidate shall be promoted to 7th semester of the course provided he/she has successfully completed both the spells of Industrial Training (Passed).  
A candidate is eligible to appear for 7th semester examination if he/she
- i) Puts the required percentage of attendance in the 7th semester and
- ii) Should not have failed in more than 6 backlog subjects of 1st year, 3rd and 4th semesters put together.
- iii) Should not have failed in more than six backlog subjects of 3rd and 4th semester put together for IVC students.

### **3.32 For Diploma Courses of 3 ½ Years duration: FW**

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

### **3.33 For Diploma Courses of 3 ½ Years duration: BM**

The same rules as are applicable for conventional courses also apply for these courses. Since the industrial training in respect of these courses is restricted to one semester (6 months) after the 6<sup>th</sup> semester (3 years) of the course.

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

## OR

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

### 3.4 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 4<sup>th</sup> Semester.
- c) The Second spell of Industrial training shall commence within 10 days after the completion of I spell of Industrial training.
- d) Each Semester of Institutional study shall be a minimum of 90 working days. (With 6 working days in a week i.e. from Monday to Saturday, with 7 periods of 50 minutes, duration per day.

## 4 STUDENTS PERFORMANCE EVALUATION

### 4.1 AWARD OF DIPLOMA

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

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 3<sup>rd</sup> and subsequent Semesters.

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

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

### 4.2 EXAMINATION FEE SCHEDULE:

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

### 4.3 STRUCTURE OF END EXAMINATION QUESTION PAPER:

The question paper for theory examination is patterned in such a manner that the Weightage of periods/marks allotted for each of the topics for a particular subject be considered.

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

- a) Each theory paper consists of Section 'A' and Section 'B'. Section 'A' contains 20 short answer questions out of which 15 questions are to be answered and each carries 2 marks Max. Marks:  $15 \times 2 = 30$ .

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:  $5 \times 10 = 50$ . 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:  $4 \times 5=20$ . Section 'B' contains six (6) questions. Out of which four (4) questions to be answered and each question carries 10 Marks. Max. Marks  $4 \times 10 = 40$ .

Practical Examinations

For Workshop practice and Laboratory Examinations,

Each student has to pick up a question paper distributed by Lottery System.

Max. Marks for an experiment / exercise : 50%

Max. Marks for VIVA-VOCE : 10%

Total : 60%

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

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

#### **4.4 ISSUE OF MEMORANDUM OF MARKS**

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

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

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

## **4.6 ELIGIBILITY FOR AWARD OF DIPLOMA**

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

- i. He / She pursued a course of study for not less than 3 / 3 ½ academic years & not more than 6 / 7 academic years.
- ii. He / she has completed all the subjects.

Students who fail to fulfill all the academic requirements for the award of the Diploma within 6 / 7 academic years from the year of admission shall forfeit their seat in the course & their seat shall stand cancelled.

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

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

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

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

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

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

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

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

#### **4.73 FOR RE-VERIFICATION OF THE VALUED ANSWER SCRIPT**

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

#### **4.74 MALPRACTICE CASES:**

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

#### **4.75 DISCREPANCIES/ PLEAS:**

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

### **5 ISSUE OF CERTIFICATES AND VETO**

#### **5.1. ISSUE OF DUPLICATE DIPLOMA**

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

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

#### **5.2 ISSUE OF MIGRATION CERTIFICATE AND TRANSCRIPTS:**

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

### **5.3 GENERAL**

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

## DIPLOMA IN MECHANICAL ENGINEERING

### C-16, SCHEME OF INSTRUCTIONS AND EXAMINATIONS FIRST YEAR

Subject Code	Name of the Subject	Instruction periods / week		Total Periods/ year	Scheme of Examination			
		Theory	Practical /Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
M-101	English	3	-	90	3	20	80	100
M-102	Engineering Mathematics - I	5	-	150	3	20	80	100
M-103	Engineering Physics	4	-	120	3	20	80	100
M-104	Engineering Chemistry & Environmental Studies	4	-	120	3	20	80	100
M-105	Engineering Mechanics	4	-	120	3	20	80	100
M-106	Workshop Technology	4	-	120	3	20	80	100
PRACTICAL:								
M-107	Engineering Drawing	-	6	180	3	40	60	100
M-108	Basic Work shop practice	-	6	180	3	40	60	100
M-109	Physics Lab	-	3	90	3	20	30	50
M-110	Chemistry Lab	-				20	30	50
M-111	Computer fundamentals Lab	-	3	90	3	40	60	100
<b>TOTAL</b>		<b>24</b>	<b>18</b>	<b>1260</b>		<b>280</b>	<b>720</b>	<b>1000</b>

**DIPLOMA IN MECHANICAL ENGINEERING**  
**C-16, SCHEME OF INSTRUCTIONS AND EXAMINATIONS**  
**III Semester**

Subject Code	Name of the Subject	Instruction periods / week		Total Periods / year	Scheme of Examination			
		Theory	Practical /Tutorial		Duration (hours)	Session al Marks	End Exam Marks	Total Marks
THEORY:								
M- 301	Engineering Mathematics - II	5	-	75	3	20	80	100
M -302	Strength of Materials	5	-	75	3	20	80	100
M -303	Engineering Materials	4	-	60	3	20	80	100
M-304	Basic Thermodynamics	5	-	75	3	20	80	100
M-305	Production Technology-I	5	-	75	3	20	80	100
PRACTICAL:								
M-306	Machine Drawing	-	6	90	3	40	60	100
M-307	Fuels Lab / Material Testing Lab	-	3	45	3	40	60	100
M-308	Communication Skills Lab	-	3	45	3	40	60	100
M-309	Manufacturing & Fabrication Engg. Practice -I	-	3	45	3	40	60	100
M-310	CAD Lab		3	45	3	40	60	100
<b>TOTAL</b>		<b>24</b>	<b>18</b>	<b>630</b>		<b>300</b>	<b>700</b>	<b>1000</b>



**DIPLOMA IN MECHANICAL ENGINEERING**  
**C-16, SCHEME OF INSTRUCTIONS AND EXAMINATIONS**  
**IV Semester**

Subject Code	Name of the Subject	Instruction periods / week		Total Periods / year	Scheme of Examination			
		Theory	Practical/Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
<b>THEORY:</b>								
M - 401	Design of Machine Elements-I	4		60	3	20	80	100
M - 402	Heat Power Engineering	5		75	3	20	80	100
M - 403	Hydraulics and Pneumatics	5		75	3	20	80	100
M - 404	Basic Electrical & Electronics Engineering	4		60	3	20	80	100
M - 405	Production Technology -II	5	-	75	3	20	80	100
<b>PRACTICAL:</b>								
M - 406	Production Drawing	-	7	105	3	40	60	100
M - 407	Hydraulics and Pneumatics Lab	-	3	45	3	40	60	100
M - 408	Manufacturing & Fabrication Engg. Practice -II	-	3	45	3	40	60	100
M - 409	Electrical Engineering lab	-	3	45	3	40	60	100
M-410	Programming lab in C		3	45	3	40	60	100
<b>TOTAL</b>		<b>23</b>	<b>19</b>	<b>630</b>		<b>300</b>	<b>700</b>	<b>1000</b>

**DIPLOMA IN MECHANICAL ENGINEERING  
C-16; SCHEME OF INSTRUCTIONS AND EXAMINATIONS  
V Semester**

Subject Code	Name of the Subject	Instruction periods / week		Total Periods / year	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
<b>THEORY:</b>								
M-501	Industrial Management and Entrepreneurship	5	-	75	3	20	80	100
M-502	Industrial engineering	4	-	60	3	20	80	100
M-503	Estimation & Costing	4	-	60	3	20	80	100
M-504	Design of Machine Elements-II	5	-	75	3	20	80	100
M-505	CAD/ CAM	5	-	75	3	20	80	100
M-506	<b>Elective</b> (A) Refrigeration and Air conditioning (B) Automobile Engineering (C) Energy sources and Power plant engineering	5	-	75	3	20	80	100
<b>PRACTICAL:</b>								
M-507	CAM Lab	-	4	60	3	40	60	100
M-508	T.E and R & AC Lab	-	3	45	3	40	60	100
M-509	Manufacturing & Servicing and Maintenance Practice	-	4	60	3	40	60	100
M-510	Project work	-	3	45	3	40	60	100
<b>TOTAL</b>		<b>28</b>	<b>14</b>	<b>630</b>		<b>280</b>	<b>720</b>	<b>1000</b>

**DIPLOMA IN MECHANICAL ENGINEERING  
C-16; SCHEME OF INSTRUCTIONS AND EXAMINATIONS  
VI Semester**

Subject Code	Name of the Subject	Instruction periods / week		Total Periods / year	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
M-601	Industrial Training		-	6 months				300

**1<sup>st</sup> YEAR**

## DIPLOMA IN MECHANICAL ENGINEERING

### C-16, SCHEME OF INSTRUCTIONS AND EXAMINATIONS FIRST YEAR

Subject Code	Name of the Subject	Instruction periods / week		Total Periods/ year	Scheme of Examination			
		Theory	Practical /Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
M-101	English	3	-	90	3	20	80	100
M-102	Engineering Mathematics - I	5	-	150	3	20	80	100
M-103	Engineering Physics	4	-	120	3	20	80	100
M-104	Engineering Chemistry & Environmental Studies	4	-	120	3	20	80	100
M-105	Engineering Mechanics	4	-	120	3	20	80	100
M-106	Workshop Technology	4	-	120	3	20	80	100
PRACTICAL:								
M-107	Engineering Drawing	-	6	180	3	40	60	100
M-108	Basic Work shop practice	-	6	180	3	40	60	100
M-109	Physics Lab	-	3	90	3	20	30	50
M-110	Chemistry Lab	-				20	30	50
M-111	Computer fundamentals Lab	-	3	90	3	40	60	100
<b>TOTAL</b>		<b>24</b>	<b>18</b>	<b>1260</b>		<b>280</b>	<b>720</b>	<b>1000</b>

**ENGLISH**  
(Common to all Branches)

**Subject Title** : English  
**Subject Code** : M - 101  
**Periods per Week** : 03  
**Periods per Year** : 90

**Time Schedule**

SI No	Major Topics	No. of Periods	Weightage of Marks	No of Short Answers	No of Long Answers
1	Speaking	19	20	10	-
2	Listening	06	04	02	-
3	Reading	12	10	-	1
4	Grammar	27	34	07	2
5	Writing	26	52	01	5
				-	-
		90	120	20	08

**Introduction**

Globalization has ushered in an era of opportunities for those who have the necessary competencies. Effective communication is one among them. In C-16 Curriculum the focus is therefore on improving communicative abilities resulting in students becoming industry – ready and employable.

**Objectives:**

- On completion of the course the students shall be able to
- Understand basic principles of language usage and apply them
  - Read and comprehend passages
  - Write short paragraphs, letters and reports
  - Use English appropriately in day-to-day communication

**Specific Instructional objectives**

**1.0 Practice spoken communication suited to various situations.**

- 1.1 Use proper expressions to make requests
- 1.2 Use proper expressions for asking and giving directions
- 1.3 Use suitable expressions to state feelings
- 1.4 Use suitable expressions to express obligations
- 1.5 Use suitable expressions to extend and accept invitations
- 1.6 Fix and cancel appointments
- 1.7 Express likes and dislikes
- 1.8 Give instructions
- 1.9 Use everyday expressions in the class room

**2 0 Listen and understand.**

- 2.1 Main ideas
- 2.2 Specific details
- 2.3 Make inferences

### **3.0 Read and comprehend English.**

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

### **4.0 Learn various grammatical structures.**

- 4.1 Use the present tense
- 4.2 Use the past tense
- 4.3 Use the future tense
- 4.4 Identify and use adjectives
- 4.5 Use prepositions
- 4.6 State basic sentence structures
- 4.7 Frame questions to elicit information
- 4.8 Frame questions for confirmation
- 4.9 Use active voice
- 4.10 Use passive voice
- 4.11 Use indirect speech
- 4.12 Use direct speech

### **5.0 Learn to excel in various forms of written communication.**

- 5.1 Identify components of a good paragraph
- 5.2 Write different types of paragraphs
- 5.3 Distinguish between formal and informal letters
- 5.4 Write personal letters
- 5.5 Write official letters
- 5.6 Prepare a resume
- 5.7 Write a cover letter
- 5.8 Report industrial visits
- 5.9 Make notes
- 5.10 Present and interpret data from flow chart, tree diagram and table

#### **Course Material**

The text book prepared by the faculty of English of Polytechnics.

#### **Reference Books**

- 1. Essential English Grammar Raymond Murphy
- 2. Learn English Santanu Sinha Chaudhuri
- 3. Grammar Builder Oxford University Press
- 4. Word Power made Easy Norman Lewis
- 5. Spoken English Shashi Kumar and Dhamija
- 6. English Grammar and Composition – David Greene (Mc Millan)

**Engineering Mathematics – I (Common to all )**

Subject Title : Engineering Mathematics-I  
 Subject Code : M-102  
 Periods per week : 05  
 Periods per Semester : 150

**Blue Print**

S. No	Major Topic	No of Periods		Weightage of Marks	Short Type			Essay Type		
		Theory	Practice		R	U	App	R	U	App
	<b>Unit - I : Algebra</b>									
1	Logarithms	3	1	2	1	0	0	0	0	0
2	Partial Fractions	5	1	4	1	1	0	0	0	0
3	Matrices and Determinants	20	6	16	1	2	0	0	½	½
	<b>Unit - II : Trigonometry</b>									
4	Compound Angles	5	2	2	1	0	0	0	0	0
5	Multiple and Submultiple angles	6	2	4	1	1	0	0	0	0
6	Transformations	8	3	10	0	0	0	0	½	½
7	Inverse Trigonometric Functions	8	3	10	0	0	0	0	½	½
8	Properties of triangles	2	0	2	1	0	0	0	0	0
9	Hyperbolic Functions	2	0	0	0	0	0	0	0	0
10	Complex Numbers	4	2	4	1	1	0	0	0	0
	<b>Unit III : Co-ordinate Geometry</b>									
11	Straight Lines	4	2	9	1	1	0	0	½	0
12	Circles	5	2	9	1	1	0	0	½	0
	<b>Unit – IV : Differential Calculus</b>									
13	Limits and Continuity	6	2	4	1	1	0	0	0	0
14	Differentiation	22	10	24	1	1	0	0	1	1
S. No	Major Topic	No of Periods		Weightage of Marks	Short Type			Essay Type		
	<b>Unit - V : Applications of Differentiation</b>	Theory	Practice		R	U	App	R	U	App
15	Geometrical Applications	5	2	10	0	0	0	0	0	1
16	Maxima and Minima	5	2	10	0	0	0	0	0	1



Total	110	40	120	11	9			3½	4½
			Marks	22	18	0	0	35	45

**R: Remembering type**                    **22** marks  
**U: Understanding type**                **53** marks  
**App: Application type**                **45** 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

$$\begin{array}{ll} i) \frac{f(x)}{(x+a)(x+b)(x+c)} & ii) \frac{f(x)}{(x+a)^2(x+b)(x+c)} \\ iii) \frac{f(x)}{(x^2+a)(x+b)} & iv) \frac{f(x)}{(x+a)(x^2+b)^2} \end{array}$$

**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 (emphasis on 3<sup>rd</sup> 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 a 3x3 square matrix 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 Apply the properties of determinants to solve problems.
- 3.12 Solve system of 3 linear equations in 3 unknowns using Cramer's rule.
- 3.13 Define multiplicative inverse of a matrix and list properties of adjoint and inverse.
- 3.14 Compute adjoint and multiplicative inverse of a square matrix.
- 3.15 Solve system of 3 linear equations in 3 unknowns by matrix inversion method
- 3.16 State elementary row operations.
- 3.17 Solve a system of 3 linear equations in 3 unknowns by Gauss- Jordan method

## UNIT – II

### Trigonometry :

#### 4.0 Solve simple problems on Compound Angles

- 4.1 Define compound angles and state the formulae of  $\sin(A\pm B)$ ,  $\cos(A\pm B)$ ,  $\tan(A\pm B)$  and  $\cot(A\pm B)$
- 4.2 Give simple examples on compound angles to derive the values of  $\sin 15^\circ$ ,  $\cos 15^\circ$ ,  $\sin 75^\circ$ ,  $\cos 75^\circ$ ,  $\tan 15^\circ$ ,  $\tan 75^\circ$  etc.
- 4.3 Derive identities like  $\sin(A+B) \cdot \sin(A-B) = \sin^2 A - \sin^2 B$  etc.,
- 4.4 Solve simple problems on compound angles.

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

- 5.1 Derive the formulae of multiple angles  $2A$ ,  $3A$  etc and sub multiple angles  $A/2$  in terms of angle  $A$  of trigonometric functions.
- 5.2 Derive useful allied formulas like  $\sin^2 A = (1 - \cos 2A)/2$  etc.
- 5.3 Solve simple problems using the above formulae

#### 6.0 Apply Transformations for solving the problems in Trigonometry

- 6.1 Derive the formulae on transforming sum or difference of two trigonometric ratios in to a product and vice versa - examples on these formulae.
- 6.2 Solve problems by applying these formulae to sum or difference or product of three or more terms.

#### 7.0 Use Inverse Trigonometric Functions for solving engineering problems

- 7.1 Explain the concept of the inverse of a trigonometric function by selecting an appropriate domain and range.
- 7.2 Define inverses of six trigonometric functions along with their domains and ranges.

- 7.3 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.
- 7.4 State various properties of inverse trigonometric functions and identities like  $\sin^{-1}x + \cos^{-1}x = \frac{\pi}{2}$  etc.
- 7.5 Derive formulae like  $\tan^{-1}x + \tan^{-1}y = \tan^{-1}\left(\frac{x+y}{1-xy}\right)$ , where  $x \geq 0, y \geq 0, xy < 1$  etc., and solve simple problems.

### 8.0 Appreciate Properties of triangles

- 8.1 State sine rule, cosine rule, tangent rule and projection rule .

### 9.0 Represent the Hyperbolic Functions in terms of logarithm functions

- 9.1 Define Sinh  $x$ , cosh  $x$  and tanh  $x$  and list the hyperbolic identities.
- 9.2 Represent inverse hyperbolic functions in terms of logarithms.

### 10.0 Represent Complex numbers in various forms

- 10.1 Define complex number, its modulus , conjugate and list their properties.
- 10.2 Define the operations on complex numbers with examples.
- 10.3 Define amplitude of a complex number
- 10.4 Represent the complex number in various forms like modulus-amplitude (polar) form, Exponential (Euler) form – illustrate with examples.

## UNIT - III

### Coordinate Geometry

#### 11.0 Solve the problems on Straight lines

- 11.1 Write the different forms of a straight line – point slope form, two point form, intercept form, normal form and general form
- 11.2 Solve simple problems on the above forms
- 11.3 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.

#### 12.0 Solve the problems on Circles

- 12.1 Define locus of a point – circle and its equation.
- 12.2 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
  - (v) Centre and tangent
- 12.3 Write the general equation of a circle and find the centre and radius.
- 12.4 Write the equation of tangent and normal at a point on the circle.
- 12.5 Solve the problems to find the equations of tangent and normal.

## UNIT - IV

### Differential Calculus

#### 13.0 Use the concepts of Limit and Continuity for solving the problems

- 13.1 Explain the concept of limit and meaning of  $\lim_{x \rightarrow a} f(x) = l$  and state the properties of limits .
- 13.2 Mention the Standard limits  $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a}$ ,  $\lim_{x \rightarrow 0} \frac{\sin x}{x}$ ,  $\lim_{x \rightarrow 0} \frac{\tan x}{x}$ ,  $\lim_{x \rightarrow 0} \frac{a^x - 1}{x}$ ,  
 $\lim_{x \rightarrow 0} \frac{e^x - 1}{x}$ ,  $\lim_{x \rightarrow 0} (1+x)^{\frac{1}{x}}$ ,  $\lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^x$  (All without proof).
- 13.3 Solve the problems using the above standard limits
- 13.4 Evaluate the limits of the type  $\lim_{x \rightarrow l} \frac{ax^2 + bx + c}{\alpha x^2 + \beta x + \gamma}$  and  $\lim_{x \rightarrow \infty} \frac{f(x)}{g(x)}$
- 13.5 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.

#### 14.0 Appreciate Differentiation and its meaning in engineering situations

- 14.1 State the concept of derivative of a function  $y = f(x)$  – definition, first principle as  $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$  and also provide standard notations to denote the derivative of a function.
- 14.2 State the significance of derivative in scientific and engineering applications.
- 14.3 Find the derivatives of elementary functions like  $x^n$ ,  $a^x$ ,  $e^x$ ,  $\log x$ ,  $\sin x$ ,  $\cos x$ ,  $\tan x$ ,  $\sec x$ ,  $\csc x$  and  $\cot x$  using the first principles.
- 14.4 Find the derivatives of simple functions from the first principle .
- 14.5 State the rules of differentiation of sum, difference, scalar multiplication, product and quotient of functions with illustrative and simple examples.
- 14.6 Explain the method of differentiation of a function of a function (Chain rule) with illustrative examples such as

$$(i) \sqrt{t^2 + \frac{2}{t}} \quad (ii) x^2 \sin 2x \quad (iii) \frac{x}{\sqrt{x^2 + 1}} \quad (iv)$$

$\log(\sin(\cos x))$ .

- 14.7 Find the derivatives of Inverse Trigonometric functions and examples using the Trigonometric transformations.
- 14.8 Explain the method of differentiation of a function with respect to another function and also differentiation of parametric functions with examples.
- 14.9 Find the derivatives of hyperbolic functions.
- 14.10 Explain the procedures for finding the derivatives of implicit function with examples.
- 14.11 Explain the need of taking logarithms for differentiating some functions with examples like  $[f(x)]^{g(x)}$ .
- 14.12 Explain the concept of finding the higher order derivatives of second and third order with examples.
- 14.13 Explain the concept of functions of several variables, partial derivatives and difference between the ordinary and partial derivatives with simple examples.
- 14.14 Explain the definition of Homogenous function of degree n
- 14.15 Explain Euler's theorem for homogeneous functions with applications to simple problems.

## UNIT - V

### Applications of the Differentiation

#### 15.0 Understand the Geometrical Applications of Derivatives

- 15.1 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.
- 15.2 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.
- 15.3 Find the lengths of tangent, normal, sub-tangent and sub normal at any point on the curve  $y=f(x)$ .
- 15.4 Explain the concept of angle between two curves and procedure for finding the angle between two given curves with illustrative examples.

#### 16.0 Use Derivatives to find extreme values of functions

- 16.1 Define the concept of increasing and decreasing functions.
- 16.2 Explain the conditions to find points where the given function is increasing or decreasing with illustrative examples.
- 16.3 Explain the procedure to find the extreme values (maxima or minima) of a function of single variable - simple problems yielding maxima and minima.

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

## 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:

$$\begin{array}{ll} i) \quad \frac{f(x)}{(x+a)(x+b)(x+c)} & ii) \quad \frac{f(x)}{(x+a)^2(x+b)(x+c)} \\ iii) \quad \frac{f(x)}{(x^2+a)(x+b)} & iv) \quad \frac{f(x)}{(x+a)(x^2+b)^2} \end{array}$$

#### 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 3 variables-Solutions by Cramers's rule, Matrix inversion method-examples-Elementary row operations on matrices -Gauss-Jordan method to solve a system of equations.

### Unit-II

#### Trigonometry :

4. Compound angles: Formulas of  $\sin(A\pm B)$ ,  $\cos(A\pm B)$ ,  $\tan(A\pm B)$ ,  $\cot(A\pm B)$ , and related identities with problems.

5. Multiple and sub-multiple angles: trigonometric ratios of multiple angles  $2A$ ,  $3A$  and submultiple angle  $A/2$  with problems.
6. Transformations of products into sums or differences and vice versa simple problems
7. Inverse trigonometric functions : definition, domains and ranges-basic properties-problems.
8. Properties and solutions of triangles: relation between sides and angles of a triangle- sine rule, cosine rule, tangent rule and projection rule – statements only .
9. Hyperbolic functions: Definitions of hyperbolic functions, identities of hyperbolic functions, inverse hyperbolic functions and expression of inverse hyperbolic functions in terms of logarithms.
10. 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.

### **UNIT-III**

#### **Coordinate geometry**

11. Straight lines: various forms of straight lines, angle between lines, perpendicular distance from a point, distance between parallel lines-examples.
12. 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 and (v) centre and tangent equation - general equation of a circle - finding center, radius: tangent, normal to circle at a point on it.

### **UNIT-IV**

#### **Differential Calculus**

13. Concept of Limit- Definition- Properties of Limits and Standard Limits -Simple Problems-Continuity of a function at a point- Simple Examples only.
14. 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:**

15. Geometrical meaning of the derivative, equations of Tangent and normal to a curve at any point. Lengths of tangent, normal, subtangent and subnormal to the curve at any point . Angle between the curves - problems.
16. 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.

### **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** : **M -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 (2 marks)	Essay Type (10 marks)
1.	Units and Dimensions	08	04	2	-
2.	Elements of Vectors	12	14	2	1
3.	Kinematics	12	14	2	1
4.	Friction	08	04	2	-
5.	Work, Power and Energy	12	12	1	1
6.	Simple Harmonic Motion	12	14	2	1
7.	Heat & Thermodynamics	12	14	2	1
8.	Sound	12	14	2	1
9.	Properties of matter	08	04	2	-
10.	Electricity & magnetism	14	14	2	1
11.	Modern Physics	10	12	1	1
	<b>Total:</b>	<b>120</b>	<b>120</b>	<b>20</b>	<b>8</b>

### 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 (without problems)
- 1.15 State the limitations of dimensional analysis

#### **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 a vector graphically
- 2.5 Classify the Types of 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 an 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 and state formulae for torque and 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 an expression for 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 and state its causes
- 4.2 Classify the types of friction
- 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 List the Advantages and Disadvantages of friction
- 4.10 Mention the methods of minimizing friction
- 4.11 Solve the related numerical problems

### **5.0 Understand the concept of Work, Power, and Energy**

- 5.1 Define the terms Work, Power and Energy.
- 5.2 State SI units and dimensional formula for Work, Power, and Energy
- 5.3 Define potential energy
- 5.4 Derive an expression for Potential energy with examples

- 5.5 Define kinetic energy
- 5.6 Derive an expression for kinetic energy with examples
- 5.7 State and prove Work- Energy theorem
- 5.8 Explain the relation between Kinetic energy and momentum
- 5.9 State the law of conservation of energy
- 5.10 Verify the law of conservation of energy in the case of a freely falling body
- 5.11 Solve the related numerical problems

## **6.0 Understand the concept of Simple harmonic motion**

- 6.1 Define Simple harmonic motion
- 6.2 State the conditions of Simple harmonic motion
- 6.3 Give examples for Simple harmonic motion
- 6.4 Show that the tip of the projection of a body moving in circular path with uniform speed is SHM
- 6.5 Derive an expression for displacement of a body executing SHM
- 6.6 Derive an expression for velocity of a body executing SHM
- 6.7 Derive an expression for acceleration of a body executing SHM
- 6.8 Derive expressions for Time period and frequency of S H M
- 6.9 Define phase of S H M
- 6.10 Derive expression for Time period of a simple pendulum
- 6.11 State the laws of simple pendulum
- 6.12 Explain seconds pendulum
- 6.13 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 Explain Boyle's law
- 7.3 State Charle's laws in terms of absolute temperature
- 7.4 Define absolute zero temperature
- 7.5 Explain absolute scale of temperature
- 7.6 Define ideal gas
- 7.7 Derive the ideal gas equation.
- 7.8 Define gas constant and Universal gas constant
- 7.9 Explain why universal gas constant is same for all gases
- 7.10 State SI unit of universal gas constant
- 7.11 Calculate the value of universal gas constant
- 7.12 State the gas equation in terms of density
- 7.13 Distinguish between  $r$  and  $R$
- 7.14 Define Isothermal process
- 7.15 Define adiabatic process
- 7.16 Distinguish between isothermal and adiabatic process
- 7.17 State first and second laws of thermodynamics
- 7.18 Define specific heats & molar specific heats of a gas
- 7.19 Derive the relation  $C_p - C_v = R$
- 7.20 Solve the related numerical problems

## **8.0 Understand the concept of Sound**

- 8.1 Define the term sound
- 8.2 Explain longitudinal and transverse wave motion
- 8.3 Distinguish between musical sound and noise
- 8.4 Explain noise pollution and state SI unit for noise
- 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 List the applications of beats
- 8.10 Define Doppler effect
- 8.11 List the Applications of Doppler effect
- 8.12 Explain reverberation and reverberation time
- 8.13 Write Sabine's formula
- 8.14 Explain echoes
- 8.15 State conditions of a good auditorium
- 8.16 Solve the related numerical problems

## **9.0 Understand the properties of matter**

- 9.1 Define terms Elasticity and plasticity
- 9.2 Define the terms stress and strain
- 9.3 State the units and dimensional formulae for stress and strain
- 9.4 State the Hooke's law
- 9.5 Define the surface tension
- 9.6 Explain Surface tension with reference to molecular theory
- 9.7 Define angle of contact
- 9.8 Define capillarity and state examples
- 9.9 Write the formula for surface tension based on capilarity
- 9.10 Explain the concept of Viscosity
- 9.11 Provide examples for surface tension and Viscosity
- 9.12 State Newton's formula for viscous force
- 9.13 Define co-efficient of viscosity
- 9.14 Explain the effect of temperature on viscosity of liquids and gases
- 9.15 State Poiseulle's equation for Co-efficient of viscosity
- 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 the Ohm's law
- 10.3 Explain the Ohm's law
- 10.4 Define specific resistance, conductance and 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 Explain the basic concept of Meter Bridge with legible sketch
- 10.10 Explain the concept of magnetism
- 10.11 State the Coulomb's inverse square law of magnetism
- 10.12 Define magnetic field and magnetic lines of force
- 10.13 State the Magnetic induction field strength-units and dimensions
- 10.14 Describe the moment of couple on a bar magnet placed in a uniform magnetic field
- 10.15 Solve the related numerical problems

## **11.0 Understand the concept of Modern physics**

- 11.1 Explain Photo-electric effect
- 11.2 Write Einstein's photoelectric equation
- 11.3 State the laws of photoelectric effect

- 11.4 Explain the Working of a 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 basic principle of optical Fiber
- 11.10 Mention types of optical fibers
- 11.11 List the applications of optical Fiber
- 11.12 Define super conductor and superconductivity
- 11.13 List the examples 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- Applications and limitations of Dimensional analysis.

### **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 friction— Motion of a body over a horizontal surface- 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- Charle's laws- Ideal gas equation- Universal gas constant- Differences between r and R- Isothermal and adiabatic processes- Laws of thermodynamics- Specific heats of a gas - 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-Condition 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 - Poiseulle’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-moment of couple-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 of an optical fiber-types of optical fibers - Applications of optical fibers- concepts of superconductivity - applications

**REFERENCE BOOKS**

- |                                       |                          |
|---------------------------------------|--------------------------|
| 1. Intermediate physics Volume- I & 2 | Telugu Academy           |
| 2. Text book of physics               | Resnick & Holiday        |
| 3. Engineering physics                | Gaur and Gupta           |
| 4. Fundamental Physics Volume -1 & 2  | K.L.Gomber and K.L.Gogia |

**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	04	2	0	0	0	0	0
2.	Elements of Vectors	12	14	0	0	2	0	0	1
3.	Kinematics	12	14	0	2	0	1	0	0
4.	Friction	08	04	2	0	0	0	0	0

5.	Work, Power and Energy	12	12	0	0	1	0	1	0
6.	Simple Harmonic Motion	12	14	0	0	2	0	1	0
7.	Heat & Thermodynamics	12	14	0	2	0	1	0	0
8.	Sound	12	14	0	2	0	0	1	0
9.	Properties of Matter	08	04	1	1	0	0	0	0
10.	Electricity & magnetism	14	14	0	2	0	0	0	1
11.	Modern Physics	10	12	1	0	0	0	1	0
	<b>Total:</b>	<b>120</b>	<b>120</b>	<b>6</b>	<b>9</b>	<b>5</b>	<b>2</b>	<b>4</b>	<b>2</b>



## ENGG. CHEMISTRY & ENVIRONMENTAL STUDIES

(Common Subject)

Subject Title : Engg. Chemistry & Environmental Studies  
Subject Code : M -104  
Total periods per year : 120  
Curriculum : C-16

### Blue Print

S.No	Major topic	No of Periods	Weight age of marks	Short Type (2 Marks)	Essay Type (10 Marks)	Remarks
1	Fundamentals of Chemistry	18	18	4	1	
2	Solutions	10	9	2	½	5 mark
3	Acids and bases	10	9	2	½	5 mark
4	Principles of Metallurgy	10	10	0	1	
5	Electrochemistry	14	14	2	1	
6	Corrosion	8	10	0	1	
7	Water Technology	14	14	2	1	
8	Polymers	12	14	2	1	
9	Fuels	6	4	2	0	
10	Environmental Studies	18	18	4	1	
	<b>Total</b>	120	120	20	08	
				40	80	

### OBJECTIVES

Upon completion of the course the student shall be able to

#### A. ENGINEERING CHEMISTRY

##### 1.0 Fundamentals of Chemistry

- 1.1 Explain the fundamental particles of an atom like electron, proton and neutron etc.,
- 1.2 Explain the concept of atomic number and mass number
- 1.3 State the Postulates of Bohr's atomic theory and its limitations
- 1.4 Explain the concept of Quantum numbers with examples
- 1.5 Explain 1. Aufbau's principle, 2. Hund's rule and 3. Pauli's exclusion principle with examples.
- 1.6 Define Orbital.
- 1.7 Draw the shapes of s, p and d Orbitals.
- 1.8 Distinguish between Orbit and Orbital
- 1.9 Write the electronic configuration of elements up to atomic number 30
- 1.10 Define chemical bond.

- 1.11 Explain the Postulates of Electronic theory of valency
- 1.12 Define and explain three types of Chemical bonding viz., Ionic, Covalent, Coordinate covalent bond with examples.
- 1.13 Explain bond formation in NaCl and MgO
- 1.14 List the Properties of Ionic compounds
- 1.15 Explain covalent bond formation in Hydrogen molecule, Oxygen molecule, and Nitrogen molecule using Lewis dot method.
- 1.16 List the Properties of Covalent compounds
- 1.17 Distinguish between ionic compounds and covalent compounds.
- 1.18 Define the terms 1.Oxidation, 2.Reduction 3.Oxidation number 4. Valency, with examples.
- 1.19 Calculate the Oxidation Number
- 1.20 Differentiate between Oxidation Number and Valency.

## **2.0 Solutions**

- 2.1 Define the terms 1.Solution, 2.Solute and 3.Solvent
- 2.2 Classify solutions based on physical state.
- 2.3 Define solubility, unsaturated, saturated and super saturated solutions.
- 2.4 Define mole.
- 2.5 Explain Mole concept with examples.'
- 2.6 Define the terms 1. Atomic weight, 2. Molecular weight and 3. Equivalent weight
- 2.7 Calculate Molecular weight and Equivalent weight of Acids, Bases and Salts.
- 2.8 Define Molarity and Normality.
- 2.9 Solve Numerical problems on Mole, Molarity and Normality

## **3.0 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 and bases.
- 3.4 State the limitations of Bronsted – Lowry theory of acids and 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 Sorenson scale
- 3.9 Solve the Numerical problems on pH (Strong Acids and Bases)
- 3.10 Define buffer solution and give examples.
- 3.11 State the applications of buffer solutions.

## **4.0 Principles of Metallurgy**

- 4.1 List the Characteristics of Metals.
- 4.2 Distinguish between Metals and Non Metals
- 4.3 Define the terms 1.Metallurgy 2.Mineral, 3.Ore, 4. Gangue, 5. Flux and 6. Slag
- 4.4 Describe Froth Floatation method of concentration of ore.
- 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. German silver, and Nichrome
- 4.9 List the uses of following Alloys: Brass, German silver, Nichrome

## **5.0 Electrochemistry**

- 5.1 Define the terms 1. conductor, 2. Insulator, 3. Electrolyte and 4. Non – electrolyte
- 5.2 Types of electrolytes.- strong and weak with examples.
- 5.3 Distinguish between metallic conductors and Electrolytic conductors.
- 5.4 Explain Arrhenius theory of electrolytic dissociation
- 5.5 Explain electrolysis of fused NaCl.
- 5.6 Explain Faraday's laws of electrolysis
- 5.7 Define Chemical equivalent, Electrochemical equivalent.
- 5.8 Solve the Numerical problems based on Faraday's laws of electrolysis
- 5.9 Define Galvanic cell
- 5.10 Explain the construction and working of Galvanic cell
- 5.11 Distinguish between electrolytic cell and galvanic cell
- 5.12 Explain the standard electrode potentials
- 5.13 Define electrochemical series and explain its significance.
- 5.14 Define and explain emf of a cell.
- 5.15 Solve the numerical problems on emf of cell

## **6.0 Corrosion**

- 6.1 Define the term corrosion
- 6.2 Explain the Factors influencing the rate of corrosion
- 6.3 Explain the concept of electrochemical theory of corrosion
- 6.4 Describe the formation of a) composition cell, b) stress cell c) concentration cell
- 6.5 Define rust and explain the mechanism of rusting of iron with chemical reactions.
- 6.6 Explain the methods of prevention of corrosion: a) Protective coatings  
b) Cathodic protection (Sacrificial anode process and Impressed – voltage process)

## **7.0 Water Technology**

- 7.1 State the various Sources of water.
- 7.2 Define the terms soft water and hard water with examples
- 7.3 Define hardness of water.
- 7.4 Explain temporary and permanent hardness of water.
- 7.5 List the usual chemical compounds causing hardness (with Formulae)
- 7.6 Define Degree of hardness, units of hardness in ppm (mg/L) and numerical problems related to hardness.

- 7.7 Disadvantages of using hard water in industries.
- 7.8 Explain the methods of softening of hard water: a) permutit process b).Ion-Exchange process.
- 7.9 Essential qualities of drinking water.
- 7.10 Explain municipal treatment of water for drinking purpose.
- 7.11 Define Osmosis and Reverse Osmosis(RO).
- 7.12 List the advantages of RO

## **8.0 Polymers**

- 8.1 Explain the concept of polymerisation
- 8.2 Describe the methods of polymerisation a) addition polymerisation b) condensation polymerization with examples.
- 8.3 Define the term plastic
- 8.4 Types of plastics with examples.
- 8.5 Distinguish between thermoplastics and thermosetting 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 and uses of the following plastics:
  1. Polythene, 2. PVC, 3.Teflon, 4. Polystyrene 5. Urea formaldehyde
  6. Bakelite(only flow chart i.e. without chemical equations).
- 8.10 Define the term natural rubber
- 8.11 State the structural formula of Natural rubber
- 8.12 Explain the processing of Natural rubber from latex
- 8.13 List the Characteristics of natural rubber
- 8.14 Explain the process of Vulcanization
- 8.15 List the Characteristics of Vulcanized rubber
- 8.16 Define the term Elastomer
- 8.17 Describe the preparation and uses of the following synthetic rubbers a) Butyl rubber, b) Buna-s and c) Neoprene rubber

## **9.0 Fuels**

- 9.1 Define the term fuel
- 9.2 Classify the fuels based on physical state – solid, liquid and gaseous fuels with examples.
- 9.3 Classify the fuels based on occurrence- primary and secondary fuels with examples.
- 9.4 List the characteristics of a good fuel.
- 9.5 State the composition and uses of the following gaseous fuels:
  - a) water gas, b) producer gas, c) natural gas, d) coal gas, e) Bio gas and f) acetylene

## **B. ENVIRONMENTAL STUDIES**

- 1.1 Define the term environment

- 1.2 Explain the scope and importance of environmental studies
- 1.3 Define and understand the following terms 1).Lithosphere, 2).Hydrosphere, 3).Atmosphere, 4).Biosphere, 5)Pollutant, 6).Contaminant 7) Pollution 8)Receptor 9)Sink 10) Particulates, 11)Dissolved oxygen(DO), 12).Threshold limit value(TLV), 13).BOD, and 14).COD
- 1.4 Explain the growing energy needs
- 1.5 Explain renewable(non-conventional) and non renewable(conventional) energy sources with examples.
- 1.6 Define an Ecosystem. Understand biotic and abiotic components of ecosystem.
- 1.7 Define the terms:
  - 1).Producers, 2).Consumers and 3).Decomposers with examples.
- 1.8 Explain biodiversity and threats to biodiversity
- 1.9 Define air pollution
- 1.10 Classify the air pollutants- based on origin and states of matter
- 1.11 Explain the causes of air pollution
- 1.12 Explain the uses and over exploitation of forest resources
- 1.13 Define and explain deforestation
- 1.14 Explain the effects of air pollution on human beings, plants and animals
- 1.15 Explain the green house effect - ozone layer depletion and acid rain
- 1.16 Explain the methods of control of air pollution
- 1.17 Define water pollution
- 1.18 Explain the causes of water pollution
- 1.19 Explain the effects of water pollution on living and non living things
- 1.20 Understand the methods of control of water pollution.

## COURSE CONTENT

### **A. ENGINEERING CHEMISTRY**

#### **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 – Valency, types of chemical bonds – Ionic, covalent and co-ordinate covalent bond with examples – Properties of Ionic and Covalent compounds

**Oxidation-Reduction:** Concepts of Oxidation-Reduction, Oxidation Number- calculations,

#### **2. Solutions**

Introduction-concentration terms – Mole concept, Molarity, Normality- Molecular weight, 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 –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 - Arrhenius theory of electrolytic dissociation – electrolysis – Faraday's laws of electrolysis- numerical problems – Galvanic cell – standard electrode potential – electro chemical series –emf and numerical problems on emf of a cell

#### **6. Corrosion**

Introduction - factors influencing the rate of corrosion - electrochemical theory of corrosion - composition, stress and concentration cells– rusting of iron and its mechanism – prevention of corrosion by coating methods, cathodic protection

#### **7. Water technology**

Introduction –soft and hard water – causes of hardness – types of hardness –disadvantages of hard water – degree of hardness (ppm) – softening methods – permutit process – ion exchange process – numerical problems related to degree of hardness – drinking water – municipal treatment of water for drinking purpose – Osmosis, Reverse Osmosis - advantages of Reverse osmosis

#### **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 – preparation and uses of the following plastics: 1. Polythene 2. PVC 3. Teflon 4. Polystyrene 5. Urea formaldehyde 6. Bakelite – Rubber – Natural rubber – processing from latex – Vulcanization – Elastomers – Butyl rubber, Buna-s, Neoprene rubber and their uses.

#### **9. Fuels**

Definition and classification of fuels – characteristics of good fuel - composition and uses of gaseous fuels- a) water gas,b) producer gas, c) natural gas, d) coal gas, e) Bio gas and f) acetylene

### **B. ENVIRONMENTAL STUDIES**

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 Biodiversity.

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

### **REFERENCE BOOKS**

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

## ENGINEERING MECHANICS

Subject Title	:	Engineering Mechanics
Subject Code	:	M-105
Periods/Week	:	04
Periods per year	:	120

### TIME SCHEDULE

S No.	Major Topics	No. of Periods	Weightage of Marks	Short Answer Questions	Essay Type Questions
1	Statics	22	23	04	1 ½
2	Friction	18	18	04	01
3	Geometrical properties of sections	22	19	02	1 ½
4	Dynamics	28	28	04	02
5	Simple machines	30	32	06	02
	<b>Total</b>	<b>120</b>	<b>120</b>	<b>20</b>	<b>08</b>

### OBJECTIVES

Upon completion of the course the student shall be able to

#### 1.0 Understand the concept of Statics

- 1.1 Explain the meaning of mechanics in engineering.
- 1.2 State the importance of mechanics in engineering.
- 1.3 Review the system of units used.
- 1.4 Explain the concept of force
- 1.5 List the types of forces
- 1.6 Explain the force system
  - a) Co-planar and Non-Coplanar,
  - b) Parallel and Non-Parallel,
  - c) Like and Unlike, d) Concurrent and Non-concurrent
- 1.7 Explain the concept of equilibrium
- 1.8 State the parallelogram law of forces
- 1.9 State the triangle law of forces
- 1.10 State the polygon law of forces
- 1.11 State the Lami's theorem.
- 1.12 Explain the concept of free body diagram
- 1.13 Solve the problems involving concurrent coplanar forces
- 1.14 Solve simple problems involving non-concurrent coplanar forces
- 1.15 Solve simple problems using Lami's theorem
- 1.16 Define the term couple and moment of couple with legible sketch.
- 1.17 Explain the properties of a couple
- 1.18 State the conditions of equilibrium of a body acted upon by co-planar forces.

#### 2.0 Understand the concept of Friction

- 2.1 Explain the concept of friction
- 2.2 State the laws of friction
- 2.3 Identify the machine members in which friction exists and desirable
- 2.4 Resolve the forces acting on bodies moving on horizontal plane.



- 2.5 Resolve the forces acting on bodies moving along the inclined planes.
- 2.6 Solve the related numerical problems

### **3.0 Understand the Geometric Properties of Sections**

- 3.1 Define the terms Centre of Gravity, Centre of Mass and Centroid.
- 3.2 State the need for finding the Centroid and Centre of gravity for various engineering applications
- 3.3 Locate the C.G. of a given section.
- 3.4 Explain the method of determining the Centroid by 'Method of moments'
- 3.5 Determine the position of Centroid of standard sections-T, L, I, Channel section, Z section, unsymmetrical I section
- 3.6 Explain the meaning of the term moment of Inertia.
- 3.7 Define the term polar moment of inertia
- 3.8 Explain the term radius of gyration
- 3.9 State the necessity of finding Moment of Inertia for various engineering applications
- 3.10 Determine Moment of Inertia and Radius of gyration for regular geometrical sections like T, L, I, Channel section, Z section, unsymmetrical I section
- 3.11 State Parallel axis theorem and perpendicular axis theorem
- 3.12 Determine MI of standard sections by applying parallel axes theorem
- 3.13 Determine MI of standard sections by applying perpendicular axes theorem
- 3.14 Calculate the moment of Inertia of composite sections.
- 3.15 Calculate radius of gyration of standard sections.
- 3.16 Determine the polar M.I for solid and hollow circular section applying perpendicular axes theorem.
- 3.17 Solve the related numerical problems

### **4.0 Understand the concept of Dynamics**

- 4.1 Define the terms Kinematics and Kinetics
- 4.2 Classify the motion types
- 4.3 Define the terms distance, displacement, speed, velocity and acceleration
- 4.4 State the Newton's Laws of motion (without derivation)
- 4.5 Solve the problems related to the rectilinear motion of a particle
- 4.6 Explain the Motion of projectile
- 4.7 Solve the numerical problems
- 4.8 State the D'Alembert's principle
- 4.9 Define the Law of conservation of energy
- 4.10 Explain the Work, Power and Energy
- 4.11 Define the Law of conservation of momentum
- 4.12 Explain the Impulse –momentum equation
- 4.13 Solve the problems using the above principles
- 4.14 Explain the Rotary motion of particle
- 4.15 Define Centripetal force.
- 4.16 Define Centrifugal force.
- 4.17 Differentiate Centripetal and Centrifugal forces

### **5.0 Comprehend the Principles involved in Simple Machines**

- 5.1 Define the important terms of simple machines  
a) Machine, b) Mechanical Advantage, c) Velocity Ratio, d) Efficiency.
- 5.2 Illustrate the use of three classes of simple lever.
- 5.3 Show that an inclined plane is a simple machine to reduce the effort in lifting loads.
- 5.4 Derive expression for VR in cases of wheel & axle, simple pulley, screw jack and rack & pinion.
- 5.5 Compute the efficiency of a given machine.

- 5.6 Compute effort required to raise or lower the load under given conditions.
- 5.7 Interpret the law of machine.
- 5.8 State the conditions for self-locking and reversibility.
- 5.9 Calculate effort lost in friction and load equivalent of friction.

## **COURSE CONTENT**

### **1.0 Statics**

- 1.1 The meaning of word mechanics.
- 1.2 Application of Mechanics to Engineering.
- 1.3 System of Units.
- 1.4 Definition and specification of force
- 1.5 System of forces
- 1.6 Resolution of force
- 1.7 Equilibrium and Equilibrant.
- 1.8 Statement of Parallelogram law of forces, triangle law of forces, polygon law of forces and Lami's theorem
- 1.9 Drawing the free body diagram
- 1.10 Numerical problems related to concurrent coplanar forces
- 1.11 Couple and moment of a couple
- 1.12 Condition for equilibrium of a rigid body subjected to number of coplanar non-concurrent forces.
- 1.13 Related Numerical problems

### **2.0 Friction**

- 2.1 Definition of static friction, dynamic friction and impending friction
- 2.2 laws of solid and liquid friction
- 2.3 Derivation of limiting angle of friction and angle of repose
- 2.4 Resolution of Forces considering Friction when a body moves on horizontal plane.
- 2.5 Resolution of Forces considering Friction when a body moves on inclined plane.
- 2.6 Numerical problems on the above cases

### **3.0 Geometric Properties of Sections**

- 3.1 Definition and explanation of the terms Centre of Gravity, Centre of Mass and centroid
- 3.2 Centroid of square, rectangle, triangle, semi-circle and trapezium (formulae only without derivations)
- 3.3 Centre of gravity of composite sections by analytical method Only (T-Section, L-Section I-section and channel section).
- 3.4 Moment of Inertia.
  - a) Definition and Explanation, b) Theorems of Moment of Inertia.
    - i) Parallel axes theorem, ii) Perpendicular axes theorem.
  - c) Moment of Inertia for simple Geometrical Sections, Rectangular, circular and triangular section and Radius of Gyration.
- 3.5 Calculation of Moment of Inertia and Radius of Gyration of
  - a) I – Section, b) Channel Section, c) T – Section.
  - d) L – Section (Equal & unequal lengths), e) Z - section

### **4.0 Dynamics**

- 4.1 Definition of Kinematics and Kinetics
- 4.2 Classification of motion
- 4.3 Definition of distance, displacement, speed, velocity and acceleration

- 4.4 Laws of motion (without derivation)
- 4.5 Solving the problems related to the rectilinear motion of a particle
- 4.6 Motion of projectile and solving the numerical problems
- 4.7 Newton's laws of motion.
- 4.8 D'Alembert's principle
- 4.9 Definition of Law of conservation of energy
- 4.10 Work, Power and Energy
- 4.11 Law of conservation of momentum
- 4.12 Impulse –momentum equation
- 4.13 Solving the kinetic problems using the above principles
- 4.14 Rotary motion of particle and laws of motion
- 4.15 Definition and Differentiate Centripetal and Centrifugal forces.

### 5.0 Simple Machines

- 5.1 Definition of Simple machine, and uses of simple machine, levers and inclined plane.
- 5.2 Fundamental terms like mechanical advantage, velocity ratio and efficiency.
- 5.3 Expressions for VR in case of Simple pulley, Rack and pinion, wheel & axle and Screw jack.
- 5.4 Conditions for reversibility and self locking.
- 5.5 Law of Simple Machine.
- 5.6 Effort lost in friction, Load Equivalent of Friction.

### REFERENCE BOOKS:

1	Engineering Mechanics	by	FL Singer	B.S.Publications
2	Engineering Mechanics	by	Basudeb Bhattacharya –	Oxford Publishers
3	Engineering Mechanics	by	A Nelson	Mc Graw Hill Publishers
4	Engineering Mechanics	by	I.B.Prasad	
5	Engineering Mechanics	by	R.S.Khurmi	S.Chand & Comp
6	Theory of Machines	by	S.S.Rathan	TMH P

## WORKSHOP TECHNOLOGY

**Subject Title** : **Workshop Technology**  
**Subject Code** : **M-106**  
**Periods per Week** : **04**  
**Periods per Year** : **120**

### TIME SCHEDULE

S. No	Major Topics	No. of Periods	Weightage of Marks	Short Answer Questions	Essay type Questions
1	Basic Workshop tools & operations				
	(1) Carpentry	22	21	3	11/2
	(2) Fitting	18	18	4	1
	(3) Forging	12	12	1	1
	(4) Sheet metal	16	16	3	1
2	Drilling	14	16	3	1
3	Foundry	24	24	2	2
4	Mechanical working of metals	14	13	4	1/2
	<b>Total</b>	120	120	20	08

### OBJECTIVES

Upon completion of the course the student shall be able to

#### 1.0 Comprehend the use of Basic workshop tools and its operation

- a. State the importance of workshop processes.
- b. List the various workshop processes and explain briefly about each.

##### 1.1 Carpentry

- a. Identify various carpentry tools.
- b. Distinguish between marking tools, measuring tools and cutting tools.
- c. List work holding devices.
- d. Explain wood working processes viz., sawing, chiselling and planing.
- e. Explain the use of carpentry joints such as lap joint, dovetail joint, mortise and tenon joint with legible sketch
- f. Explain the working of wood working machines.

##### 1.2 Fitting

- a. List various fitting tools.
- b. Distinguish between marking and measuring tools.
- c. List cutting tools.
- d. List various work holding devices.
- e. List various checking and measuring instruments.
- f. Explain fitting operations such as marking, sawing, chipping, filing, grinding, drilling and tapping with legible sketch

##### 1.3 Forging

- a. List various tools used in black-smithy.

- b. List equipment used in a forging shop.
- c. Explain the important smithy operations
- d. Explain machine forging operations such as upsetting, drawing down and punching with legible sketch
- e. List the forging defects

#### 1.4 Sheet Metal

- a. List various marking tools in sheet metal work
- b. List various stakes
- c. List various measuring tools used in sheet metal work
- d. List various sheet metal joints.
- e. Describe sheet metal operations such as shearing, bending drawing and squeezing

### 2.0 Understand the concept of drilling

- 2.1 State the working principle of drilling.
- 2.2 List out different types of drilling machines.
- 2.3 Draw the line diagrams of the sensitive and radial drilling machines.
- 2.4 Identify the parts of these machines.
- 2.5 Describe the functions of each part.
- 2.6 Write the Specifications of drilling machines.
- 2.7 Write the nomenclature of the drill bit.
- 2.8 Write the geometry of twist drill.
- 2.9 List the functions of twist drill elements.
- 2.10 List the different operations on drilling machine.

### 3.0 Understand the concept of Foundry

- 3.1 Acquaint with foundry as a manufacturing process.
- 3.2 State the advantages of casting over other process.
- 3.3 State the limitations of the process.
- 3.4 List the various hand moulding tools.
- 3.5 State the properties of good moulding sand.
- 3.6 State the types of moulding sands.
- 3.7 List the ingredients in foundry sand.
- 3.8 List the various types of patterns.
- 3.9 State the sequence of pattern making operations.
- 3.10 Identify the colour codes.
- 3.11 List the various moulding processes.
- 3.12 State the need and types of cores.
- 3.13 Describe the casting processes.
- 3.14 Identify the defects in casting.

### 4.0 Mechanical working of metals

- 4.1 Define mechanical working of metals.
- 4.2 Differentiate cold working with hot working.
- 4.3 Illustrate the working principle of hot rolling, piercing, spinning, extrusion and drawing.
- 4.4 State advantages and limitations of hot working.
- 4.5 Identify various cold working processes such as rolling, bending and squeezing.
- 4.6 State advantages and limitations of cold working.

## COURSE CONTENT

### 1 Introduction : Basic workshop tools and its operation

Methods of manufacturing processes - casting, forming, metal removal processes, joining processes, surface finishing processes, basic workshop processes - carpentry, fitting, hand forging, machine forging, sheet metal work, cold and hot working of metals.

## 1.1 Carpentry

1.1.1 **Marking & measuring tools:** scales, rules, fourfold wooden rule, flexible measuring rule (tape), straight edge, try square, bevel square, combination square, marking knife, marking gauge, mortise gauge, cutting gauge, wing compass, trammel, divider, outside calliper, inside calliper, odd leg calliper, spirit level, plum bob, specifications- uses.

### 1.1.2 Cutting Tools

**Saws:** rip saw, cross cut saw (hand saw), panel saw, tenon or back saw, dovetail saw, bow saw, coping saw, compass saw, pad or keyhole saw, specifications & uses.

**Chisels:** Firmer chisel, bevelled edge firmer chisel, parting chisel, mortise chisel, inside and outside gauges, specifications and uses.

**Planes:** Jack plane (wooden jack plane, metal jack plane), rough plane, smoothing plane, rebate plane, plough plane, router, spoke shave, special planes and their specifications and uses.

### Boring Tools:

Gimlet, braces- wheel brace, ratchet brace, bit-shell bit, twist bit (auger bit), expansive bit, centre bit, router bit, countersink bit, drill, reamer their specifications & uses.

### 1.1.2 Striking tools:

Hammers - Warrington hammer, claw hammer, mallet, specifications & uses.

### 1.1.3 Holding devices

Bench vice, bench stop, bench hold fast, sash cramp (bar cramp) G- cramp, Hand screw, specifications & uses.

### 1.1.4 Miscellaneous tools

Rasps and files, scraper, oilstone, glass paper, pincer, screw driver, cabinet screw driver, ratchet-screw driver, saw set, oil stone slip. specifications and uses.

### 1.1.5 Carpentry Processes

Marking, measuring, sawing, chiselling, planning, boring, grooving, rebating & moulding.

### 1.1.6 Carpentry joints

Halving Joint, mortise and tenon joint, bridle joint, butt joint. dowel joint, tongue & groove joint, screw & slot joint, dovetail joint, corner joint.

### 1.1.7 Wood working machines

Wood working lathe (wood turning lathe), circular saw, band saw, wood planer, sanding machine specifications and uses.

## 1.2 Fitting

### 1.2.1 Cutting tools

**Chisels:** Flat chisel, cross cut chisel, half round chisel, diamond point chisel, side chisel, specifications and uses.

**Files:** Different parts of a file – sizes and shapes - flat file, hand file, square file ,pillar file ,round file, triangular file, half round files, knife edge file, needle file – specifications and uses.

**Scrapers:** Flat, triangular, half round scrapers, specifications & uses.

**Saws:** Hand hacksaw - solid frame, adjustable frame, specifications & uses, hand hacksaw blades. Power hack saw – description(horizontal reciprocating type), power hacksaw blade, specifications and uses, teeth set - saw material.

**Drill bits:** Flat drill, straight fluted drill, twist drill, parallel shank, tapered shank, specifications & uses only.

**Reamer:** Hand reamer, machine reamer, straight and spiral flutes reamers, specifications and uses.

**Taps:** Hand taps - taper tap, plug tap and bottoming tap, specifications and uses.

**Dies & Sockets:** Dies- solid, adjustable - specifications and uses.

#### 1.2.2 **Striking Tools**

**Hammers:** Parts, ball peen, cross peen, straight peen hammers, soft hammer, sizes, specifications and uses.

#### 1.2.3 **Holding Devices**

**Vices:** Bench vice, leg-vice, hand vice, pin vice, tool maker's vice, pipe vice, care of vices, specifications and uses.

#### 1.2.4 **Marking Tools**

Surface plate, V-block, angle plate, try square, scribe, punch, prick punch, centre punch, number punch, letter punch, specifications and uses.

#### 1.2.5 **Miscellaneous Tools**

Screw drivers, spanners, single ended & double ended, box type, adjustable spanners, cutting pliers, nose pliers, allen keys, specifications and uses.

#### 1.2.6 **Checking and measuring instruments**

Checking instruments.

Callipers: Outside& Inside callipers, hermaphrodite (odd leg) calliper with firm joint, spring callipers, transfer calliper sizes & uses, dividers - sizes & uses.

Measuring instruments:

Combination square, bevel protractor, universal bevel protractor, sine bar, universal surface gauge, engineer's parallels, slip gauges, plane gauge, feeler gauge, angle gauge, radius & template gauge, screw pitch gauge, telescopic gauges, plate & wire gauge, ring and plug gauges, snap gauges specifications & uses, vernier callipers, vernier height gauge, vernier depth gauge, micrometer - outside & inside, stick micrometer, depth micrometer, vernier micrometer, screw thread micrometer specifications and uses.

#### 1.2.7 **Fitting Operations**

Marking, sawing, chipping, filing, scrapping, grinding, drilling, reaming, tapping and dieing.

### 1.3 **Forging**

- 1.3.1 **Hand forging tools:** Anvil, swage block, hand hammers - types; sledge hammer, specifications and uses, tongs - types, specifications & uses, chisel - hot & cold chisels specifications & uses. swages - types and sizes, fullers, flatters, set hammer, punch and drift - sizes and uses.
- 1.3.2 **Equipment:** Open and closed hearth heating furnaces, hand and power driven blowers, open and stock fire, fuels-charcoal, coal, oil gaseous fuels.
- 1.3.3 **Smith Operations:** Upsetting, drawing down, setting down, punching, drifting, bending, welding, cutting, swaging, fullering and flatterring.
- 1.3.4 **Forging defects:** Types and remedies.

#### 1.4 **Sheet Metal Work**

- 1.4.1 Metals used for sheet metal work.
- 1.4.2 **Sheet metal hand tools:**  
**Measuring tools** - steel rule, circumference rule, thickness gauge, sheet metal gauge, straight edge, scribe, divider, trammel points, punches, chisels, hammers, snips or shears, straight snip, double cutting shear, squaring shear, circular shear, bench & block shears.  
**Stakes:** Double seaming stake, beak horn stake, bevel edged square stake, Hatches stake, needle stake, blow Horn stake, hollow mandrel stake, pliers (flat nose and round nose), grocers and rivet sets, soldering iron, specifications & uses.
- 1.4.3 **Sheet Metal Operations**  
**Shearing:** Cutting off, parting, blanking, punching, piercing, notching, slitting, lancing, nibbling and trimming.  
**Bending:** Single bend, double bend, straight flange, edge hem, Embossing, beading, double hem or lock seam.  
**Drawing:** Deep drawing, shallow or box drawing.  
**Squeezing:** Sizing, coining, hobbing, ironing, riveting.
- 1.4.4 **Sheet Metal Joints**  
**Hem Joint:** single hem, double hem & wired edge, seam joint -lap seam, grooved seam, single seam, double seam, dovetail seam, burred bottom seam or flanged seam.

## 2 **Drilling**

- 2.1 **Type of drilling machines:** sensitive & radial and their constructional detail and specifications.
- 2.2 **Drill bits:** Terminology - geometry of twist drill - functions of drill elements.
- 2.3 **Operations:** Drilling, reaming, boring, counter boring, counter sinking, tapping, spot facing and trepanning.

## 3 **Foundry.**

- 3.1 **Introduction:** Development of foundry as a manufacturing process, advantages and limitations of casting over other manufacturing processes.
- 3.2 **Foundry equipment:**  
**Hand moulding tools:** shovel, riddle, rammers, trowels, slicks, lifter, strike - off bar, spruepin, bellow, swab, gate cutter, mallet, vent rod, draw spike,



rapping plate or lifting plate, pouring weight, gagger, clamps, spirit level, moulding boxes, snap box & flash box.

- 3.3 **Sands:** Properties of moulding sand - porosity, flowability, collapsibility, adhesiveness, cohesiveness and refractoriness.
- 3.4 **Types of moulding sand :** green sand, dry sand, loam sand, facing sand, backing sand, parting sand, core sand, system sand their ingredients and uses.
- 3.5 **Pattern making:** Materials such as wood, cast Iron, aluminium, brass, plastics their uses and relative advantages, classification of patterns such as solid (one piece), two piece and three pieces, split patterns, gate patterns and shell patterns, sequence in pattern making, pattern allowances and colour codes.
- 3.6 **Cores:** Need of cores, types of cores.
- 3.7 **Casting:** green sand and dry sand moulding, cement bonded moulding, shell moulding, ceramic moulding, defects in castings and their remedies.

#### 4 **Mechanical working of metals**

- 4.1 **Introduction:** Hot working and cold working
- 4.2 **Hot working processes:** rolling - types of rolling, two high mill, three high mills, four high mills, piercing or seamless tubing, drawing or cupping, spinning, extrusion - direct or forward extrusion, indirect or backward extrusion, tube extrusion, Impact extrusion.
- 4.3 Effects of hot working of metals, advantages & limitations of hot working of metals.
- 4.4 **Cold working process:**  
Rolling, drawing - wire drawing, tube drawing, bending, roll forming, angle bending, spinning, extrusion, squeezing, cold heading.
- 4.5 Effects of cold working of metals, advantages & limitations of cold working.

#### **REFERENCE BOOKS**

- 1. Production Technology by Jain & Gupta (Khanna Publiahers)
- 2. Elementary Workshop Technology by Hazra Chowdary & Bhattacharya  
(Media Promotors)
- 3. Manufacturing Technology (Vol I ) by P N Rao (Mc Graw Hill)
- 3. Workshop Technology Vol I & II by Raghuvamshi

## ENGINEERING DRAWING

Subject Title : Engineering Drawing  
Subject Code : M-107  
Periods/Week : 06  
Periods Per Year : 180

### TIME SCHEDULE

S.No	Major Topics	Minimum No. of Drawing plates	Periods	Weightage of Marks	Short Answer Questions	Essay type Questions
1	Importance of Engineering Drawing	--	01	-	-	-
2	Engineering Drawing Instruments	01	05	-	-	-
3	Free hand lettering & Numbering	01	06	5	1	-
4	Dimensioning Practice	01	09	5	1	-
5	Geometrical constructions	05	21	15	1	1
6	Projection of points, Lines, Planes & Solids	03	21	10	-	1
7	Auxiliary views	02	06	5	1	-
8	Sectional views	02	21	10	-	1
9	Orthographic Projection	04	36	10	-	1
10	Pictorial drawing	02	30	10	-	1
11	Development of surfaces	03	24	10	-	1
<b>Total</b>		<b>24</b>	<b>180</b>	<b>80</b>	<b>04</b>	<b>06</b>

**NOTE:** The numbers of plates mentioned above are minimum. The actual number may be increased based on the need

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

**Pre-Requisite:** Clear visualization and sound pictorial intelligence

### OBJECTIVES

Upon completion of the subject the student shall be able to

#### 1.0 Understand the basic concepts of Engineering Drawing

- 1.1 State the importance of drawing as an engineering communication medium
- 1.2 State the necessity of B.I.S. Code of practice for Engineering Drawing.
- 1.3 Explain the linkages between Engineering drawing and other subjects of study in diploma course.

#### 2.0 Use of Engineering Drawing Instruments

- 2.1 Select the correct instruments and draw lines of different orientation.
- 2.2 Select the correct instruments and draw small and large Circles.
- 2.3 Select the correct instruments for measuring distances on the drawing.
- 2.4 Use correct grade of pencil for different types of lines, thickness and given function.
- 2.5 Select and use appropriate scales for a given application.
- 2.6 Identify different drawing sheet sizes as per I.S. and Standard Lay- outs.
- 2.7 Prepare Title block as per B.I.S. Specifications.
- 2.8 Identify the steps to be taken to keep the drawing clean and tidy.

Drawing Plate 1: (02 exercises)

### **3.0 Write Free Hand Lettering and Numbers**

- 3.1 Write titles using inclined lettering and numerals of 7mm, 10mm and 14mm height
- 3.2 Write titles using vertical lettering and numerals of 7mm, 10mm and 14mm height
- 3.3 Select suitable sizes of lettering for different layouts and applications
- 3.4 Practice the use of lettering stencils.

Drawing plate 2: ( 6 exercises)

### **4.0 Understand Dimensioning Practice**

- 4.1 Define "Dimensioning.
- 4.2 State the need of dimensioning the drawing according to accepted standard.
- 4.3 Identify notations of Dimensioning used in dimensioned drawing.
- 4.4 Identify the system of placement of dimensions in the given dimensioned drawing.
- 4.5 Dimension a given drawing using standard notations and desired system of dimensioning.
- 4.6 Dimension standard features applying necessary rules.
- 4.7 Arrange dimensions in a desired method given in a drawing.
- 4.8 Identify the deviations if any made in the given dimensioned drawing with reference to SP-46-1988, and dimension the same correctly.

Drawing Plate 3: (10 exercises)

### **5.0 Apply Principles of Geometric Constructions**

- 5.1 Divide a given line into desired number of equal parts internally.
- 5.2 Draw tangent lines and arcs.
- 5.3 Use General method to construct any polygon.
- 5.4 Explain the importance of conics
- 5.5 Construct conics (ellipse, parabola and hyperbola) by general method
- 5.6 Construct ellipse by concentric circles method
- 5.7 Construct parabola by rectangle method
- 5.8 Construct rectangular hyperbola from the given data.
- 5.9 Construct involute from the given data.
- 5.10 Construct cycloid and helix from the given data.
- 5.11 State the applications of the above constructions in engineering practice.

Drawing Plate -4: Problems up to construction Tangents and Arcs

Drawing Plate -5: problems on construction of polygon

Drawing Plate -6: problems on construction of conics

Drawing Plate -7 & 8: Problems on construction of involute, cycloid and helix

## **6.0 Apply Principles of Projection of points, lines, planes & solids**

- 6.1 Visualize the objects
- 6.2 Explain the First angle and Third angle projections
- 6.3 Practice the First angle projections
- 6.4 Draw the projection of a point with respect to reference planes (HP&VP)
- 6.5 Draw the projections of straight lines with respect to two reference Planes (up to lines parallel to one plane and inclined to other plane)
- 6.6 Draw the projections of planes (up to planes perpendicular to one plane and inclined to other plane)
- 6.7 Draw the projections of solids (up to axis of solids parallel to one plane and inclined to other plane)

Drawing Plate -9: Problems up to projection of points and Lines (15 exercises)

Drawing Plate -10: Problems of projection of planes (6 exercises)

Drawing Plate -11: Problems of projection of solids (10 exercises)

## **7.0 Understand the need of auxiliary views**

- 7.1 State the need of Auxiliary views for a given engineering drawing.
- 7.2 Draw the auxiliary views of a given engineering component
- 7.3 Differentiate between auxiliary view and apparent view

Drawing plate No.12 &13: (10 exercises)

## **8.0 Appreciate the need of Sectional Views**

- 8.1 Explain the need to draw sectional views.
- 8.2 Select the section plane for a given component to reveal maximum information.
- 8.3 Explain the positions of section plane with reference planes
- 8.4 Differentiate between true shape and apparent shape of section
- 8.5 Draw sectional views and true sections of regular solids discussed in **6.0**
- 8.6 Apply principles of hatching.

Drawing Plate–14 & 15: (6 exercises)

## **9.0 Apply principles of orthographic projection**

- 9.1 Explain the principles of orthographic projection with simple sketches.
- 9.2 Draw the orthographic view of an object from its pictorial drawing.
- 9.3 Draw the minimum number of views needed to represent a given object fully.

Drawing Plate 16,17,18 &19 : (16 exercises)

## **10.0 Prepare pictorial drawings**

- 10.1 State the need of pictorial drawings.
- 10.2 Differentiate between isometric scale and true scale.
- 10.3 Prepare Isometric views for the given orthographic drawings.

Drawing plate 20 & 21: (12 exercises)

## **11.0 Interpret Development of surfaces of different solids**

- 11.1 State the need for preparation of development of surfaces and solids..
- 11.2 Prepare development of simple engineering objects (cubes, prisms, cylinders, cones, pyramid) using parallel line and radial line method.
- 11.3 Prepare development of surface of engineering components like trays,

funnel, 90° elbow & rectangular duct.  
 Drawing plate No. 22,23 &24 : (10 exercises)

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

<b>S.No</b>	<b>Major topic</b>	<b>Key Competency</b>
1.	Importance of Engineering Drawing	<ul style="list-style-type: none"> <li>Explain the linkages between Engineering drawing and other subjects of study in Diploma course.</li> </ul>
2.	Engineering Drawing Instruments	<ul style="list-style-type: none"> <li>Select the correct instruments to draw various entities in different orientation</li> </ul>
3.	Free hand lettering & Numbering	<ul style="list-style-type: none"> <li>Write titles using inclined and vertical lettering and numerals as per B.I.S (Bureau of Indian standards)</li> </ul>
4.	Dimensioning Practice	<ul style="list-style-type: none"> <li>Dimension a given drawing using standard notations and desired system of dimensioning</li> </ul>
5.	Geometrical construction	<ul style="list-style-type: none"> <li>Construct ellipse, parabola, rectangular hyperbola, involute, cycloid and helix from the given data.</li> </ul>
6.	Projection of points, Lines, Planes & Solids	<ul style="list-style-type: none"> <li>Draw the projection of a point, straight lines, planes &amp; solids with respect to reference planes (HP&amp; VP)</li> </ul>
7.	Auxiliary views	<ul style="list-style-type: none"> <li>Draw the auxiliary views of a given Engineering component</li> <li>Differentiate between Auxiliary view and apparent view</li> </ul>
8.	Sectional views	<ul style="list-style-type: none"> <li>Differentiate between true shape and apparent shape of section</li> <li>Use conventional representation of Engineering materials as per B.I.S. Code.</li> <li>Apply principles of hatching.</li> <li>Draw simple sections of regular solids</li> </ul>
9.	Orthographic Projection	<ul style="list-style-type: none"> <li>Draw the minimum number of views needed to represent a given object fully.</li> </ul>
10.	Pictorial drawing	<ul style="list-style-type: none"> <li>Differentiate between isometric scale and true scale.</li> <li>Draw the isometric views of given objects,.</li> </ul>
11.	Development of surfaces	<ul style="list-style-type: none"> <li>Prepare development of Surface of Engineering components like trays, funnel, 90° elbow &amp; rectangular duct.</li> </ul>

## **COURSE CONTENT**

### **NOTE**

- 1. B.I.S Specification should invariably be followed in all the topics.**
- 2. A-3 Size Drawing Sheets are to be used for all Drawing Practice Exercises.**

#### **1.0 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.

#### **2.0 Engineering drawing Instruments**

Classifications: Basic Tools, tools for drawing straight lines, tools for curved lines, tools for measuring distances and special tools like mini drafter & drafting machine – Mentioning of names under each classification and their brief description -Scales: Recommended scales reduced & enlarged -Lines: Types of lines, selection of line thickness - Selection of Pencils -Sheet Sizes: A0, A1, A2, A3, A4, A5, Layout of drawing sheets in respect of A0, A1, A3 sizes, Sizes of the Title block and its contents - Care and maintenance of Drawing Sheet, Drawing plate:  
Lay out of sheet – as per SP-46-1988 to a suitable scale.  
Simple Exercises on the use of Drawing Instruments. Importance of Title Block.

#### **3.0 Free hand lettering & numbering**

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

#### **4.0 Dimensioning practice**

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

#### **5.0 Geometric Constructions**

Division of a line: to divide a straight line into given number of equal parts  
Examples in engineering application.  
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 touching 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 length using  
general method  
Conics: Explanation of Ellipse, Parabola, Hyperbola, as sections of a

cone and loci of a moving point, Eccentricity of above curves – Their Engg. application viz. Projectiles, reflectors, P-V Diagram of a Hyperbolic process,  
Construction of any conic section of given eccentricity by general method  
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 application, viz, Gear tooth profile, screw threads, springs etc. - their construction

## **6.0 Projection of points, lines and planes & solids**

Projecting a point on two planes of projection -Projecting a point on three planes of projection -Projection of straight line.

- (a) Parallel to both the planes.
- (b) Perpendicular to one of the planes.
- (c) inclined to one plane and parallel to other planes

Projection of regular planes

- (a) Plane perpendicular to HP and parallel to VP and vice versa.
- (c) Plane perpendicular to HP and inclined to VP and vice versa.

Projection of regular solids

- (a) Axis perpendicular to one of the planes
- (b) Axis parallel to VP and inclined to HP and vice versa.

## **7.0 Auxiliary views**

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

## **8.0 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

## **9.0 Orthographic Projections**

Meaning of orthographic projection -Using a viewing box and a model – Number of views obtained on the six faces of the box, - Legible sketches of only 3 views for describing object -Concept of front view, top view, and side view sketching these views for a number of engg 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 miter 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.

## **10.0 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

### **11.0 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 and parallel to the other -Development of simple solids like cubes, prisms, cylinders, cones, pyramid (sketches only) -Types of development: Parallel line and radial line development -Procedure of drawing development, drawings of trays, funnels, 90° elbow pipes and rectangular ducts.

### **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 WORKSHOP PRACTICE

**Subject Title** : **Workshop Practice**  
**Subject Code** : **M -108**  
**Periods/Week** : **06**  
**Periods Per Year** : **180**

### TIME SCHEDULE

<b>S.No</b>	<b>Major Title</b>	<b>No of Periods</b>
1.	Fitting shop	39
2.	Forging shop	39
3.	Carpentry shop	51
4.	Sheet metal work	51
	Total	180

### OBJECTIVES

Upon completion of the course the student shall be able to

- Practice the required operations in Fitting Shop
- Practice the required operations in Forging Shop
- Practice the required operations in Carpentry Shop
- Practice the required operations in Sheet metal Shop

**Competencies and Key competencies to be achieved by the student.**

Title of the Job	Competencies	Key Competencies
<p><b>Fitting shop</b></p> <p>1. Marking and Chipping on Mild steel flat of 12 mm thick (12)</p>	<ul style="list-style-type: none"> <li>- Identify appropriate measuring tool</li> <li>- Handle appropriate marking tool</li> <li>- Handle appropriate chipping tool</li> <li>- Mark the dimensions</li> <li>- Remove the material by chipping from MS flats</li> </ul>	<ul style="list-style-type: none"> <li>• Mark the dimensions</li> <li>• Remove the material by chipping from MS flats</li> </ul>
<p>2. Cutting with hack saw of MS flats of 6mm thick (06)</p>	<ul style="list-style-type: none"> <li>- Check the raw material for size</li> <li>- Fix the work piece in vice</li> <li>- Mark the work as per given dimensions</li> <li>- Perform dot punching</li> <li>- Load and unload hack saw blade from its frame</li> <li>- Use the hack saw to perform cutting operation</li> </ul>	<ul style="list-style-type: none"> <li>• Load and unload hack saw blade from its frame</li> <li>• cut the work as per marked dimensions using Hack saw</li> </ul>
<p>3. Drilling, chamfering and on a MS flat of 2 mm thick (06)</p>	<ul style="list-style-type: none"> <li>- Check the raw material for size</li> <li>- Apply the chalk on the surface and on all sides of the flat</li> <li>- Layout the dimensions and mark the lines using dot punch</li> <li>- Chamfer the edges through filing</li> <li>- Locate the hole centres using odd leg callipers and centre punching</li> <li>- Identify appropriate drill bit</li> <li>- Load and unload drill bit from the machine</li> </ul>	<ul style="list-style-type: none"> <li>• Load and unload drill bit from the machine</li> <li>• Identify appropriate taps</li> <li>• Tap the hole</li> </ul>

<p>4. Tapping and Dieing on a MS flat of 2 mm thick (06)</p>	<ul style="list-style-type: none"> <li>- Check the raw material for size</li> <li>- Identify appropriate tap and die</li> <li>- Secure the tap in the</li> </ul>	<ul style="list-style-type: none"> <li>• Secure the tap in the wrench</li> <li>• Tap the hole</li> <li>• Fix the die in die stock</li> <li>• Cut external threads using a Die</li> </ul>
--	--	--

	wrench – Tap the hole – Hold the bar in bench vice – Fix the die in die stock – Cut external threads using a Die – Check the fit for accuracy	
5.Assembling of two pieces, matching by filing (06)	– Cut the pieces to size using hack saw – File surface of flat for trueness – Mark the surfaces as per dimensions – Dot punch the marked lines – Cut with hack saw as per marked lines – Smooth the surfaces with file – Assemble the two pieces	<ul style="list-style-type: none"> <li>• Identify appropriate file</li> <li>• File the specimen</li> <li>• Assemble two pieces</li> </ul>

<b>Title of the Job</b>	<b>Competencies</b>	<b>Key Competencies</b>
<b>Forging shop</b> 6.Conversion of Round to Square (09)	– Identify the holding and striking tools – Heat the specimen to the appropriate temperature – Remove the specimen and hold it on the anvil – Hammer the specimen	<ul style="list-style-type: none"> <li>• Heat the specimen to the appropriate temperature</li> <li>• Hammer the specimen to the required shape</li> </ul>

	to the required shape	
7. Conversion of Round to Hexagon (09)	<ul style="list-style-type: none"> <li>– Identify the holding and striking tools</li> <li>– Heat the specimen to the appropriate temperature</li> <li>– Remove the specimen and hold it on the anvil</li> <li>– Hammer the specimen to the required shape</li> </ul>	<ul style="list-style-type: none"> <li>• Heat the specimen to the appropriate temperature</li> <li>• Hammer the specimen to the required shape</li> </ul>
8. Preparation of a Chisel from round rod (09)	<ul style="list-style-type: none"> <li>– Identify the holding and striking tools</li> <li>– Heat the specimen to the appropriate temperature</li> <li>– Remove the specimen and hold it on the anvil</li> <li>– Hammer the specimen to the required shape</li> </ul>	<ul style="list-style-type: none"> <li>• Heat the specimen to the appropriate temperature</li> <li>• Hammer the specimen to the required shape</li> </ul>
9. Preparation of a ring and hook from M.S round (06)	<ul style="list-style-type: none"> <li>– Identify the holding and striking tools</li> <li>– Heat the specimen to the appropriate temperature</li> <li>– Remove the specimen and hold it on the anvil</li> <li>– Hammer the specimen to the required shape</li> </ul>	<ul style="list-style-type: none"> <li>• Heat the specimen to the appropriate temperature</li> <li>• Hammer the specimen to the required shape</li> </ul>
10. Preparation of a hexagonal bolt and nut (06)	<ul style="list-style-type: none"> <li>– Identify the holding and striking tools</li> <li>– Heat the specimen to the appropriate temperature</li> <li>– Remove the specimen and hold it on the anvil</li> <li>– Hammer the specimen to the required shape</li> </ul>	<ul style="list-style-type: none"> <li>• Heat the specimen to the appropriate temperature</li> <li>• Hammer the specimen to the required shape</li> </ul>

Title of the Job	Competencies	Key Competencies
<b>Carpentry Shop</b> 11. Cutting of wood with hand saw (06)	<ul style="list-style-type: none"> <li>– Identify the orientation of grains</li> <li>– Select appropriate saw for cutting in each of the directions viz. across and along the grains</li> </ul>	<ul style="list-style-type: none"> <li>• Identify the orientation of grains</li> <li>• Mark dimensions on work using marking gauge</li> <li>• Perform cutting along and perpendicular the grains using appropriate saw</li> </ul>

	<ul style="list-style-type: none"> <li>- Select appropriate work holding device</li> <li>- Handle appropriate measuring and marking tools(Steel rule, Try square, Marking gauge)</li> <li>- Mark dimensions on work using Marking gauge</li> <li>- Fix the work in the vice</li> <li>- Perform cutting along the grains using Rip saw</li> <li>- Change the position of work in the vice</li> <li>- Perform cutting perpendicular the grains using cross cut saw</li> </ul>	
12.Planning of wood(06)	<ul style="list-style-type: none"> <li>- Identify the direction for planning wood stock</li> <li>- Select appropriate jack plane</li> <li>- Prepare the jack plane for planning (Load and unload the blade of a jack plane</li> <li>- Select appropriate work holding device</li> <li>- Perform marking on work using appropriate tool</li> <li>- Fix the work in the vice</li> <li>- Plane the surfaces on all four sides using jack plane</li> </ul>	<ul style="list-style-type: none"> <li>• Identify the direction for planning wood stock</li> <li>• Prepare the jack plane for planning</li> <li>• Plane the surfaces on all four sides using jack plane</li> </ul>

Title of the Job	Competencies	Key Competencies
<p><b>Contd.,,,</b></p> <p>13.Chiselling of wood (06)</p>	<ul style="list-style-type: none"> <li>- Select appropriate chisels and saw</li> <li>- Select appropriate work holding device</li> <li>- Select appropriate measuring and marking tools</li> <li>- Fix the work in the vice</li> <li>- Mark the position of grooves on work using</li> </ul>	<ul style="list-style-type: none"> <li>• Select appropriate chisels and saw</li> <li>• Mark the position of grooves on work using marking gauge</li> <li>• Cut sides of grooves by hand saw</li> <li>• Chip the material using firmer chisel by applying pressure with mallet</li> </ul>

	marking gauge – Cut sides of grooves by hand saw – Chip the material using firmer chisel by applying pressure with mallet – Finish the grooves with rasp file	
14.Preparation of a Dove tail joint (09)	- Select the appropriate cutting tools and work holding devices - Plane the wooden pieces on all sides - Mark at an angle of 75° with bevel square - Trim the dovetail by chisel to exact size - Cut the dovetail groove on second piece - Finish the groove - Assemble the two pieces to prepare dovetail halving joint by using mallet	<ul style="list-style-type: none"> <li>• Trim the dovetail by chisel to exact size</li> <li>• Mark at an angle of 75° with bevel square</li> <li>• Cut the dovetail groove on second piece</li> <li>• Assemble the two pieces to prepare dovetail halving joint by using mallet</li> </ul>
15.Preparation of Mortise and Tenon joint (09)	- Select the appropriate cutting tools and work holding devices - Plane the two pieces to the required size using jack plane - Mark the dimensions to make Tenon using mortise gauge - Cut tenon with tenon saw along the marked lines	<ul style="list-style-type: none"> <li>• Mark the dimensions to make Tenon and mortise on two pieces using mortise gauge</li> <li>• Cut tenon with tenon saw along the marked lines</li> </ul>
<b>Title of the Job</b>	<b>Competencies</b>	<b>Key Competencies</b>
<b>Contd.,,,</b> Preparation of Mortise and Tenon joint	– Use firmer chisel to remove the excess material to set finished tenon – Mark the dimension to make mortise on the second piece with mortise gauge – Use mortise chisel to provide recess in the second piece to accommodate tenon – Assemble the two pieces by fitting the	<ul style="list-style-type: none"> <li>• Use mortise chisel to provide recess in the second piece to accommodate tenon</li> <li>• Assemble the two pieces by fitting the tenon into mortise</li> </ul>

	tenon into mortise	
16.Wood turning on lathe (06)	<ul style="list-style-type: none"> <li>- Select appropriate tools</li> <li>- Plane the four corners of the work piece using jack plane</li> <li>- Mark the centres of the work on either side</li> <li>- Mount the work between head stock &amp; tailstock centres</li> <li>- Fix the tool in the tool post &amp; Position it in appropriate height</li> <li>- Start the lathe to make the work piece to revolve at desired speed</li> <li>- Feed the bevel gauge against the rotating work to get the required size and shape</li> <li>- Use outside callipers to check the diameter of the pin</li> <li>- Use parting off tool to reduce the diameter on either ends of the pin</li> <li>- Remove the rolling pin between centres and cut off excess material on either sides</li> </ul>	<ul style="list-style-type: none"> <li>• Mark the centres of the work on either side</li> <li>• Fix the tool in the tool post &amp; Position it in appropriate height</li> <li>• Start the lathe to make the work piece to revolve at desired speed</li> <li>• Feed the bevel gauge against the rotating work to get the required size and shape</li> </ul>

Title of the Job	Competencies	Key Competencies
<p>Contd.,,,</p> <p>17.Preparation of any household article (ex: stool) (09)</p>	<ul style="list-style-type: none"> <li>- Prepare the drawings of a stool required for a particular drawing table</li> <li>- State the specifications of the wood stock required</li> <li>- Identify the type of joints to be made</li> <li>- Identify the operations</li> </ul>	<ul style="list-style-type: none"> <li>• Prepare the drawings of a stool required for a particular drawing table</li> <li>• Identify the operations to be made and their sequence</li> <li>• Perform operations to produce pieces of joint</li> <li>• Assemble all joints as per the drawing</li> </ul>

	<p>to be made and their sequence</p> <ul style="list-style-type: none"> <li>- Perform operations to produce pieces of joint</li> <li>- Assemble all joints as per the drawing</li> </ul>	
--	--	--

Title of the Job	Competencies	Key Competency
<p><b>Sheet metal Work</b> 18.Practice on cutting of sheet (06)</p>	<ul style="list-style-type: none"> <li>- Cut the required sheet from the stock using snip</li> <li>- Mark the dimensions on the sheet using scribe &amp; steel rule</li> <li>- Draw the circular shapes using divider</li> <li>- Perform rough cutting of the curved shapes using chisel and finish cutting using snips</li> <li>- Cut the straight edges using straight snips</li> </ul>	<ul style="list-style-type: none"> <li>• Identify the marking and cutting tools</li> <li>• Cut the sheet of different shapes using appropriate tools</li> </ul>
<p>19.Formation of joints like grooved joint, locked groove joint (06)</p>	<ul style="list-style-type: none"> <li>- Cut the sheet in to two halves</li> <li>- Form the flange on the sheet by folding the sheet along scribed lines using mallet &amp; stakes</li> <li>- Perform bending edges of sheets applying moderate pressure using mallet</li> <li>- Inter lock the bent edges and apply pressure with mallet to make required joint</li> </ul>	<ul style="list-style-type: none"> <li>• Identify the marking and cutting tools</li> <li>• Cut the sheet</li> <li>• Perform bending along the marked lines.</li> </ul>
Title of the Job	Competencies	Key Competency
<p>20.Preparation of a rectangular open type tray (09)</p>	<ul style="list-style-type: none"> <li>- Draw the development of the object to be made</li> <li>- Place the pattern on the sheet</li> <li>- Mark the dimensions using scribe</li> <li>- Shear the required piece from the stock using straight snips</li> <li>- Mark the lines on the sheet to form bends</li> <li>- Strengthen the sides of sheet by single hem using hatchet stake</li> </ul>	<ul style="list-style-type: none"> <li>• Drawing development of objects</li> <li>• Cut the sheet</li> <li>• Seam the corners by inserting laps of the adjacent sides with single hem</li> </ul>



	<ul style="list-style-type: none"> <li>- Form the sheet in to desired shape using stakes</li> <li>- Seam the corners by inserting laps of the adjacent sides with single hem</li> </ul>	
21.Preparation of hollow cylinder (06)	<ul style="list-style-type: none"> <li>- Draw the development of the object to be made</li> <li>- Place the pattern on the sheet</li> <li>- Mark the dimensions using scribe</li> <li>- Shear the required piece from the stock using straight snips</li> <li>- Mark the lines on the sheet to form bends</li> <li>- Strengthen the sides of sheet by single hem on top &amp; bottom side using hatchet stake</li> <li>- Form the flat sheet into cylindrical shape by cylindrical stake and apply pressure using mallet</li> <li>- Prepare single hem on to longitudinal sides in opposite directions</li> <li>- Inter lock the sides and apply pressure to make a strong joint</li> </ul>	<ul style="list-style-type: none"> <li>• Identify the marking and cutting tools</li> <li>• Drawing development of objects</li> <li>• Cut the sheet</li> <li>• Inter lock the sides and apply pressure using mallet to make a strong joint</li> </ul>
<b>Title of the Job</b>	<b>Competencies</b>	<b>Key Competency</b>
22.Preparation of pipe elbow (09)	<ul style="list-style-type: none"> <li>- Draw the development of a cylindrical pipe truncated at an angle of 45° on one side</li> <li>- Scribe the lines on the sheet by placing the pattern on it</li> <li>- Cut the sheet over the marked dimensions using curved snips</li> <li>- Hem the straight side of the sheet and flange the curved side</li> <li>- Fold the edges of joining sides</li> <li>- Form the sheet into cylindrical shape using stakes</li> </ul>	<ul style="list-style-type: none"> <li>• Draw the development of a cylindrical pipe truncated at an angle of 45° on one side</li> <li>• Cut the sheet over the marked dimensions using curved snips</li> <li>• Form the sheet into cylindrical shape using stakes</li> </ul>

	<ul style="list-style-type: none"> <li>- Seam the sides using mallet</li> <li>- Repeat the similar operation for making the second pipe</li> <li>- Butt the treated portions of the cylindrical pipes at rectangles</li> <li>- Seam the two pipes</li> <li>- Solder the joint to make leak proof</li> </ul>	
--	---	--

Title of the Job	Competencies	Key Competency
23.Preparation of funnel (09)	<ul style="list-style-type: none"> <li>- Draw the development of upper conical part</li> <li>- Place the pattern on the sheet and cut to required size</li> <li>- Hem the upper side of the sheet</li> <li>- Flange out the bottom side of the sheet</li> <li>- Fold the edges of the joining sides</li> <li>- form the sheet into conical shape using appropriate stake and mallet</li> <li>- Repeat the similar operation for making the bottom part</li> <li>- Seam the top conical part and bottom conical part to obtain required funnel</li> </ul>	<ul style="list-style-type: none"> <li>• Draw the development of upper and bottom conical parts</li> <li>• Place the pattern on the sheet and cut to required size</li> <li>• form the sheet into conical shape using appropriate stake and mallet</li> <li>• Seam the top conical part and bottom conical part to obtain required funnel</li> </ul>

<p>24.Preparation of utility articles such as dust pan, kerosene hand pump (06)</p>	<ul style="list-style-type: none"> <li>- Draw the development of given dust pan</li> <li>- Scribe the lines on the sheet and cut to required size</li> <li>- Hem all the four sides to strengthen the edges</li> <li>- Form the sheet into designed shape using suitable stakes and mallet</li> <li>- Solder the corner lap joints to make the required dust pan</li> </ul>	<ul style="list-style-type: none"> <li>• Identify the marking and cutting tools</li> <li>• Drawing development of objects</li> <li>• Cut the sheet</li> <li>• Perform bending along the marked lines and to form the article</li> </ul>
---	---	---

## **COURSE CONTENT**

### **FITTING SHOP**

1. Marking and chipping on Mild – steel flat 12 mm thick.
2. Cutting with hack saw, M.S. Flats of 6 mm thick.
3. Marking, cutting, drilling, Chamfering and tapping on a M.S. Flat 12 mm thick.
4. Assembling of two pieces, Matching by filing (6 mm thick M.S. Plate)

### **FORGING SHOP**

1. Conversion of round to square.
2. Conversion of round to Hexagon.
3. Preparation of chisel from round rod.
4. Preparation of ring and hook from M.S. round.
5. Preparation of a hexagonal bolt and nut.

### **CARPENTRY SHOP**

1. Cutting of wood with hand saw.
2. Planning of wood.
3. Planning and chiseling of wood.
4. Orientation of wood grain.
5. Preparation of dovetail joint.
6. Mortise and tenon joint.
7. Wood turning on a lathe.
8. Preparation of one household article.

### **SHEET METAL WORK**

1. Practice on cutting of sheet

2. Formation of joints like grooved joints, locked groove joint
3. Preparation of a rectangular open type tray
4. Preparation of hollow cylinder
5. Preparation of pipe elbow
6. Preparation of mug.
7. Preparation of funnel
8. Preparation of utility articles such as dustpan, kerosene hand pump.

#### **REFERENCE BOOKS**

1. Manufacturing Technology (Vol I) by P N Rao (Mc Graw Hill)
2. Principles of Foundry Technology by P L Jain (Mc Graw Hill)

**PHYSICS LAB**  
**(Common for all branches)**

**Subject Title** : **Physics Lab**  
**Subject Code** : **M -109**  
**Periods per week** : **03**  
**Total periods per year** : **45**

**TIME SCHEDULE**

<b>S.No</b>	<b>Name of the Experiment</b>	<b>No. of</b>
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
	<b>Total:</b>	<b>45</b>

**Objectives:**

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

- 1.0 Practice the Vernier caliper to determine the volume of a cylinder and sphere
- 2.0 Practice the Screw gauge to determine thickness of a glass plate and cross section of a wire

- 3.0 Verify the parallelogram law and Triangle law of forces.
- 4.0 Determine the value of acceleration due to gravity using Simple Pendulum and verify with  $L-T^2$  graph.
- 5.0 Determine the velocity of sound in air at room temperature
- 6.0 Determine the Focal length and focal power of convex lenses using U-V and graphical method
- 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 wire material using Meter Bridge
- 12.0 Practice the mapping of magnetic lines of force

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

Name of the Experiment	Competencies	Key competencies
1. Hands on practice on Vernier Calipers(03)	<ul style="list-style-type: none"> <li>• Find the Least count</li> <li>• Fix the specimen in posit</li> <li>• Read the scales</li> <li>• Calculate the volume of given object</li> </ul>	<ul style="list-style-type: none"> <li>• Read the scales</li> <li>• Calculate the volume of given object</li> </ul>
2. Hands on practice on Screw gauge(03)	<ul style="list-style-type: none"> <li>• Find the Least count</li> <li>• Fix the specimen in posit</li> <li>• Read the scales</li> <li>• Calculate thickness of glass place and cross section of wire</li> </ul>	<ul style="list-style-type: none"> <li>• Read the scales</li> <li>• Calculate thickness of given glass plate</li> <li>• Calculate cross section of wire</li> </ul>

<p>3. Verification of Parallelogram law of forces and Triangle law of forces(03)</p>	<ul style="list-style-type: none"> <li>• Fix suitable weights</li> <li>• Note the positions of threads on drawing sheet</li> <li>• Find the angle at equilibrium point</li> <li>• Construct parallelogram</li> <li>• Compare the measured diagonal</li> <li>• Construct triangle</li> <li>• Find the length of sides</li> <li>• Compare the ratios</li> </ul>	<ul style="list-style-type: none"> <li>• Find the angle at equilibrium point</li> <li>• Constructing parallelogram</li> <li>• Construct triangle</li> <li>• Compare the ratios of force and length</li> </ul>
<p>4. Simple pendulum(03)</p>	<ul style="list-style-type: none"> <li>• Fix the simple pendulum to the stand</li> <li>• Adjust the length of pendulum</li> <li>• Find the time for number of oscillations</li> <li>• Find the time period</li> <li>• Calculate the acceleration due to gravity</li> <li>• Draw I-T and I-T<sup>2</sup> graph</li> </ul>	<ul style="list-style-type: none"> <li>• Find the time for number of oscillations</li> <li>• Find the time period</li> <li>• Calculate the acceleration due to gravity</li> <li>• Draw I-T and I-T<sup>2</sup> graph</li> </ul>
<p>5. Velocity of sound in air –Resonance method (03)</p>	<ul style="list-style-type: none"> <li>• Arrange the resonance apparatus</li> <li>• Adjust the reservoir level for booming sound</li> <li>• Find the first and second resonating lengths</li> <li>• Calculate velocity of sound</li> </ul>	<ul style="list-style-type: none"> <li>• Adjust the reservoir level</li> <li>• Find the first and second resonating lengths</li> <li>• Calculate velocity of sound</li> <li>• Calculate velocity of sound at 0<sup>o</sup> C</li> </ul>

<p>6. Focal length and Focal power of convex lens (Separate &amp; Combination) (03)</p>	<ul style="list-style-type: none"> <li>• Fix the object distance</li> <li>• Find the Image distance</li> <li>• Calculate the focal length and power of convex lens and combination of convex lenses</li> <li>• Draw u-v and <math>1/u - 1/v</math> curves</li> </ul>	<ul style="list-style-type: none"> <li>• Calculate the focal length and power of convex lens</li> <li>• Draw u-v and <math>1/u - 1/v</math> graph</li> </ul>
<p>7. Refractive index of solid using traveling microscope(03)</p>	<ul style="list-style-type: none"> <li>• Find the least count of vernier on microscope</li> <li>• Place the graph paper below microscope</li> <li>• Read the scale</li> <li>• Calculate the refractive index of glass slab</li> </ul>	<ul style="list-style-type: none"> <li>• Read the scale</li> <li>• Calculate the refractive index of glass slab</li> </ul>
<p>8. Surface tension of liquid using traveling microscope(03)</p>	<ul style="list-style-type: none"> <li>• Find the least count of vernier on microscope</li> <li>• Focus the microscope to the lower meniscus &amp; bent pin</li> <li>• Read the scale</li> <li>• Calculate height of liquid rise</li> <li>• Calculate the surface tension of water</li> </ul>	<ul style="list-style-type: none"> <li>• Read the scale</li> <li>• Calculate height of liquid rise</li> <li>• Calculate the surface tension of water</li> </ul>
<p>9. Coefficient of viscosity by capillary method(03)</p>	<ul style="list-style-type: none"> <li>• Find the least count of vernier</li> <li>• Fix the capillary tube to aspiratory bottle</li> <li>• Find the mass of collected water</li> <li>• Find the pressure head</li> <li>• Calculate rate of volume of liquid collected</li> <li>• Find the radius of capillary tube</li> <li>• Calculate the viscosity of water using capillary method</li> </ul>	<ul style="list-style-type: none"> <li>• Find the pressure head</li> <li>• Calculate rate of volume of liquid collected</li> <li>• Find the radius of capillary tube</li> <li>• Calculate the viscosity of water</li> </ul>



Name of the Experiment	Competencies	Key competencies
10. Boyle's law verification (03)	<ul style="list-style-type: none"> <li>• Note the atmospheric pressure</li> <li>• Fix the quill tube to retort stand</li> <li>• Find the length of air column</li> <li>• Find the pressure of enclosed air</li> <li>• Find and compare the calculated value <math>P \times l</math></li> </ul>	<ul style="list-style-type: none"> <li>• Find the length of air column</li> <li>• Find the pressure of enclosed air</li> <li>• Find the value <math>P \times l</math></li> </ul>
11. Meter bridge(03)	<ul style="list-style-type: none"> <li>• Make the circuit connections</li> <li>• Find the balancing length</li> <li>• Calculate unknown resistance</li> <li>• Find the radius of wire</li> <li>• Calculate the specific resistance</li> </ul>	<ul style="list-style-type: none"> <li>• Find the balancing length</li> <li>• Calculate unknown resistance</li> <li>• Calculate the specific resistance</li> </ul>
12. Mapping of magnet lines of force(03)	<ul style="list-style-type: none"> <li>• Draw magnetic meridian</li> <li>• Placed the bar magnet in NN and NS directions</li> <li>• Draw magnetic lines of force</li> <li>• Locate the neutral points along equatorial and axial lines</li> </ul>	<ul style="list-style-type: none"> <li>• Draw magnetic lines of force</li> <li>• Locate the neutral points along equatorial and axial lines</li> </ul>

## CHEMISTRY LAB

<b>Subject Title</b>	:	<b>Chemistry Lab</b>
<b>Subject Code</b>	:	<b>M -110</b>
<b>Periods per week</b>	:	<b>03</b>
<b>Total periods per year</b>	:	<b>45</b>
<b>Curriculum</b>	:	<b>C-16</b>

### TIME SCHEDULE

<b>S.No</b>	<b>Name of the Experiment</b>	<b>No. of Periods</b>
1.	Familiarization of methods for Volumetric analysis	03
2.	Preparation of Std $\text{Na}_2\text{CO}_3$ solution and making solutions of different dilution	03
3.	Estimation of HCl solution using Std. $\text{Na}_2\text{CO}_3$ solution	03
4.	Estimation of NaOH using Std. HCl solution	03
5.	Estimation of $\text{H}_2\text{SO}_4$ using Std. NaOH solution	03
6.	Estimation of Mohr's Salt using Std. $\text{KMnO}_4$	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.	Revision	06
14	Practice Test	03
	<b>Total:</b>	<b>45</b>

### 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 making dilutions, etc.

- 2.0 Practice making standard solutions with pre weighted salts and to make desired dilutions using appropriate techniques.
- 3.0 Conduct titrations adopting standard procedures and using Std.  $\text{Na}_2\text{CO}_3$  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  $\text{H}_2\text{SO}_4$
- 6.0 Conduct titrations adopting standard procedures and using Std.  $\text{KMnO}_4$  solution for estimation of Mohr's Salt
- 7.0 Conduct titrations adopting standard procedures to determine the acidity of given samples of water ( ground water and surface / tap water, and rain water if available)
- 8.0 Conduct titrations adopting standard procedures to determine the alkalinity of given samples of water ( ground water and surface / tap water)
- 9.0 Conduct titrations adopting standard procedures to determine the total hardness of given samples of water ( ground water and 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 waste water ( ground water and 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 Revision
- 14.0 To conduct Test.

#### 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 $\text{Na}_2\text{CO}_3$ and making different diluted solution (03)	<ul style="list-style-type: none"> <li>▪ Weighting the salt to the accuracy of 0.001g</li> <li>▪ Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette</li> <li>▪ Making appropriate dilutions</li> </ul>	<ul style="list-style-type: none"> <li>▪ Weighting the salt to the accuracy of 0.001g</li> <li>▪ Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette</li> <li>▪ Making appropriate dilutions</li> </ul>
<b>Name of the Experiment (No of Periods)</b>	<b>Competencies</b>	<b>Key competencies</b>
Estimation of HCl solution using Std. $\text{Na}_2\text{CO}_3$ solution (03)	<ul style="list-style-type: none"> <li>▪ Cleaning the glassware and rinsing with appropriate solutions</li> <li>▪ Making standard solutions</li> <li>▪ Measuring accurately the standard solutions and titrants</li> <li>▪ Filling the burette with titrant</li> <li>▪ Fixing the burette to the stand</li> <li>▪ Effectively Controlling the flow of the titrant</li> <li>▪ Identifying the end point</li> <li>▪ Making accurate observations</li> <li>▪ Calculating the results</li> </ul>	<ul style="list-style-type: none"> <li>▪ Making standard solutions</li> <li>▪ Measuring accurately the standard solutions and titrants</li> <li>▪ Effectively Controlling the flow of the titrant</li> <li>▪ Identifying the end point</li> <li>▪ Making accurate observations</li> </ul>
Estimation of NaOH using Std. HCl solution (03)		
Estimation of $\text{H}_2\text{SO}_4$ using Std. NaOH solution (03)		
Estimation of Mohr's Salt using Std. $\text{KMnO}_4$ (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)		
	<ul style="list-style-type: none"> <li>▪ Familiarize with instrument</li> <li>▪ Choose appropriate 'Mode' / 'Unit'</li> <li>▪ Prepare standard solutions / buffers, etc.</li> <li>▪ Standardize the instrument with</li> </ul>	<ul style="list-style-type: none"> <li>▪ Prepare standard solutions / buffers, etc.</li> <li>▪ Standardize the instrument with appropriate standard solutions</li> <li>▪ Plot the standard curve</li> <li>▪ Make measurements</li> </ul>
Determination of pH using pH meter (03)		

	appropriate standard solutions <ul style="list-style-type: none"> <li>▪ Plot the standard curve</li> <li>▪ Make measurements accurately</li> <li>▪ Follow Safety precautions</li> </ul>	accurately
<b>Name of the Experiment (No of Periods)</b>	<b>Competencies</b>	<b>Key competencies</b>
Revision (06)  Practice Test (03)		<ul style="list-style-type: none"> <li>▪ To prepare the student for practical examination</li> </ul>

**COMPUTER FUNDAMENTALS LAB**  
(Common to all Branches )

**Subject Title** : Computer Fundamentals Lab  
**Subject Code** : M -111  
**Periods/Week** : 03  
**Periods/Year** : 90

**List of Experiments:**

<b>S. No.</b>	<b>Major Topics</b>	<b>No. of sessions each of 3 periods duration</b>	<b>No. of Period s</b>
I.	Computer hardware Basics	01	03
II.	Windows Operating System	02	06
III.	MS Word	09	27
IV.	MS Excel	09	27
V.	MS PowerPoint	09	27
<b>Total</b>		<b>30</b>	<b>90</b>

**Rationale:** The knowledge of Computer usage has become a must for everyone, due to widespread 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 Computer system and hardware connections  
b) To start and Shut down Computer correctly  
c) To check the software details of the computer
2. To check the hardware present in your computer

**II. Windows's operating system (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

Exp No.	Name of the Experiment	Competencies	Key Competencies
1 (a).	To familiarize with Computer system and hardware connections	<ul style="list-style-type: none"> <li>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</li> <li>b. Identify and connect various peripherals</li> <li>c. Identify and connect the cables used with computer system</li> <li>d. Identify various ports on CPU and connect Keyboard &amp; Mouse</li> </ul>	Connect cables to external hardware and operate the computer
1 (b).	To Start and Shut down Computer correctly	<ul style="list-style-type: none"> <li>a. Log in using the password</li> <li>b. Start and shut down the computer</li> <li>c. Use Mouse and Key Board</li> </ul>	<ul style="list-style-type: none"> <li>a. Login and logout as per the standard procedure</li> <li>b. Operate mouse &amp; Key Board</li> </ul>
1 (c).	To Explore Windows Desktop	<ul style="list-style-type: none"> <li>a. Familiarize with Start Menu, Taskbar, Icons and Shortcuts</li> <li>b. Access application programs using Start menu, Task manager</li> <li>c. Use Help support</li> </ul>	<ul style="list-style-type: none"> <li>a. Access application programs using Start menu</li> <li>b. Use taskbar and Task manager</li> </ul>
2.	To check the software details of the computer	<ul style="list-style-type: none"> <li>a. Find the details of Operating System being used</li> <li>b. Find the details of Service Pack installed</li> </ul>	Access the properties of computer and find the details
3.	To check the hardware present in your computer	<ul style="list-style-type: none"> <li>a. Find the CPU name and clock speed</li> <li>b. Find the details of RAM and Hard disk present</li> <li>c. Access Device manager using Control Panel and check the status of devices like mouse and key board</li> <li>d. Use My Computer to check the details of Hard drives and partitions</li> <li>e. Use the Taskbar</li> </ul>	<ul style="list-style-type: none"> <li>a. Access device manager and find the details</li> <li>b. Type /Navigate the correct path and Select icon related to the details required</li> </ul>



4.	Working with Files and Folders  Working with Files and Folders  Continued....	<ul style="list-style-type: none"> <li>a. Create folders and organizing files in different folders</li> <li>b. Use copy / paste move commands to organize files and folders</li> <li>c. Arrange icons – name wise, size, type, Modified</li> <li>d. Search a file or folder and find its path</li> <li>e. Create shortcut to files and folders (in other folders) on Desktop</li> <li>f. Familiarize with the use of My Documents</li> <li>g. Familiarize with the use of Recycle Bin</li> </ul>	<ul style="list-style-type: none"> <li>a. Create files and folders Rename , arrange and search for the required folder/file</li> <li>b. Restore deleted files from Recycle bin</li> </ul>
5.	To use Windows Accessories:  Calculator – Notepad – WordPad – MS Paint	<ul style="list-style-type: none"> <li>a. Familiarize with the use of Calculator</li> <li>b. Access Calculator using Run command</li> <li>c. Create Text Files using Notepad and WordPad and observe the difference in file size</li> <li>d. Use MS paint and create .jpeg, .bmp files using MS Paint</li> </ul>	<ul style="list-style-type: none"> <li>a. Use windows accessories and select correct text editor based on the situation.</li> <li>b. Use MS pain to create /Edit pictures and save in the required format.</li> </ul>
6.	To familiarize with Ribbon layout of MS word. – Home – Insert- page layout- References-Review-View	<ul style="list-style-type: none"> <li>a. Create/Open a document</li> <li>b. Use Save and Save as features</li> <li>c. Work on two documents simultaneously</li> <li>d. Choose correct Paper size and Printing options</li> </ul>	<ul style="list-style-type: none"> <li>a. Create a Document and name appropriately and save</li> <li>b. Set paper size and print options</li> </ul>
7.	To practice Word Processing Basics	<ul style="list-style-type: none"> <li>a. Typing text</li> <li>b. Keyboard usage</li> <li>c. Use mouse (Left click / Right click / Scroll)</li> <li>d. Use Keyboard shortcuts</li> <li>e. Use Find and Replace features in MS- word</li> <li>f. Use Undo and Redo Features</li> <li>g. Use spell check to correct Spellings and Grammar</li> </ul>	<ul style="list-style-type: none"> <li>a. Use key board and mouse to enter/edit text in the document.</li> <li>b. Use shortcuts</li> <li>c. Use spell check/ Grammar features for auto corrections.</li> </ul>
8.	To practice Formatting techniques	<ul style="list-style-type: none"> <li>a. Formatting Text</li> <li>b. Formatting Paragraphs</li> <li>c. Setting Tabs</li> <li>d. Formatting Pages</li> <li>e. The Styles of Word</li> <li>f. Insert bullets and numbers</li> <li>g. Themes and Templates</li> <li>h. Insert page numbers, header and footer</li> </ul>	<ul style="list-style-type: none"> <li>a. Format Text and paragraphs and use various text styles.</li> <li>b. Use bullets and numbers to create lists</li> <li>c. Use Templates /Themes</li> <li>d. Insert page numbers date, headers and footers</li> </ul>
9.	To insert a table of required number of rows and columns	<ul style="list-style-type: none"> <li>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</li> <li>b. Changing the background colour of the table</li> <li>c. Use table design tools</li> <li>d. Use auto fit – fixed row/ column height/length – Even distribution of rows / columns features</li> <li>e. Convert Text to table and Table to Text</li> <li>f. Use Sort feature of the Table to arrange data in ascending/descending order</li> </ul>	<ul style="list-style-type: none"> <li>a. Insert table in the word document and edit</li> <li>b. Use sort option for arranging data.</li> </ul>

10.	To Insert objects, clipart and Hyperlinks	<ul style="list-style-type: none"> <li>a. Create a 2-page document. &amp;Insert hyperlinks and Bookmarks.</li> <li>b. Create an organization chart</li> <li>c. Practice examples like preparing an Examination schedule notice with a hyperlink to Exam schedule table.</li> </ul>	<ul style="list-style-type: none"> <li>a. Insert hyperlinks &amp;Bookmarks</li> <li>b. Create organization charts/flow charts</li> </ul>
11	To Use Mail merge feature of MS Word	<ul style="list-style-type: none"> <li>a. Use mail merge to prepare individually addressed letters</li> <li>b. Use mail merge to print envelopes.</li> </ul>	Use Mail merge feature
12.	To use Equations and symbols features.	<ul style="list-style-type: none"> <li>a. Explore various symbols available in MS Word</li> <li>b. Insert a symbol in the text</li> <li>c. Insert mathematical equations in the document</li> </ul>	Enter Mathematical symbols and Equations in the word document
13.	To Practice with MS-EXCEL	<ul style="list-style-type: none"> <li>a. Open /create an MS Excel spreadsheet and familiarize with MS Excel 2007 layout like MS office Button- Ribbon-Worksheets- Formula Bar- Status Bar</li> <li>b. Use Quick Access Toolbar- Title Bar-</li> </ul>	<ul style="list-style-type: none"> <li>a. Familiarize with excel layout and use</li> <li>b. Use various features available in toolbar</li> </ul>
14.	To access and Enter data in the cells	<ul style="list-style-type: none"> <li>a. Move Around a Worksheets-Quick access -Select Cells</li> <li>b. Enter Data-Edit a Cell-Wrap Text-Delete a Cell Entry-Save a File-Close Excel</li> </ul>	<ul style="list-style-type: none"> <li>a. Access and select the required cells by various addressing methods</li> <li>b. Enter data and edit</li> </ul>
15.	To edit spread sheet Copy, Cut, Paste, and selecting cells	<ul style="list-style-type: none"> <li>a. Insert and Delete Columns and Rows-Create Borders-Merge and Center</li> <li>b. Add Background Color-Change the Font, Font Size, and Font Color</li> <li>c. Format text with Bold, Italicize, and Underline-Work with Long Text-Change a Column's Width</li> </ul>	Format the excel sheet
16.	To use built in functions and Formatting Data	<ul style="list-style-type: none"> <li>a. Sort and filter data in a worksheet</li> <li>b. Perform Mathematical Calculations verify -AutoSum</li> <li>c. Perform Automatic Calculations-Align Cell Entries</li> </ul>	Use built in functions in Excel
17.	To enter a Formula for automatic calculations	<ul style="list-style-type: none"> <li>a. Enter formula</li> <li>b. Use Cell References in Formulae</li> <li>c. Use Automatic updating function of Excel Formulae</li> <li>d. Use Mathematical Operators in Formulae</li> <li>e. Use Excel Error Message and Help</li> </ul>	Enter formula for automatic calculations
18.	To Create Excel Functions, Filling Cells	<ul style="list-style-type: none"> <li>a. Use Reference Operators</li> <li>b. Work with sum, Sum if , Count and Count If Functions</li> <li>c. Fill Cells Automatically</li> </ul>	<ul style="list-style-type: none"> <li>a. Create Excel sheets involving cross references and equations</li> <li>b. Use the advanced functions for conditional calculations</li> </ul>
19.	To Practice Excel Graphs and Charts	<ul style="list-style-type: none"> <li>a. Produce an Excel Pie Chart</li> <li>b. Produce Excel Column Chart</li> </ul>	<ul style="list-style-type: none"> <li>a. Use data in Excel sheet to Create technical charts and graphs Produce Excel Line Graph</li> <li>b. Produce a Pictograph in Excel</li> </ul>
20.	To format a Worksheet in Excel, page setup and print	<ul style="list-style-type: none"> <li>a. Shade alternate rows of data</li> <li>b. Add currency and percent symbols</li> </ul>	<ul style="list-style-type: none"> <li>a. Format Excel sheet</li> <li>b. Insert headers &amp;footers and</li> </ul>

		<ul style="list-style-type: none"> <li>c. Change height of a row and width of a column</li> <li>d. Change data alignment</li> <li>e. Insert Headers and Footers</li> <li>f. Set Print Options and Print</li> </ul>	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	c. Access required options in the tool bar
22.	To create a simple PowerPoint Presentation	<ul style="list-style-type: none"> <li>a. Insert a New Slide into PowerPoint</li> <li>b. Change the Title of a PowerPoint Slide</li> <li>c. PowerPoint Bullets</li> <li>d. Add an Image to a PowerPoint Slide</li> <li>d. Add a Textbox to a PowerPoint slide</li> </ul>	<ul style="list-style-type: none"> <li>a. Create simple PowerPoint presentation with photographs/ClipArt and text boxes</li> <li>Use bullets option</li> </ul>
22.	To create a simple PowerPoint Presentation	<ul style="list-style-type: none"> <li>e. Insert a New Slide into PowerPoint</li> <li>f. Change the Title of a PowerPoint Slide</li> <li>g. PowerPoint Bullets</li> <li>h. Add an Image to a PowerPoint Slide</li> <li>e. Add a Textbox to a PowerPoint slide</li> </ul>	<ul style="list-style-type: none"> <li>b. Create simple PowerPoint presentation with photographs/ClipArt and text boxes</li> <li>Use bullets option</li> </ul>
23.	To Set up a Master Slide in PowerPoint and add notes	<ul style="list-style-type: none"> <li>a. Create a PowerPoint Design Template</li> <li>b. Modify themes</li> <li>c. Switch between Slide master view and Normal view</li> <li>d. Format a Design Template Master Slide</li> <li>e. Add a Title Slide to a Design Template</li> <li>i. The Slide Show Footer in PowerPoint</li> <li>d. Add Notes to a PowerPoint Presentation</li> </ul>	<ul style="list-style-type: none"> <li>a. Setup Masterslide and format</li> <li>Add notes</li> </ul>
24.	To Insert Text and Objects	<ul style="list-style-type: none"> <li>a. Insert Text and objects</li> <li>b. Set Indents and line spacing</li> <li>c. Insert pictures/ clipart</li> <li>d. Format pictures</li> <li>e. Insert shapes and word art</li> <li>f. Use 3d features</li> <li>f. Arrange objects</li> </ul>	<ul style="list-style-type: none"> <li>Inset Text and Objects</li> <li>Use 3d features</li> </ul>
25.	To insert a Flow Chart / Organizational Charts	<ul style="list-style-type: none"> <li>a. Create a Flow Chart in PowerPoint</li> <li>b. Group and Ungroup Shapes Use smart art</li> </ul>	c. Create organizational charts and flow charts using smart art
26.	To insert a Table	<ul style="list-style-type: none"> <li>a. PowerPoint Tables</li> <li>b. Format the Table Data</li> <li>c. Change Table Background</li> <li>c. Format Series Legend</li> </ul>	c. Insert tables and format
27.	To insert a Charts/Graphs	<ul style="list-style-type: none"> <li>a. Create 3D Bar Graphs in PowerPoint</li> <li>b. Work with the PowerPoint Datasheet</li> <li>c. Format a PowerPoint Chart Axis</li> <li>d. Format the Bars of a Chart</li> <li>d. Create PowerPoint Pie Charts</li> <li>e. Use Pie Chart Segments</li> <li>f. Create 2D Bar Charts in PowerPoint</li> <li>g. Format the 2D Chart</li> <li>g. Format a Chart Background</li> </ul>	c. Create charts and Bar graphs, Pie Charts and format.
28.	<p>To Insert audio &amp; video, Hyper links in a slide</p> <p>Add narration to the slide</p>	<ul style="list-style-type: none"> <li>a. Insert sounds in the slide and hide the audio symbol</li> <li>b. Adjust the volume in the settings</li> <li>c. Insert video file in the format supported by PowerPoint in a slide</li> <li>d. Use automatic and on click options</li> <li>e. Add narration to the slide</li> <li>Insert Hyperlinks</li> </ul>	<ul style="list-style-type: none"> <li>a. Insert Sounds and Video in appropriate format.</li> <li>b. Add narration to the slide</li> <li>c. Use hyperlinks to switch to different slides and files</li> </ul>

29.	To Practice Animation effects	<ul style="list-style-type: none"> <li>a. Apply transitions to slides</li> <li>j. To explore and practice special animation effects like <i>Entrance, Emphasis, Motion Paths &amp; Exit</i></li> </ul>	c. Add animation effects
30.	Reviewing presentation	<ul style="list-style-type: none"> <li>a. Checking spelling and grammar</li> <li>b. Previewing presentation</li> <li>c. Set up slide show</li> <li>d. Set up resolution</li> <li>e. Exercise with Rehearse Timings feature in PowerPoint</li> <li>f. Use PowerPoint Pen Tool during slide show</li> <li>g. Saving</li> <li>h. Printing presentation               <ul style="list-style-type: none"> <li>(a) Slides (b) Handout</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>a. Use Spell check and Grammar feature</li> <li>b. Setup slide show</li> <li>c. Add timing to the slides</li> <li>b. Setup automatic slide show</li> </ul>