CURRICULUM - 2023
C -23

DIPLOMA IN
MECHANICAL ENGINEERING

STATE BOARD OF TECHNICAL EDUCATION & TRAINING

ANDHRA PRADESH

PREAMBLE

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

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

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

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

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

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

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

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

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

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

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

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

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

2. HIGHLIGHTS OF CURRICULUM C-23

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

- ✓ **Industrial Automation and Industry 4.0 concepts.**
- ✓ **Rapid Prototype methods and 3D Printing.**
- ✓ **Green Energy Sources.**

- ✓ **Eco-friendly Refrigerants and Modern trends in Refrigeration and Air conditioning applications.**
- ✓ **Alternative Fuels and E-Vehicle Technologies**
- ✓ **Metrology and Statistical Quality Control Techniques**
- ✓ **Industrial New Labour Codes.**
- ✓ **Engineering Ethics and Human Values**.

3. ACKNOWLEDGEMENTS

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

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

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

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

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

4. RULES AND REGULATIONS OF C-23 CURRICULUM

Duration and pattern of the courses

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

Procedure for Admission into the Diploma Courses:

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

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

Medium of Instruction

The medium of instruction and examination shall be English.

Permanent Identification Number (PIN)

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

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

Eligibility (Attendance to Appear for the End Examination)

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

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

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

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

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

For INDUSTRIAL TRAINING:
i) During Industrial Training the candidate shall put in a minimum of 90% attendance.
ii) If the student fails to secure 90% attendance during industrial training, the student shall reappear for 6 months industrial training at his own expenses.

Readmission

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

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

   (ii) For Industrial Training: before commencement of the Industrial training.

b) Within 30 days after commencement of class work in any year (including D. Pharmacy course or first year course in Engineering and Non-Engineering Diploma streams). Otherwise, such cases shall not be considered for readmission for that semester / year and are advised to seek readmission in the next subsequent eligible academic year.

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

Scheme of Evaluation

a) First Year

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

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

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

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

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

Internal Assessment Scheme

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

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

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

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

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

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

b) **Practical Courses:**
   (i) **Drawing Courses:**
   The award of Sessional marks for internal Assessment shall be as given in the following table:

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

➢ For first year engineering drawing each unit test will be conducted for a duration of 2 hours with maximum marks of 40.

➢ (Part - A: 4 questions x 5 marks = 20 Marks; Part –B: 2 questions x 10 marks = 20 marks).

> For the semester drawing examinations, Two Unit tests shall be conducted as per the Board End Examination Question Paper Pattern.

> All Drawing exercises are to be filed in serial order and secured for further scrutiny by a competent authority

   (ii) Laboratory Courses:

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

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

     i. Instruction (teaching) in laboratory courses (except for the course on Drawing) here after shall be task/competency based as delineated in the Laboratory sheets, prepared by SBTET, AP & NITTTR- ECV and posted in SBTET website.

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

     iii. Question paper for End semester Evaluation shall also be task/s based and shall be prepared and distributed by SBTET as done in case of theory courses be prepared as per SBTET rules in vogue.

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

d) For practical examinations, except in drawing, there shall be two examiners. External examiner shall be appointed by the Principal in consultation with respective Head of Section preferably choosing a qualified person from in the order of preference.

   i) Nearby Industry

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

   iii) Govt / University Engg College.

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

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

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

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

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

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

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

Minimum Pass Marks

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

b) Practical Examination:

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

C) Industrial Training:
  I.   Monitoring: Similar to project work each teacher may be assigned a batch of 10-15 students irrespective of the placement of the students to facilitate effective monitoring of students learning during industrial training.
  II.   Assessment: The Industrial training shall carry 300 marks and pass marks is 50% in assessments at industry (first and second assessment) and final summative assessment at institution level put together i.e. 150 marks out of 300 marks. And also student has to secure 50% marks in final summative assessment at institution level.
  III. **In-Plant Industrial Training for 3-Year Diploma (C-23) Courses is scheduled as per the Academic Calendar of the SBTET every year.**

Provision for Improvement

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

a) Improvement is allowed in any 4 (Four) Courses of the Diploma.

b) The student can avail of this improvement chance **ONLY ONCE**, that too within the succeeding two examinations after the completion of Diploma. However, the duration including Improvement examination shall not exceed **FIVE** years from the year of first admission.

c) No improvement is allowed in Practical / Lab Courses or Project work or Industrial Training assessment. However, improvement in drawing Course(s) is allowed.

d) If improvement is not achieved, the marks obtained in previous Examinations hold good.

e) Improvement is not allowed in respect of the candidates who are punished under Mal-practice in any Examination.

f) Examination fee for improvement shall be paid as per the notification issued by State Board of Technical Education and Training from time to time.

g) All the candidates who wish to appear for improvement of performance shall deposit the original Marks Memos of all the years / Semesters and also original Diploma Certificate to the Board. If there is improvement in performance of the current examination, the revised Memorandum of marks and Original Diploma Certificate will be issued, else the submitted originals will be returned.

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

A) For Diploma Courses of 3 Years duration

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

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

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

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

iv) A candidate shall be promoted to 5th semester provided he / she puts the required percentage of attendance in the 4th semester and pays the examination fee. A candidate, who could not pay the 4th semester examination fee, has to pay the

promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5th semester.

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

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

For IVC & ITI Lateral Entry students:

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

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

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

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

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

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

B) For Diploma Courses of 3 ½ Years duration (MET/ CH/ CHPP/ CHPC/ CHOT/ TT):
   i. A candidate shall be permitted to appear for 1st year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds upto 10%)

i.e. attendance after condonation on Medical grounds should not be less than 65% and pay the examination fee.

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

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

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

For IVC & ITI Lateral Entry students:

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

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

v. Promotion from 5th to 6th semester is automatic (i.e., from 1st spell of Industrial Training to 2nd spell) provided he/she puts the required percentage of attendance, which in this case ie.,90 % of attendance and attends for the VIVA-VOCE examination at the end of training.

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

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

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

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

For IVC & ITI Lateral Entry students:

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

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

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

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

ii. A candidate shall be promoted to 3rd semester if he/she puts the required percentage of attendance in the first year and pays the examination fee. A

candidate who could not pay the first year examination fee has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 3rd semester.

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

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

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

For IVC & ITI Lateral Entry Students:

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

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

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

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

For IVC & ITI Lateral Entry students:

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

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

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

A candidate is eligible to appear for 6th semester examination

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

IVC & ITI Lateral Entry students:

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

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

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

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

For IVC & ITI Lateral Entry students:

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

Students Performance Evaluation

Successful candidates shall be awarded the Diploma under the following divisions of pass.
a) First Class with Distinction shall be awarded to the candidates who secure an overall aggregate of 75% marks and above.
b) First Class shall be awarded to candidates who secure overall aggregate of 60% marks and above and below 75% marks.
c) Second Class shall be awarded to candidates who secure a pass with an overall aggregate of below 60%.
    i. The Weightage of marks for various year/Semesters which are taken for computing overall aggregate shall be 25% of I year marks + 100% of 3rd and subsequent Semesters.
    ii. In respect IVC & ITI Lateral Entry candidates who are admitted directly into diploma course at the 3rd semester (i.e., second year) level the aggregate of (100%) marks secured at the 3rd and subsequent semesters of study shall be taken into consideration for determining the overall percentage of marks secured by the candidates for award of class/division.
d) Second Class shall be awarded to all students, who fail to complete the Diploma in the regular 3 years/ 3 ½ years and four subsequent examinations from the year of first admission.

EXAMINATION FEE SCHEDULE:

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

Structure of Examination Question Paper:

I. Formative assessment (Internal examination)
a) For theory Courses:
Three-unit tests for first year and two-unit tests for semesters shall be conducted with a duration of 90 minutes for each test for maximum marks of 40. It consists of part A and Part B.

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

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

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

b) For drawing Courses:

For I year:

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

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

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

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

For semester: Two-unit tests with duration of 90 minutes and for maximum marks of 40 marks shall be conducted. The sum of marks obtained in 2-unit test marks shall be reduced to 20 marks for arriving at final sessional marks. Remaining 20 marks are awarded by the Course teacher based on the student's performance during regular class exercise.

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

II. Summative assessment (End examination)

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

a) **Each theory paper consists of Section 'A' and 'B'**
   Section 'A' with Max marks of 30, contains 10 short answer questions. All questions are to be answered and each carry 3 marks, i.e., 10 x 3 = 30.

   Section 'B' with Max marks of 50 contains 8 essay type questions. Only 5 questions are to be answered and each carry 10 marks, i.e., Max. Marks: 5 x 10 = 50.
   Thus, the total marks for theory examination shall be: 80.

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

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

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

c) Practical Examinations

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

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

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

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

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

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

I.   Instruction (teaching) in laboratory courses (except for the course on Drawing) hereafter shall be task/competency based as delineated in the Laboratory sheets, prepared by SBTET, AP and posted in its website.
II.   Internal assessment for Laboratory shall be done on basis of task/s performed by the student as delineated in the laboratory sheets, prepared by SBTET, AP and posted in its website.
III.   Question paper for End semester Evaluation shall be prepared as per SBTET rules in vogue.

ISSUE OF MEMORONDUM OF MARKS

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

MAXIMUM PERIOD FOR COMPLETION OF DIPLOMA PROGRAMMES:

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

ELIGIBILITY FOR AWARD OF DIPLOMA

A candidate is eligible for award of Diploma Certificate if he / she fulfil the following academic regulations.
   i.   He / She pursued a course of study for not less than 3 / 3 ½ academic years & not more than 6 / 7 academic years.
   ii.   He / she have completed all the Courses.

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

For IVC & ITI Lateral Entry students:

i. He / She pursued a course of study for not less than 2 / 2 ½ academic years & not more than 4 / 5 academic years.
ii. He / she has completed all the Courses.

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

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

A) FOR ISSUE OF PHOTO COPIES OF VALUED ANSWER SCRIPTS
I. A candidate desirous of applying for Photo copy of valued answer script/s should apply within prescribed date from the date of the declaration of the result.
II. Photo copies of valued answer scripts will be issued to all theory Courses and Drawing Course (s).
III. The Photo copy of valued answer script will be dispatched to the concerned candidate's address as mentioned in the application form by post.
IV. No application can be entertained from third parties.

B) FOR RE-COUNTING (RC) and RE-VERIFICATION(RV) OF THE VALUED ANSWER SCRIPT
i. A candidate desirous of applying for Re-verification of valued answer script should apply within prescribed date from the date of the declaration of the result.
ii. Re-verification of valued answer script shall be done for all theory Courses' and Drawing Course(s).
iii. The Re-verification committee constituted by the Secretary, SBTETAP with Course experts shall re-verify the answer scripts.

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

II. RE-VERIFICATION
(i) The Committee has to verify the intactness and genuineness of the answer script(s) placed for Re-verification.
(ii) Initially single member shall carry out the re-verification.
(iii) On re-verification by single member, if the variation is less than 12% of maximum marks, and if there is no change in the STATUS in the result of the candidate, such cases will not be referred to the next level ie., for 2-Tier evaluation.

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

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

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

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

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

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

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

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

Mal Practice Cases:

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

Discrepancies/ Pleas:

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

Issue of Duplicate Diploma

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

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

Issue of Migration Certificate and Transcripts:

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

General

i. The Board may change or amend the academic rules and regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students, for whom it is intended, with effect from the dates notified by the competent authority.

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

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

FIRST YEAR

C-23 :: DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
I YEAR

Course Code	Course Title	Instruction periods / week		Total Periods	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	3	-	90	3	20	80	100
M-104	Engineering Chemistry & Environmental Studies	3	-	90	3	20	80	100
M-105	Engineering Mechanics	4	-	120	3	20	80	100
M-106	Basic Manufacturing Processes	3	-	90	3	20	80	100
PRACTICAL								
M-107	Engineering Drawing	-	6	180	3	40	60	100
M-108	Basic Workshop Practices	-	6	180	3	40	60	100
M-109	Physics Lab	-	1 ½	45	3	20	30	50
M-110	Chemistry Lab	-	1 ½	45	3	20	30	50
M-111	*Computer Fundamentals Lab*	-	3	90	3	40	60	100
Co-Curricular Activities :								
1	*Library*		1	30				
2	*Physical Education*		1	30				
3	*Quantitative Aptitude / Seminars/ Social Awareness Programmes. etc*		1	30				
TOTAL		**21**	**21**	**1260**		**280**	**720**	**1000**

*The five marks allotted for dynamic learning activities can be awarded from above co-curricular activities.

SCHEME OF INSTRUCTIONS AND EXAMINATIONS

C23-COMMON-101: English

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for FA	Marks for SA
C23-Common-101	English	3	90	20	80

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

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

CO No.	Course Outcomes
CO1	Learn and apply various grammatical concepts to communicate in academic, professional and everyday situations
CO2	Use appropriate vocabulary in various contexts
CO3	Read and comprehend different forms of academic, professional and general reading material
CO4	Communicate effectively in speaking and writing in academic, professional and everyday situations.
CO5	Display human values by applying the knowledge of themes related to Self, Society, Environment, Science and Technology for holistic development and harmonious living through communication.

CO-PO Matrix

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

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

Learning Outcomes

1. English for Employability
   Perceive the need for improving communication in English for employability
   Use adjectives and articles effectively while speaking and in writing
   Write simple sentences

2. Living in Harmony
   Develop positive self-esteem for harmonious relationships
   Use affixation to form new words
   Use prepositions and use a few phrasal verbs contextually

3. Connect with Care
   Use social media with discretion
   Speak about abilities and possibilities
   Make requests and express obligations
   Use modal verbs and main verbs in appropriate form
   Write short dialogues about everyday situations

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

5. Never Ever Give Up!
   Learn to deal with failures in life
   Use the present tense form for various every day communicative functions such as speaking and writing about routines, professions, scientific descriptions and sports commentary
   Write paragraphs with coherence and other necessary skills

6. Preserve or Perish
   Understand the ecological challenges that we face today and act to save the environment.
   Narrate / Report past events and talk about future actions
   Develop vocabulary related to environment
   Write e-mails

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

8. New Challenges – Newer Ideas
   Understand the functional difference between Active Voice and Passive Voice
   Use Passive Voice to speak and write in various contexts
   Understand the major parts and salient features of an essay
   Learn about latest innovations and get motivated

9. The End Point First!
   Understand the importance of setting goals in life
   Report about what others have said both in speaking and writing
   Write an essay following the structure in a cohesive and comprehensive manner

Apply the words related to Goal Setting in conversations and in life

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

11. Dealing with Disasters
be aware of different kinds of disasters and the concept of disaster management
Generate vocabulary relevant to disaster management and use it in sentences
Analyze an error in a sentence and correct it
Learn and write different kinds of reports

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

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

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

S.no.	Title of the Unit	Periods allotted	Weightage of Marks	No. of Short answer questions	No. of Long Answer questions	Mapping of COs
			Time Schedule : C23-Common- 101 : ENGLISH			
1	English for Employability	8	16	2	1	CO1, CO2, CO3, CO4, CO5
2	Living in Harmony	8			2	CO1, CO2, CO3, CO4, CO5
3	Connect with Care	8	26	2		CO1, CO2, CO3, CO4, CO5
4	Humour for Happiness	8				CO1, CO2, CO3, CO4, CO5
5	Never Ever Give Up!	8	10	1	1	CO1, CO2, CO3, CO4, CO5
6	Preserve or Perish	9	23		2	CO1, CO2, CO3, CO4, CO5
7	The Rainbow of Diversity	8		2		CO1, CO2, CO3, CO4, CO5
8	New Challenges -Newer Ideas	8	19		1	CO1, CO2, CO3, CO4, CO5
9	The End Point First	8		1		CO1, CO2, CO3, CO4, CO5
10	The Equal Halves	8	16	1	1	CO1, CO2, CO3, CO4, CO5
11	Dealing with Disaster	9		1		CO1, CO2, CO3, CO4, CO5
	Total	**90**	**110**	**30**	**80**	

C-23 M-102
ENGINEERING MATHEMATICS-I
(Common to all Branches)

Course Code	Course Title	No. of Periods/week	Total No. of periods	Marks for FA	Marks for SA
Common-102	Engineering Mathematics-I	5	150	20	80

S.No.	Unit Title	No. of periods	COs mapped
1	Algebra	31	CO1
2	Trigonometry	44	CO2
3	Co-ordinate Geometry	23	CO3
4	Differential Calculus	34	CO4
5	Applications of Derivatives	18	CO5
	Total Periods	**150**	

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

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

Learning Outcomes:
UNIT - I
C.O. 1 Identify functions, resolve partial fractions and solve problems on matrices and determinants.

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

Explain Relations and Functions – examples

Find Domain & Range of functions – simple examples.

Define one-one and onto functions.

Find the inverse of a function – simple examples.

Define rational, proper and improper fractions of polynomials.

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

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

Define a matrix and order of a matrix.

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

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

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

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

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

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

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

UNIT - II

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

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

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

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

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

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

Solve simple problems on compound angles.

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

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

Solve simple problems using the multiple and submultiple formulae.

$$\boxed{\text{Syllabus for Unit test-I completed}}$$

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

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

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

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

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

State various properties of inverse trigonometric functions and identities like

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

Apply formulae liketo solve $\quad \tan^{-1} x + \tan^{-1} y = \tan^{-1}\left(\frac{x+y}{1-}\right); \quad where\ x \geq 0, y \geq 0, xy < 1 \quad$ etc.,

Simple problems.

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

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

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

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

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

Define arithmetic operations on complex numbers with examples.

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

UNIT - III

Coordinate Geometry

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

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

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.

Define locus of a point and circle.

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

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

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

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

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

Syllabus for Unit test-II

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

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

Evaluate the limits of the type $\lim\limits_{x \to a} \dfrac{f(x)}{g(x)}$ and $\lim\limits_{x \to \infty} \dfrac{f(x)}{g(x)}$

State the Standard limits $\lim\limits_{x \to a} \dfrac{x^n - a^n}{x - a}$, $\lim\limits_{x \to 0} \dfrac{\sin x}{x}$, $\lim\limits_{x \to 0} \dfrac{\tan x}{x}$, $\lim\limits_{x \to 0} \dfrac{a^x - 1}{x}$,

$\lim\limits_{x \to 0} \dfrac{e^x - 1}{x}$, $\lim\limits_{x \to 0} (1 + x)^{\frac{1}{x}}$, $\lim\limits_{x \to \infty} \left(1 + \dfrac{1}{x}\right)^x$ (without proof) and solve simple problems using these standard limits.

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

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

Explain the significance of derivative in scientific and engineering applications.

Find the derivative of standard algebraic, logarithmic, exponential and trigonometric functionsusing the first principle.

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

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

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

Explain the method of differentiation of parametric functions with examples.

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

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

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

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

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

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

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

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

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

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

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

Explain the procedure to find the extreme values (maxima or minima) of a function of single variable- simple problems for quadratic and cubic polynomials.

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

Syllabus for Unit test-III completed

CO/PO – Mapping

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

3 = Strongly mapped (High), **2** =moderately mapped (Medium), **1** =slightly mapped (Low)

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

For PO5:   Appropriate quiz programmes may be conducted at intervals and duration as decided by concerned faculty.

For PO6:   Seminars on applications of mathematics in various engineering disciplines are to be planned and conducted.

For PO7: Plan activities in such a way that students can visit the Library to refer standard books on Mathematics and access the latest updates in reputed national and international journals. Additionally, encourage them to attend seminars and learn mathematical software tools.

PO- CO – Mapping strength

PO No	Mapped with CO no	CO periods addressing PO in column I		Level (1,2 or 3)	Remarks
		No	**%**		
1	CO1, CO2, CO3, CO4, CO5	150 (31+44+23+34+18)	100%	3	>40% Level 3 Highly addressed 25% to 40% Level 2 Moderately addressed 5% to 25% Level 1 Low addressed <5% Not addressed
2	CO1, CO2, CO3, CO4, CO5	80 (8+23+12+22+15)	53.3%	3	
3	CO1, CO2, CO3, CO4, CO5	61 (9+14+9+14+15)	40.6%	3	
4	CO1, CO2, CO3, CO4, CO5	61 (14+9+9+14+15)	40.6%	3	
PSO 1	CO1, CO2, CO3, CO4, CO5	150 (31+44+23+34+18)	100%	3	
PSO 2	CO1, CO2, CO3, CO4, CO5	62 (10+14+9+14+15)	41.3%	3	
PSO 3	CO1, CO2, CO3, CO4, CO5	62 (10+14+9+14+15)	41.3%	3	

<u>**COURSE CONTENT**</u>

Unit-I
Algebra

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

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

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

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

Unit-II
Trigonometry

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

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

6. **Multiple and sub multiple angles:**
   Formulae for trigonometric ratios of multiple angles 2A, 3A and sub multiple angle A/2.

7. **Transformations:**
   Transformations of products into sums or differences and vice versa.

8. **Inverse trigonometric functions:**
   Definition, domains and ranges-basic properties.

9. **Trigonometric equations:**
   Concept of a solution, principal value and general solution of trigonometric equations:
   Sinx =k, cosx= k, tanx =k, where k is a constant. Solutions of simple quadratic equations and equations of type a sin x + b cos x=c.

10. **Properties of triangles:**
    Relations between sides and angles of a triangle- sine rule, cosine rule, tangent rule and projection rule-area of a triangle.

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

UNIT-III
Coordinate geometry

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

13. **Circle:** Locus of a point, Circle definition - Circle equation given (i) centre and radius, (ii) two ends of a diameter (iii) three non-collinear points of type (0,0), (a,0), (0, b) - General equation of a circle –its centre and radius.
14. Definition of a conic section - Equation of a conic when focus, directrix and eccentricity are given - Properties of parabola, ellipse and hyperbola in standard forms.

UNIT-IV
Differential Calculus

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

UNIT-V
Applications of Derivatives

17. Geometrical meaning of the derivative, equations of tangent and normal to a curve at any point.
18. Physical applications of derivatives – Velocity, acceleration, derivative as a rate measurer.
19. Applications of the derivative to find the extreme values – Increasing and decreasing functions, maxima and minima for quadratic and cubic polynomials.
20. Absolute, relative and percentage errors - Approximate values due to errors in measurements.

Textbook:

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

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

TIME SCHEDULE

S.No.	Chapter	No. of Periods	Marks Allotted	Short type	Essay type	COs mapped
Unit - I: Algebra						
1	Functions	6	3	1	0	CO1
2	Partial Fractions	5	3	1	0	CO1
3	Matrices and Determinants	20	16	2	1	CO1
Unit - II: Trigonometry						
4	Trigonometric Ratios	2	0	0	0	CO2
5	Compound Angles	5	3	1	0	CO2
6	Multiple and Submultiple angles	8	3	1	0	CO2
7	Transformations	6	5	0	1/2	CO2

8	Inverse Trigonometric Functions	6	5	0	1/2	CO2
9	Trigonometric Equations	6	5	0	1/2	CO2
10	Properties of triangles	5	5	0	1/2	CO2
11	Complex Numbers	6	3	1	0	CO2
Unit III: Co-ordinate Geometry						
12	Straight Lines	5	3	1	0	CO3
13	Circles	6	5	0	1/2	CO3
14	Conic Sections	12	5	0	1/2	CO3
Unit – IV: Differential Calculus						
15	Limits and Continuity	6	3	1	0	CO4
16	Differentiation	28	23	1	2	CO4
Unit – V: Applications of Derivatives						
17	Geometrical Applications	4	5	0	1/2	CO5
18	Physical Applications	6	5	0	1/2	CO5
19	Maxima and Minima	4	5	0	1/2	CO5
20	Errors and Approximations	4	5	0	1/2	CO5
	Total	150	110	10	8	
	Marks		30	80		

Unit Test Syllabus

Unit Test	Syllabus
Unit Test-I	From L.O. 1.1 to L.O. 2.9
Unit Test-II	From L.O. 2.10 to L.O. 3.8
Unit Test-III	From L.O.4.1 to L.O. 5.7

M -103 **ENGINEERING PHYSICS**

Course code	Course title	No.of periods per week	Total no. of periods	Marks for FA	Marks for SA
M -103	Engineering Physics	03	90	20	80

TIME SCHEDULE

S.No	Major topics	No. of Periods	Weightage of Marks	Short Answer type (3 marks)	Essay type (10 marks)	COs mapped
1.	Units and measurements	09	03	1		CO1
2.	Statics	11	13	1	1	
3.	Gravitation	12	20	1	2	CO2
4.	Concepts of energy	10	13	1	1	
5.	Thermal physics	10	13	1	1	CO3
6.	Sound	12	16	2	1	
7.	Electricity &Magnetism	13	16	2	1	CO4
8.	Modern physics	13	16	2	1	
	Total:	**90**	110	10	8	

MATRIX SHOWING MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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

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

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

CO-PO Mapping Strength

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

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

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

(i) Seminars   (ii) Tutorials   (iii) Guest Lecturers (iv) Assignments
(v) Quiz competitions   (vi) Industrial visits   (vii) Tech fest   (viii) Mini project

(ix) Group discussions   (x) Virtual classes   (xi) Library visit for e-books

Learning outcomes

Upon completion of the course the student shall be able to

Understand the concept of units and measurements
Explain the concept of units
Define t h e t erm s
a) Physical quantity b) Fundamental physical quantities and
c) D erived physical quantities
Define unit
Define fundamental units and derived units
State SI units with symbols for fundamental and some derived quantities
State Multiples and Submultiples in SI system
State rules of writing S.I units
State advantages of SI units
What are direct and indirect measurements
Define accuracy and least count
Define error in measurement
Define absolute, relative and percentage errors with their formulae
Solve simple problems on absolute, relative and percentage errors

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

Understand the concepts of Gravitation
State and explain Newton's universal law of gravitation.
Define G and mention its value.
Explain the acceleration due to gravity (g)
Explain the factors affecting the value of g
Derive the relationship between g and G.
3.6.   State and explain the Kepler's laws of planetary motion
Define a satellite.
What are natural and artificial satellites, Give examples.
Define orbital velocity and write its formula.
Define escape velocity and write its formula.
Write a brief note on Polar satellites.

Write a brief note on Geo-stationary satellites.

Mention the applications of artificial satellites.

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

Understand the concepts of Energy.

Define work done and energy. Mention their SI units.

List various types of energy.

Define P.E with examples. Write its equation.

Define K.E with examples. Write its equation.

Derive relationship between K.E and momentum.

State the law of conservation of energy. Give various examples.

Write a brief note on solar energy.

Explain the principle of solar thermal conversion.

Explain the principle of photo voltaic effect

Solve simple problems on (i) work done (ii) P.E & K.E and (iii) Relation between K.E & momentum.

Understand the concepts of thermal physics

Define the concepts of heat and temperature

State different modes of transmission of heat

Explain conduction, convection and radiation with two examples each.

State and explain Boyle's law

Define absolute zero temperature

Explain absolute scale of temperature

State the relationship between degree Celsius, Kelvin and Fahrenheit temperatures

State Charle's law and write its equation

State Gay-Lussac's law and write its equation

Define ideal gas

Derive ideal gas equation

Explain why universal gas constant (R) is same for all gases in nature

Calculate the value of R for 1 gram mole of gas.

Solve simple problems on (i) Inter conversion of temperatures between °C, K and F
(ii) Gas laws and (iii) Ideal gas equation.

Understand the concepts of Sound

Define the term sound

Define longitudinal and transverse waves with one example each

Explain the factors which affect the velocity of sound in air

Distinguish between musical sound and noise

Explain noise pollution and state SI unit for intensity of sound

Explain sou rces of noise pollution

Explain effects of noise pollution

Explain methods of minimizing noise pollution

Define Doppler effect.

List the Applications of Doppler effect

Define reverberation and reverberation time

Write Sabine's formula and name the physical quantities in it.

Define echoes and explain the condition to hear an echo.

Mention the methods of reducing an echo

Mention the applications of an echo

What are ultrasonics

Mention the applications of ultra sonics, SONAR

Solve simple problems on echo

Understand the concepts of Electricity and Magnetism

Explain the concept of P.D and EMF

State Ohm's law and write the formula

Explain Ohm's law

Define resistance and specific resistance. Write their S.I units.

State and explain Kichoff's first law.

State and explain Kirchoff's second law.

Describe Wheatstone bridge with legible sketch.

Derive an expression for balancing condition of Wheatstone bridge.

Describe Meter Bridge experiment with necessary circuit diagram.

Write the formulae to find resistance and specific resistance in meter bridge

Explain the concept of magnetism

What are natural and artificial magnets (mention some types)

Define magnetic field and magnetic lines of force.

Write the properties of magnetic lines of force

State and explain the Coulomb's inverse square law of magnetism

Define magnetic permeability

Define para, dia, ferro magnetic materials with examples

Solve simple problems on (i) Ohm's law (ii) Kirchoff's first law (iii) Wheatstone bridge (iv) meter bridge and (v) Coulomb's inverse square law

Understand the concepts of Modern physics

State and explain Photo-electric effect.

Write Einstein's Photo electric equation and name the physical quantities in it.

State laws of photo electric effect

Explain the Working of photo electric cell

List the Applications of photoelectric effect

Recapitulate refraction of light and its laws

Define critical angle

Explain the Total Internal Reflection

Explain the principle and working of Optical Fiber

List the applications of Optical Fiber

Explain the energy gap based on band structure

Distinguish between conductors, semiconductors and insulators based on energy gap

Define doping

Explain the concept of hole

Explain the types of semiconductors , Intrinsic and extrinsic

Explain n-type and p-type semiconductors

Mention the applications of semiconductors

Define superconductor and superconductivity

List the applications of superconductors

Nanotechnology definition, nano materials and applications

COURSECONTENT

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

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

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

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

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

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

7. **Electricity & Magnetism**
   Concept of P.D and EMF - Ohm's law and explanation-Specific resistance - Kirchoff's laws – Wheat stone's bridge - Meter bridge.
   Natural and artificial magnets – magnetic field and magnetic lines of force – Coulomb's inverse square law – Permeability – Magnetic materials – Para, dia, ferro – Examples – Problems.

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

REFERENCES
1. Intermediate physics - Volume - I & 2   Telugu Academy (English version)
2. Unified physics Volume 1, 2, 3 and 4   Dr. S.L Guptha and Sanjeev Guptha
3. Concepts of Physics, Vol 1 & 2   H.C. Verma
4. Text book of physics Volume I & 2   Resnick & Halliday
5. Fundamentals of physics   Brijlal & Subramanyam
6. Text book of applied physics   Dhanpath Roy

7. NCERT Text Books of physics   Class XI & XII Standard
8. e-books/e-tools/websites/Learning Physics software/eLMS

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

Unit test	Learning outcomes to be covered
Unit test - 1	From 1.1 to 3.14
Unit test - 2	From 4.1 to 6.18
Unit test - 3	From 7.1 to 8.20

M-104 Engineering Chemistry and Environmental Studies

Course code	Course Title	No. of Periods per week	Total No. of Periods	Marks for FA	Marks for SA
M-104	Engineering Chemistry and Environmental Studies	3	90	20	80

S.No	Unit Title/Chapter	No. of Periods	COs Mapped
1	Fundamentals of Chemistry	14	CO1
2	Solutions, Acids and Bases	16	CO1
3	Electrochemistry	12	CO2
4	Corrosion	8	CO2
5	Water Treatment	8	CO3
6	Polymers& Engineering Materials	12	CO4
7	Fuels	6	CO4
8	Environmental Studies	14	CO5
	Total	90	

Course Objectives

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

Course outcomes

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

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

COs-POs mapping strength (as per given table)

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

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

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

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

Model Blue Print with Weightage for Blooms category and questions for each chapter and COs mapped

S.No	Unit Title/Chapter	No of Periods	Weightage of marks	Question wise distribution		Mapped with CO
				Essay	Short	
1	Fundamentals of Chemistry	14	21	1½*	2	CO1
2	Solutions, Acids and Bases	16	21	1½*	2	CO1
3	Electrochemistry	12	13	1	1	CO2
4	Corrosion	8	13	1	1	CO2
5	Water Treatment	8	13	1	1	CO3
6	Polymers & Engineering materials.	12	13	1	1	CO4
7	Fuels	6	3	0	1	CO4
8	Environmental Studies	14	13	1	1	CO5
	Total	90	110	8	10	

*One question of 10 marks should be given with 50% weightage from unit title 1and 2

Upon completion of the course, the student shall be able to learn out

ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES
  Atomic structure
  Explain the charge, mass of fundamental particles of an atom (electron, proton and neutron) and the concept of atomic number and mass number.
  State the Postulates of Bohr's atomic theory and its limitations.
  Explain the significance of four Quantum numbers and draw the atomic structures of Silicon and Germanium.
  Define Orbital of an atom and draw the shapes of s,p and d-orbitals.
  Explain 1. Aufbau principle, 2. Pauli's exclusion principle 3. Hund's principle.
   Write the electronic configuration of elements up to atomic number 30.
  Explain the significance of chemical bonding.
  Explain the Postulates of Electronic theory of valency.

  Define and explain Ionic and Covalent bonds with examples of NaCl , $*H_2, *O_2$ and $*N_2$.(* Lewis dot method).

  List out the Properties of Ionic compounds and covalent compounds and distinguish between their properties.
  Solutions, Acids and Bases
  Define the terms 1. Solution, 2. Solute and 3. Solvent .
  Classify solutions based on solubility.
  Define the terms 1. Atomic weight, 2. Molecular weight and 3. Equivalent weight.
  Calculate Molecular weight and Equivalent weight of the given acids (HCl, H_2SO_4, H_3PO_4)   Bases ($NaOH$, $Ca(OH)_2$, $Al(OH)_3$ and Salts ($NaCl$, Na_2CO_3, $CaCO_3$).
  Define mole and solve numerical problems on mole concept.
  Define molarity, normality and solve numerical problems on molarity and normality.
    a) Calculate the Molarity or Normality, if weight of solute and volume of solution are given.

b) Calculate the weight of solute, if Molarity or Normality with volume of solution are given.

c) Problems on dilution to convert high concentrated solutions to low concentrated solutions.

Explain Arrhenius theory f Acids and Bases and give its limitations.

Define ionic product of water, pH and solve numerical problems on pH (Strong Acids and Bases).

Define buffer solution and classify buffer solutions with examples. Give its applications.

Electrochemistry

Define the terms 1. Conductor 2. Semiconductor 3. Insulator, 4. Electrolyte 5. Non–electrolyte. Give two examples each.

Distinguish between Metallic conduction and Electrolytic conduction.

Explain electrolysis by taking an example of used NaCl and list out the applications of electrolysis.

Define Galvanic cell. Explain the construction and working of Galvanic cell.

Distinguish between electrolytic cell and galvanic cell.

Define battery and list the types of batteries with examples.

Explain the construction, working and applications of i) Dry cell (Leclanche cell), ii) Lead storage battery, iii) Lithium-Ion battery and iv) Hydrogen-Oxygen fuel cell.

Corrosion

Define the term corrosion.

state the Factors influencing the rate of corrosion.

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

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

Explain the methods of prevention of corrosion by

(a)Protective coatings (anodic and cathodic coatings).

(b) Cathodic protection (Sacrificial anode process and Impressed–voltage process).

5. 0 Water Treatment

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

Define and classify the hardness of water.

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

State the disadvantages of using hard water in industries.

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

Solve numerical problems on hardness.

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

Polymers & Engineering materials.

A) Polymers

Explain the concept of polymerization.

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

Define plastic. Explain a method of preparation and uses of the following plastics:

1. PVC 2. Teflon 3. Polystyrene 4. Nylon 6,6.

Define elastomers. Explain a method of preparation and applications of the following:

1. Buna- S 2. Neoprene.

B) Engineering Materials

Define an alloy. Write the composition and applications of the following:

1.Nichrome 2. Duralumin 3.Stainless Steel.

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

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

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

Fuels

Define the term fuel.

Classify the fuels based on occurrence.
Write the composition and uses of the following:
   1. LPG 2. CNG   3.Biogas   4.Power alcohol
 Write the commercial production of Hydrogen as future fuel. Give its advantages and disadvantages.

ENVIRONMENTAL STUDIES
Explain the scope and importance of environmental studies.
Define environment. Explain the different segments of environment.
1.Lithosphere 2. Hydrosphere 3. Atmosphere 4. Biosphere
Define the following terms:
1. Pollutant 2.Pollution 3.Contaminant 4. Receptor 5. Sink 6. Particulates 7. Dissolved oxygen (DO) 8. Threshold Limit Value (TLV) 9. BOD 10.COD 11. Eco system 12. Producers 1 3 . Co n su m ers 14. Decomposers with examples.
State the renewable and non- renewable energy sources with examples.
State the uses of forest resources.
Explain the causes and effects of deforestation.
Define air pollution and explain its Global impacts 1. Greenhouse effect, 2. Ozone layer depletion and 3. Acid rain.
Define Water pollution. Explain the causes, effects and controlling methods of Water pollution.
Define e-Pollution, State the sources of e-waste. Explain its health effects and control methods.
Define Green Chemistry. Write the Principles and benefits of Green Chemistry.

COURSE CONTENT

ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES

1. **Fundamentals of Chemistry**

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

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

2. **Solutions, Acids and Bases**
   Solutions: Types of solutions - Mole concept – Numerical problems on mole concept -Methods of expressing concentration of a solution – Molarity and Normality – Numerical problems on molarity and normality.
   Acids and Bases: Arrhenius theory of acids and bases – Ionic product of water- pH–Numerical problems on pH–Buffer solutions – Classification- applications.

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

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

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

6. **Polymers & Engineering materials**
   Polymers:

Concept of polymerization – Types of polymerization – Addition, condensation with examples – Plastics - Preparation and uses of i).PVC ii) Teflon iii) Polystyrene and iv) Nylon 6,6.
Elastomers: Preparation and application of i)Buna-s and ii) Neoprene.
Engineering Materials:
Alloys- Composition and applications of i) Nichrome, ii) Duralumin and iii) Stainless Steel.
Composite Materials- Properties and applications.
Liquid Crystals- Properties and applications.
Nano Materials- Properties and applications.

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

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

Table specifying the scope of syllabus to be covered for Unit Test- 1, Unit Test- 2 and Unit Test -3

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

REFERENCE BOOKS

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

M-105 -ENGINEERING MECHANICS

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

Time Schedule

Sl. No.	Chapter / Unit Title	No. of Periods	Weightage of marks	PART A No of questions	PART B No of questions	CO's Mapped
1	Statics	22	21	2	1.5	CO1
2	Friction	20	16	2	1	CO2
3	Geometrical Properties of Sections	22	21	2	1.5	CO3
4	Dynamics	28	26	2	2	CO4
5	Simple Mechanisms & Machines	28	26	2	2	CO5
	Total	**120**	**110**	**10**	**8**	

Course Objectives and Course Outcomes

Course Objectives			**Upon completion of the course the student shall be able to** Understand the basic principles of statics and dynamics of rigid bodies. Calculate the reactive forces and motion characteristics for given conditions. Understand the working of simple mechanisms and machines.
Course Outcomes	CO1	M-105.1	Explain the basic concepts of force, moment, composition and resolution of forces, equilibrium, resultant of forces and moments in coplanar force systems and applying them to analyze the real time problems. Construct free body diagram and calculate the reactions necessary to ensure static equilibrium.
	CO2	M-105.2	Understand the effect of friction in static and dynamic conditions.
	CO3	M-105.3	Calculate various geometric properties of areas like centriod, moment of inertia and apply them to solve the engineering problems.
	CO4	M-105.4	Apply the various principles like, Work-Energy principle and Impulse – Momentum principle to solve the kinetic problems of particles Analyse and solve different problems of kinematics and kinetics.
	CO5	M-105.5	Illustrate working principles of simple machines and functioning of simple mechanisms in different applications.

PO-CO MAPPING:

Course Code : M-105	Course Title : Engineering Mechanics	Number of Course Outcomes : 05		No. of Periods :120
POs	**Mapped with CO No.**	**CO Periods addressing PO in Column1**	**Level (1,2,3)**	**Remarks**
PO1	**CO1, CO2, CO3, CO4, CO5**	**54**	**45**	**3**	**> 40% Level 3**
PO2	**CO1, CO2, CO3, CO4, CO5**	**48**	**40**	**3**	**Highly addressed**
PO3	**CO1, CO2, CO3, CO4, CO5**	**06**	**05**	**1**	
PO4					**25% to 40% Level 2**
PO5					**ModeratelyAddressed**
PO6					
PO7	CO1, CO2, CO3, CO4,CO5	**12**	**10**	**1**	**5 to 25% Level1 Low addressed** **<5% Not addressed**

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

3 : High, 2:Moderate, 1: Low

LEARNING OUTCOMES

Upon completion of the course the student shall be able to

Statics

Explain the importance of Engineering Mechanics in real world

Explain the concept of force

Classify the system of forces.

Explain the system of forces a) Co-planar and Non-coplanar, b) Parallel and Non-Parallel,
c) Like and Unlike d) Concurrent and Non-concurrent.

Explain Composition and Resolution of forces and resultant of concurrent coplanar forces.

State (a) parallelogram law (b) triangle law (c) polygon law of forces (d) Lami's theorem.

Problems on parallelogram law and Lami's theorem.

Explain the concept of equilibrium.

State the conditions of equilibrium of a body acted upon by a number of co-planar forces.

Solve the problems on equilibrium of a body subjected to a number of concurrent coplanar forces.

Explain moment of force and couple.

State Varignon's theorem.

Friction

Explain the concept of friction

State the laws of friction

Define i) angle of friction ii) angle of repose

Identify the machine members in which friction is desirable.

Resolve the forces acting on bodies moving on horizontal plane.

Resolve the forces acting on bodies moving up on an inclined plane when the force applied is (a)parallel to the plane (b) Parallel to the base.

Resolve the forces acting on bodies moving down on an inclined plane when the force applied is (a) parallel to the plane (b) Parallel to the base.

Solve the related numerical problems of the above cases.

Geometrical Properties of Sections

Define the terms i) centre of gravity ii) centroid.

Write the differences among centre of gravity and centroid.

State the need for finding the centroid and centre of gravity for various engineeringapplications.

Explain the method of determining the centroid by 'Method of moments'

Determine the position of centroid of standard sections like -T, L, I, Channel section.

Explain the meaning of the terms i) moment of Inertia ii) Polar moment of inertia
    iii) Radius of gyration.

State the necessity of finding Moment of Inertia for various engineering applications

Statements of (a) Parallel axes theorem and (b) Perpendicular axes theorem

3.9. Determine Moment of Inertia and Radius of gyration for standard sections like -T, L, I, Channel section.

Dynamics

Define the terms Kinematics and Kinetics

Classify the types of motion

Define the terms displacement, velocity and acceleration

Write equations of motion (without derivation)

Solve the problems related to the rectilinear motion of a particle.

Definition of energy and momentum

State with expressions Newton's laws of motion.

State the law of conservation of energy

Explain the Work-Energy principle.

State law of conservation of momentum.

Explain the Impulse –momentum equation

Solve problems using the above principles.

Explain rotary motion terms involved in rotary motion of a particle.

Express the equations of rotary motion of a particle.

Differentiate centripetal force and centrifugal force.

Solve simple problems on rotary motion.

Describe simple harmonic motion with engineering applications.

Define the terms related to SHM.

Solve simple problems on simple harmonic motion.

Simple Mechanisms & Machines

A) Simple Mechanisms:

Define the terms i) kinematic link ii)kinematic pair iii)Kinematic chain iv) Mechanism
    v) Machine vi) Structure vii) inversion of mechanism.

Write classification of kinematic pairs on different criteria.

Describe the working principle of Quadratic cycle chain.

Explain with legible sketches the important inversions of quadric cycle chain.

B) Simple Machines :

Define the important terms related to Simple machines

Illustrate the use of three classes of simple lever.

    Explain the working and write mathematical expressions for the velocity ratio of i) wheel & axle, Differential wheel and axle ii) pulleys iii) Worm & Worm wheel iv) winch crabs v) screw jack vi) rack & pinion.

Calculate the efficiency of the given machine.

Calculate the effort required to raise and lower the load on screw jack under given conditions.

Explain Law of simple machine.

Explain the conditions for self-locking.

State the conditions for reversibility.

Numerical problems on the above simple machines

COURSE CONTENTS:

1.0   Statics

Importance of engineering mechanics in engineering - Definition of force and its specifications - System of forces - Composition and Resolution of force - Resultant - Equilibrant, Statement of parallelogram law of forces, triangle law of forces, polygon law of forces and Lamis' theorem - Numerical problems related to the above.

Equilibrium - Condition for equilibrium of a rigid body subjected to number of coplanar concurrent forces – Numerical Problems.

Moment of force and moment of a couple – Statement of Varignon's Principle.

2.0 Friction

Concept of Friction – Advantages and limitations of friction – Friction in Engineering applications – Types of friction - Definition of static friction, dynamic friction - Laws of solid and dynamic friction – Terminology of friction: Horizontal plane, Inclined plane, Normal reaction, Free Body Diagram, Coefficient of friction, Angle of friction and Angle of repose.

Resolution of forces considering friction when a body moves on horizontal plane – Resolution of forces when a body moving up on an inclined plane and the force applied is (a) parallel to the plane (b) Parallel to the base - Resolution

of forces when a body moving down on an inclined plane and the force applied is (a) parallel to the plane (b) Parallel to the base - (**Derivations Omitted**); Numerical problems on the above cases.

3.0 Geometrical Properties of Sections

Concept Geometric Properties of Sections - Definition of the terms centre of gravity and centroid – Position of centroids of the plane geometrical figures such as square, rectangle, triangle, semi-circle (**formulae only without derivations**) – Problems to determine the Centroid of T-Section, L-Section I-section, and Channel sections only.

Definitions of centroidal Axes and Axis of symmetry - Moment of Inertia and Radius of Gyration –Statements only for (i) Parallel axes theorem and (i) Perpendicular axes theorem - Moment of Inertia of lamina of rectangle, circle, triangle sections- Calculation of Moment of Inertia of T-Section, L-Section (Equal & unequal lengths), I-section, and Channel sections only.

4.0 Dynamics

Definition and classification of Dynamics.

Kinematics: Definition - Classification of motion - Definition of displacement, time, velocity and acceleration – Equations of motion (**without derivation**) - Problems related to the rectilinear motion of a particle.

Kinetics: Definition – Momentum – Newton's Laws of motion- Statements and applications- Law of conservation of energy - Work-Energy principle - Law of conservation of momentum - Impulse–momentum equation - Problems on the above principles.

Rotary motion of particle - laws of rotary motion – Terms involved in rotary motion – Differentiate centripetal and centrifugal forces - Simple problems.

Simple Harmonic Motion: Definition – Characteristics - Terms of SHM such as frequency, time period, amplitude - Simple problems on SHM.

Simple Mechanisms & Machines

Simple Mechanisms

Define the terms kinematic link, kinematic pair, Kinematic Chain, Mechanism, Machine, Structure and inversion - classification of kinematic pairs on different criteria – nature of contact, relative motion and type of closure – Quadric cycle chain - Inversions of Quadric cycle chain: Beam engine, Coupling rod of a locomotive and Watt's straight line mechanism.

Simple Machines

Definition of Simple machine and uses of simple machines – Terminology such as Load, effort, Mechanical advantage, Velocity ratio and Efficiency – Expressions for Velocity ratio in case of levers, three systems of pulleys, wheel and axle, Differential wheel and axle, Worm and Worm wheel, Rack and pinion, Winch crabs, & Screw jack (**Derivations omitted**) - Simple problems on the above simple machines - Importance of Law of Simple Machine - Conditions for reversibility and self-locking of a machine.

REFERENCE BOOKS:

1	Engineering Mechanics	Singer	B.S.Publications
2	Engineering Mechanics	K.L. Kumar	TMH
3	Engineering Mechanics	Timoshenko	MGH

| 4 | Mechanics of Solids | S.S. BHAVIKATTI | New Age |
| 5 | Theory of Machines | S.S. RATTAN | TMH |

Table specifying the scope of syllabus to be covered for Unit Test-I , II & III.
M-105 :: ENGINEERING MECHANICS

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 2.8
Unit Test – II	From 3.1 to 4.12
Unit Test – III	From 4.13 to 5.12

M-106 Basic Manufacturing Processes

Course Title	Course Code	Periods/Week	Periods per Semester
Basic Manufacturing Processes	M-106	03	90

TIME SCHEDULE

S. No.	Major Topics	Periods	Weightage of Marks	PART A No of questions	PART B No of questions	CO Mapping
1	Carpentry	15	26	2	2	C01, CO2
2	Fitting	15	16	2	1	C01, CO2
3	Forging	15	13	1	1	C01, CO2
4	Sheet Metal	15	13	1	1	C01, CO2
5	Drilling and Jig Boring	15	26	2	2	CO3, CO4
6	Mechanical working of metals	15	16	2	1	CO5
	Total	**90**	**110**	**10**	**8**	

Course Objectives and Course Outcomes

COURSE OBJECTIVES	Upon completion of the course the student shall be able to 1. Understand the use of basic workshop tools and their operations 2. Know the basic workshop operations such as carpentry, fitting, forging, sheet metal, drilling, jig boring and Mechanical working of metals		
COURSE OUTCOMES	CO1	M-106.1	Explain the use of basic workshop tools used in carpentry, fitting, forging and sheet metal.
	C02	M-106.2	Describe the various operations used in carpentry, fitting, smithy and sheet metal process.
	C03	M-106.3	Describe the functions of sensitive and radial drilling machines and operations on drilling machine
	C04	M-106.4	Describe the operation of jig boring machine.
	C05	M-106.5	Describe the hot working and cold working processes.

PO-CO Mapping

Course Code: M-106	Course Title: Workshop TechnologyNo of COs:5				No. Of periods: 90
POs	Mapped with CO No	CO Periods Addressing PO in Col 1		Level (1,2,3)	Remarks
		No	%		
PO1	CO1,CO2,CO4	56	46.7	3	**>40% Level 3 (Highly Addressed)**
PO2		37	30.8	2	**25% to 40% Level 2 (Moderately Addressed)**
PO3					
PO4	CO3,CO3	21	17.5	1	**5% to 25% Level 1 (Low Addressed)**
PO5					
PO6					**<5% Not Addressed**
PO7	CO1	6	5	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	**3:**
CO1	3							1			
CO2		2						1			
CO3				1				1			
CO4	2			1				1			
CO5	3							1			

High, 2: Moderate, 1: Low

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

      (i)   **Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.**

Learning Outcomes

    Upon completion of the course the student shall be able to

1.0.Carpentry

  State various types of manufacturing processes with examples

  Identify various carpentry tools.

  Distinguish between marking tools, measuring tools and cutting tools.

  List out various work holding devices.

  Explain wood working processes viz., sawing, chiselling and   planning.

  Explain the use of carpentry joints such as lap joint, dovetail joint, mortise and tenon joint with legible sketch.

  Explain the working of wood working machines.

Fitting

List out various marking and measuring tools.

2.2 List out various cutting tools

2.3. List out various work holding devices.

2.4 Explain fitting operations such as marking, sawing, chipping, filing, grinding, drilling and tapping with legible sketches.

Forging

List various tools used in black-smithy.

List equipment used in a forging shop.

Explain the important smithy operations.

Explain forging operations such as upsetting, drawing Down, settting down, fullering, flattering, swaging, bending , punching and drifting with legible sketches.

3.5 Explain the working principle of pneumatic hammer, board drop hammer and forging press with legible sketches.

Sheet Metal

List various marking tools in sheet metal work.

List various stakes.

List various sheet metal joints.

Describe sheet metal operations such as shearing, bending drawing and squeezing.

Differentiate between riveting, soldering & brazing.

Drilling& Jig boring

State the working principle of drilling

List out various types of drilling machines

Describe the Sensitive drilling machine with line diagram

Describe the radial drilling machine with line diagram

Mention the specifications of drilling machine

Explain the nomenclature of the drill bit

Explain different operations on drilling machine

Differentiate between jigs and fixtures

List different types of Jigs and fixtures.

State the principle of working of a jig boring machine.

Classify the jig boring machines.

Describe the constructional details of open front and cross rail type jig boring machines with the help of legible sketches.

6.0.   Mechanical working of metals

6.1 Define Mechanical working of metals

Explain Hot working of metals with advantages and disadvantages

Explain various hot working processes such as hot rolling, Piercing, Spinning, and hot extrusion processes.

Explain cold working of metals with advantages and disadvantages.

Explain various cold working processes such as cold rolling, wire drawing, tube drawing, bending, squeezing and cold heading.

COURSE CONTENT

1.0 Carpentry

Introduction : Methods of manufacturing processes - casting, forming, metal removal processes, joining processes, surface finishing processes.

Carpentry tools

Marking & measuring tools: scales, rules, flexible measuring rule (tape), straight edge, try square, bevel square, marking knife, marking gauge, mortise gauge, trammel, divider, spirit level, plum bob, specifications-uses.

Cutting Tools

Saws: ripsaw, cross cut saw (hand saw), panel saw, tenon or back saw, dovetail saw, specifications & uses.

Chisels: Firmer chisel, parting chisel, mortise chisel, inside and outside gauges, specifications and uses.

Planes: wooden jack plane and metal jack plane.

Striking tools: Hammers - Warrington hammer, claw hammer, mallet, Specifications & uses.

Holding devices: Bench vice, bench stop, G- cramp, Specifications & uses.

Carpentry Processes : Marking, measuring, sawing, chiselling, planning, grooving, Rebating.

Carpentry joints: Halving Joint, mortise and tenon joint, dovetail joint, corner joint.

Wood working machines: Wood working lathe (wood turning lathe), circular saw and band saw, specifications and uses.

2.0. Fitting

Cutting tools

Files: Different parts of a file – sizes and shapes - flat file, hand file, square file, and 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, hacksaw blades. Description of Power hack saw – (horizontal reciprocating type)- specifications

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.

Striking Tools

Hammers: Parts, ball peen, cross peen, straight peen hammers, specifications and uses.

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Marking Tools

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

Checking instruments:

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

Miscellaneous Tools

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

Work holding devices

Vices: Bench vice, leg-vice, hand vice, pin vice, tool makers vice, pipe vice, specifications and uses.

Fitting Operations

Marking, sawing, chipping, filing and scrapping

3.0 Forging

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.

Equipment: Open and closed hearth heating furnaces, hand and power driven blowers, open and stock fire, fuels-charcoal, coal, oil gaseous fuels.

Smithy Operations: Upsetting, drawing down, setting down, punching, drifting, bending, welding, cutting, swaging, fullering and flattering.

Machine Forging: Need of machine forging, forging hammers - working of pneumatic hammer ,board drop hammer and forging press.

4.0 Sheet Metal Work

Metals used for sheet metal work.

Measuring tools - circumference rule, thickness gauge, sheet metal gauge, straight edge, scriber, divider, hammers, snips or shears, straight snip, curved snip, bench & block shears.

Stakes: Double seaming stake, bevel edged square stake, Hatchet stake, needle stake, blow horn stake, hollow mandrel stake, rivet sets, soldering iron, specifications & uses.

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

Drawing: Deep drawing, shallow or box drawing

Sqeezing: Sizing, coining, hobbing

Sheet Metal Joints

Hem Joint: single hem, double hem & wired edge,

Seam Joint: Single seam, double seam and lap seam.

Fastening Methods: Riveting, soldering and brazing

5.0   Drilling and Jig Boring

Drilling machines: Sensitive & radial drilling machines, their constructional details and specifications.

Drills: Terminology - Flat drill, twist drill: parallel shank, tapered shank, specifications & uses.

Operations: Drilling, reaming, boring, counter boring, counter sinking, tapping and dieing.

Jigs and Fixtures: Types of jigs and fixtures – Differentiate jigs and fixtures.

Jig boring Machines: Types of jig boring machines – Principle of operation of open front and cross rail type jig boring machines –Specifications – Applications.

6.0 Mechanical working of metals

Introduction: Hot working and cold working

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.

Effects of hot working of metals**,** advantages & limitations of hot working of metals.

Cold working process: Rolling, drawing - wire drawing, tube drawing, bending, roll forming, angle bending, spinning, extrusion, squeezing, cold heading, thread rolling, peening.

Effects of cold working of metals, advantages & limitations of cold working.

REFERENCE BOOKS

1.   Production Technology   by   Jain & Gupta (Khanna Publishers)
2. Elementary Workshop Technology   by   HazraChowdary& Bhattacharya
   (Media Promoters)

3. Manufacturing Technology (Vol I)   by   P N Rao (McGraw Hill)
4. Workshop Technology Vol I & II   by   Raghuvamshi

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II
M-106 :: Basic Manufacturing Processes

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 2.4
Unit Test – II	From 3.1 to 4.6
Unit Test – III	From 5.1 to 6.5

M-107 ENGINEERING DRAWING

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for Formative Assessment	Marks for Summative Assessment
M-107	ENGINEERING DRAWING	06	180	40	60

TIME SCHEDULE

S.No	Chapter/Unit Title	No. of Drawing plates	Periods	Weightage of Marks	Short Answer Questions(5 M)	Essay Type Questions (10 M)	COs Mapped
1	Importance of Engineering Drawing	--	01	-	-	-	C01
2	Engineering Drawing Instruments	01	05	-	-	-	CO1
3	Free hand lettering & Numbering	01	06	05	1	-	CO2
4	Dimensioning Practice	01	09	05	1	-	CO2
5	Geometrical constructions	03	24	15	1	1	CO3
6	Projections of Points, Lines, Planes & Auxiliary Planes	03	21	05	1		CO4
7	Projections of Solids	01	12	10		1	CO4
8	Sections of Solids	01	21	10	-	1	CO4
9	Orthographic Projections	01	30	10	-	1	CO4
10	Isometric Views	01	30	10	-	1	CO5
11	Development of surfaces	01	21	10	-	1	CO6
	Total	**14**	**180**	**80**	**04**	**06**	

Course Objectives and Course Outcomes

Course Objectives		**Upon completion of the course the student shall able to understand** the basic graphic skills and use them in preparation of engineering drawings, their reading and interpretation
Course Outcomes	**CO1** M-107.1	Describe the use of engineering drawing instruments
	CO2 M-107.2	Practice the conventions to be followed in engineering drawing as per BIS
	CO3 M-107.3	Draw i) basic geometrical constructions ii) engineering curves
	CO4 M-107.4	Draw the orthographic projections of i) Points ii) Lines iii) Regular Planes iv) Regular Solids V) Sections of Regular Solids
	CO5 M-107.5	Practice isometric views of machine components
	CO6 M-107.6	Draw the developments of surfaces of regular solids and use them to make the components used in daily life

PO-CO Mapping

Course Code : M-107	**Course Title: ENGINEERING DRAWING** **Number of Course Outcomes: 06**			**No. of Periods: 180**	
POs	**Mapped with CO No.**	**CO Periods addressing PO in Column 1**		**Level (1,2,3)**	**Remarks**
		No	**%**		
PO1	CO2, CO3, CO4, CO5, CO6	50	42	3	**>40% Level 3 Highly addressed 25% to 40% Level 2 Moderately Addressed 5 to 25% Level 1 Low addressed <5% Not Addressed**
PO2	CO1, CO2, CO3, CO4, CO5, CO6	30	25	2	
PO3	CO1, CO2, CO3, CO4, CO5, CO6	30	25	2	
PO4					
PO5					
PO6					
PO7	CO1, CO2, CO3, CO4, CO5, CO6	10	08	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2				1	2	3	1
CO2	3	2	2				1	2	3	1
CO3	3	2	2				1	2	3	1
CO4	3	2	2				1	2	3	1
CO5	3	2	2				1	2	3	1
CO6	3	2	2				1	2	3	1

3: High, 2: Moderate,1: Low

Note:

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

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz

(vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

LEARNING OUTCOMES
Upon completion of the course the student shall able to

Understand the basic concepts of Engineering Drawing

State the importance of drawing as an engineering communication medium
State the necessity of B.I.S. Code of practice for Engineering Drawing.
Explain the linkages between Engineering drawing and other subjects of
Mechanical Engineering

Use of Engineering Drawing Instruments
Select the correct instruments to draw the different lines / curves
Use correct grade of pencil to draw different types of lines and for different
purposes
Select and use appropriate scales for a given application.
Identify different drawing sheet sizes as per I.S. and Standard Lay- outs.
Prepare Title block as per B.I.S. Specifications.
Identify the steps to be taken to keep the drawing clean and tidy.
Drawing Plate 1 : Use of Engineering Drawing Instruments

Write Free Hand Lettering and Numbers
Write titles using vertical lettering and numerals of 7mm, 10mm and 14mm height
Write titles using sloping lettering and numerals of 7mm, 10mm and 14mm height
Select suitable sizes of lettering for different layouts and applications
Drawing plate 2: Exercises on Free hand lettering and numbering

4.0 Understand Dimensioning Practice

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

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

Drawing Plate 3: Exercises on Dimensioning Practice

Apply Principles of Geometric Constructions

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

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

Draw the conics using general and special methods,

        Draw the engineering curves like i) involute ii) cycloid iii) helix

Drawing Plate -4: Having problems up to construction of polygon

Drawing Plate -5: Having problems of construction of conics

Drawing Plate -6: Having problems of construction of involute, cycloid and helix

Projections of points, lines, planes & auxiliary planes

        Explain the basic principles of the orthographic projections

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

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

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

        Draw the auxiliary views of a given engineering componentDrawing Plate -7: problems on projection of points and Lines

Drawing Plate -8: problems on projection of planesDrawing Plate -9: problems on auxiliary planes

Draw the Projections of Solids

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

Drawing plate No.10: Problems on projection of solids

Appreciate the need of Sectional Views

        Identify the need to draw sectional views.

Differentiate between true shape and apparent shape of section

        Draw sectional views and true sections of regular solids by applying the principles of hatching.

Drawing Plate–11: Problems on section of solids

Apply principles of orthographic projection

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

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

Drawing Plate 12 : Problems on **orthographic projections**

Prepare pictorial drawings

        identify the need of pictorial drawings.

        Differentiate between isometric scale and true scale.

        Prepare Isometric views from the given orthographic drawings.

    Drawing plate 13: Exercise on Isometric drawings only.

Interpret Development of surfaces of different solids.

        State the need for preparing development drawing.

        Draw the development of simple engineering objects and their truncations (cubes, prisms, cylinders, cones, pyramid)

        Prepare development of surface of engineering components like i) funnel
        ii) 90^0 elbow iii) Tray

    Drawing plate No. 14: Problems on Development of surfaces

Competencies and Key competencies to be achieved by the student

S.No	Major topic	Key Competency
1.	Importance of Engineering Drawing	• Explain the linkages between Engineering drawing and other subjects of study in Diploma course.
2.	Engineering Drawing Instruments	• Select the correct instruments to draw various entities in different orientation
3.	Free hand lettering & Numbering	• Write titles using sloping and vertical lettering and numerals as per B.I.S (Bureau of Indian standards)
4.	Dimensioning Practice	• Dimension a given drawing using standard notations and desired system of dimensioning
5.	Geometrical construction	• Construct ellipse, parabola, rectangular hyperbola, involute, cycloid and helix from the given data.
6.	Projection of points, Lines, Planes & Solids	• Draw the projections of points, straight lines, planes & solids with respect to reference planes (HP& VP)
7.	Auxiliary views	• Draw the auxiliary views of a given Engineering component • Differentiate between Auxiliary view and apparent view
8.	Sections of Solids	• Differentiate between true shape and apparent shape of section • Apply principles of hatching. • Draw simple sections of regular solids
9.	Orthographic Projection	• Draw the minimum number of views needed to represent a given object fully.
10.	Isometric Views	• Differentiate between isometric scale and true scale. • Draw the isometric views of given objects,.
11.	Development of surfaces	• Prepare development of Surface of regular solids and other components like i) funnel ii) 90^0 elbow iii) Tray

COURSE CONTENTS:

NOTES:

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

1.0   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,

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 "Circles (holes) arcs, angles, tapers, chamfers, and dimension of narrow spaces.

Geometric Construction
Division of a line: to divide a straight line into given number of equal parts
Construction of tangent lines: to draw interior and exterior tangents to two circles of givenradii and centre distance

Construction of tangent arcs:
i) To draw tangent arc of given radius to touch two lines inclined at given angle (acute, rightand 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 by general method for givenside length, inscribing circle radius and describing/superscribing circle radius

Conics: Explanation of Ellipse, Parabola, Hyperbola, as sections of a double cone and a loci ofa moving point, Eccentricity of above curves – Their Engg. Applications viz., Projectiles, reflectors, Cooling Towers, 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 and Tangent 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

Projection of points, lines and planes & auxiliary views

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

Projections of points in different quadrantsProjections 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

Projections of regular planes
(a) Plane parallel to one of the reference planes
(b) Plane perpendicular to HP and inclined to VP and vice versa.
Auxiliary views
Need for drawing auxiliary views -Explanation of the basic principles of drawing an auxiliaryviews explanation of reference plane and auxiliary plane - Partial auxiliary view.

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

8.0   Sections of Solids

Need for drawing sectional views – what is a sectional view - Hatching – Section of regularsolids 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 ofrepresenting 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: Isometric axes, angle between them, meaning of visual distortion in dimensions - Need for an isometric scale, difference betweenIsometric scale, and true 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 – Drawing the isometric views for the given orthographic projections -Use of box / offset method

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 and truncation of these solids-Types of development: Parallel line and radial line development -Procedure of drawing development of funnels, 90^0 elbow pipes, Tray.

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.

M -108 BASIC WORKSHOP PRACTICE

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for Formative Assessment	Marks for Summative Assessment
M-108	**Basic Workshop Practice**	06	180	40	60

TIMESCHEDULE

S.No	Major Title	No of Periods	CO Mapping
1.	Fitting shop	180	CO1
2.	Forging shop		CO2
3.	Carpentry shop		CO3
4.	Sheet metal work		CO4
5	Plumbing		CO5
	Total	180	

Course Objectives and Course Outcomes

Course Objectives	Upon completion of the course the student shall able to (i) To Familiarize tools used in Basic workshop processes (ii) To handle the tools appropriately and safely (iii) To reinforce theoretical concepts by practising relevant exercises of basic workshop processes		
Course Outcomes	CO1	M-108.1	Practice the operations in Fitting Shop
	CO2	M-108.2	Practice the operations in Forging Shop
	CO3	M-108.3	Practice the operations in Carpentry Shop
	CO4	M-108.4	Practice the operations in Sheet metal Shop
	CO5	M-108.5	Practice the operations in Plumbing

Learning Outcomes:
Upon completion of the course the student shall able to

1. Perform Marking and Chipping operations on Mild steel flat of 12 mm thick
    Identify appropriate measuring tool
Handle appropriate marking tool
Handle appropriate chipping tool
    Mark the dimensions
2. Cutting with hack saw of MS flats of 6mm thick
Check the raw material for size
Fix the work piece in vice
Mark the work as per given dimensions
Perform dot punching
Load and unload hack saw blade from its frame

3. Drilling, chamfering on a MS flat of 2 mm thick

check the raw material for size
Apply the chalk on the surface and on all sides of the flat
Layout the dimensions and mark the lines using dot punch
Chamfer the edges through filing
Locate the whole centres using odd leg callipers and centre punching
Identify appropriate drill bit
Load and unload drill bit from the machine

4. Tapping and Dieing on a MS flat of 2 mm thick
Check the raw material for size
Identify appropriate tap and die
Secure the tap in the wrench
Perform Tapping
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

Cut the pieces to size using hack saw
File surface of flat for trueness
    Mark the surfaces as per dimensions
    Perform cutting with hack saw as per marked lines
Smooth the surfaces with file
    Assemble the two pieces

6. Conversion of Round to Square
    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 to the required shape

7 Conversion of Round to Hexagon
    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 to the required shape

8. Preparation of a Chisel from round rod
    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 to the required shape

.9. Preparation of a ring and hook from M.S round
    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 to the required shape

10. Cutting of wood with hand saw
   Identify the orientation of grains
   Select appropriate saw for cutting in each of the directions viz. across and along the grains
   Select appropriate work holding device
   Handle appropriate measuring and marking tools(Steel rule, Try square, Marking gauge)
Mark dimensions on work using Marking gauge
   Fix the work in the vice
   Perform cutting along the grains using Rip saw
   Perform cutting perpendicular to the grains using cross cut saw
11. Planning of wood
Identify the direction for planning wood stock
   Select appropriate jack plane
   Prepare the jack plane for planning
   Load and unload the blade of a jack plane
   Select appropriate work holding device
   Perform marking on work using appropriate tool
   Fix the work in the vice
   Plane the surfaces on all four sides using jack plane
12. .Chiselling of wood
   Select appropriate chisels and saw
   Select appropriate work holding device
   Select appropriate measuring and marking tools
   Fix the work in the vice
Mark the position of grooves on work using 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

13. Preparation of a Dove-tail joint
   Select the appropriate cutting tools and work holding devices
   Plane the wooden pieces on all sides
Mark at an angle of 150 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

14. Preparation of Mortise and Tenon joint
   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
   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 tenon into mortise

15. Wood turning on lathe
   Select appropriate tools
   Plane the four corners of the work piece using jack plane

Mark the centres of the work on either side

Mount the work between head stock & tailstock centres

     Fix the tool in the tool post & Position it in appropriate height

     Start the lathe to make the work piece to revolve at desired speed

     Feed the bevel gauge against the rotating work to get the required size and shape

     Use outside callipers to check the diameter of the pin

     Use parting off tool to reduce the diameter on either ends of the pin

Remove the rolling pin between centres and cut off excess material on either sides

16. Preparation of any household article (ex: stool)

     Prepare the drawings of a stool required for a particular drawing table

     State the specifications of the wood stock required

     Identify the type of joints to be made

     Identify the operations to be made and their sequence

     Perform operations to produce pieces of joint

     Assemble all joints as per the drawing

17. Practice on cutting of sheet

Cut the required sheet from the stock using snip

Mark the dimensions on the sheet using scriber & steel rule

     Draw the circular shapes using divider

     Perform rough cutting of the curved shapes using chisel and finish cutting using snips

Cut the straight edges using straight snip

18. Formation of joints like grooved joint, locked groove joint

Cut the sheet into two halves

     Form the flange on the sheet by folding the sheet along scribed lines using mallet & stakes

     Perform bending edges of sheets applying moderate pressure using mallet

     Interlock the bent edges and apply pressure with mallet to make required joint

19. Preparation of a rectangular open type tray

     Draw the development of the object to be made

     Place the pattern on the sheet

Mark the dimensions using scriber

     Shear the required piece from the stock using straight snips

Mark the lines on the sheet to form bends

     Strengthen the sides of sheet by single hem using hatchet stake

     Form the sheet into desired shape using stakes

     Seam the corners by inserting laps of the adjacent sides with single hem

20. Preparation of hollow cylinder

     Draw the development of the object to be made

     Place the pattern on the sheet

Mark the dimensions using scriber

     Shear the required piece from the stock using straight snips

Mark the lines on the sheet to form bends

     Strengthen the sides of sheet by single hem on top & bottom side using hatchet stake

     Form the flat sheet into cylindrical shape by cylindrical stake and apply pressure using mallet

     Prepare single hem on to longitudinal sides in opposite directions

     Interlock the sides and apply pressure to make a strong joint

21. .Preparation of pipe elbow

     Draw the development of a cylindrical pipe truncated at an angle of 450 on one side

Cut the sheet over the marked dimensions using curved snips

     Form the sheet into cylindrical shape using stakes

Seam the sides of two pipes using mallet

Seam the two pipes

Solder the joint to make leak proof

22. Preparation of funnel

Draw the development of upper and bottom conical parts

Place the pattern on the sheet and cut to required size

Form the sheet into conical shape using appropriate stake and mallet

Seam the top conical part and bottom conical part to obtain required funnel

23. Preparation of utility articles such as dust pan, kerosene hand pump

Draw the development of given dust pan

Scribe the lines on the sheet and cut to required size

Hem all the four sides to strengthen the edges

Form the sheet into designed shape using suitable stakes and mallet

Solder the corner lap joints to make the required dust pan

24. Preparation of pipe joint with pipe fittings

Select the plumbing tools: pipe wrench, pipe vice, Hack Saw, Pipe Cutter, pipe Threading Dies

select pipe fittings: Coupling, union, nipple, Elbow, Tee, Reducer

Perform pipe fitting operations on the pipe

25. Thread cutting on Pipe

Select the plumbing tools: pipe wrench, pipe vice, Hack Saw, Pipe Cutter, pipe Threading Dies

Perform thread cutting on pipe

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.
     .

CARPENTRY SHOP

1.   Cutting of wood with hand saw.
2.   Planning of wood.
3.   Planning and chiselling of wood.
4.   Preparation of dovetail joint.
5.   Mortise and tenon joint.
6.   Wood turning on a lathe.
7.   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.

Plumbing Practice
1.Familiarization of Plumbing Tools
2.Familiarization of Pipefitting
3. Familiarization of Plumbing Operations

ENGINEERING PHYSICS LAB

SUBJECT	SUBJECT CODE	TOTAL PERIODS	NUMBER OF PERIODS PER WEEK
PHYSICS LAB	COMMON -109	45	03

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

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

CO-PO MAPPING

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

CO-PO Mapping Strength

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

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

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

(i) Seminars   (ii) Viva-voce   (iii) Assignments
(iv) Quiz competitions   (v) Industrial visits   (vi) Tech fest   (vii) Mini project

(viii) Group discussions (ix) Virtual labs   (x) Library visit for e-books

TIMESCHEDULE

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

Learning Outcomes

Upon completion of the course the student shall be able to

1.0   Practice with Vernier calipers to determine the volumes of cylinder and sphere.
2.0   Practice with Screw gauge to determine thickness of a glass plate and cross sectional area of a wire.

3.0   Verify the Lami's theorem using concurrent forces.
4.0   Determine the value of acceleration due to gravity (g) using Simple Pendulum. To verify the result from $l\text{-}T^2$ graph.
5.0   Calculate the Focal length and focal power of convex lens using distant object method and U-V method. To verify the result from U-V graph and $1 / U – 1 / V$ graph methods.
6.0   Determine the refractive index of a solid using travelling microscope
7.0   Verify the Boyle's law using Quill tube. To draw a graph between P and 1/l.
8.0   Determination of magnetic pole strength of a bar magnet by drawing magnetic lines of force and locating null points (either N - N or N - S method)

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

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

11.0 To verify the Newton's law of cooling.

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

Course Outcomes

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

Competencies and Key competencies to be achieved by the student

Name of the Experiment (Nu	Competencies	Key competencies
1 . Practice on Vernier Calipers (03)	• Find the Least count • Fix the specimen in position • Read the scales • Calculate the physical quantities of given object	• Read the scales • Calculate the requisite physical quantities of given objects • Calculating volumes of the cylinder and sphere
2. Practice on Screw gauge(03)	• Find the Least count • Fix the specimen in position • Read the scales • Calculate thickness of glass plate and cross section of wire from radius	• Read the scales • Noting zero error • Calculate thickness of given glass plate • Calculate cross section of wire from radius
3. Verification of Lami's theorem forces(03)	• Making experimental set up • Fix suitable weights • Note the positions of threads on drawing sheet • Find the angles between the concurrent forces • Changing weights appropriately • Verify Lami's theorem	• Measuring angles between the forces • Marking the directions of forces on a paper • Verifying Lami's theorem from the weights and measured angles between the forces.
4. Simple pendulum(03)	• Fix the simple pendulum to the stand • Adjust the length of pendulum • Find the time for number of oscillations (say 20) • Find the time period • Calculate the acceleration due to gravity • Draw l-T^2 graph	• Find the time for number of oscillations • Find the time period • Calculate the acceleration due to gravity • Verify form l-T^2 graph
5. Focal length and Focal power of convex lens (03)	• Fix the object distance • Find the Image distance • Calculate the focal length and power of convex lens • Draw u-v and 1/u – 1/v graphs	• Find focal length from distant object method. • Calculate the focal length and power of convex lens • Verify result from u-v and 1/u – 1/v graphs

6 Refractive index of solid using traveling microscope(03)	• Find the least count of Vernier on microscope • Place the graph paper below microscope • Read the scales	• Reading the scales on Microscope. • Fiding real and apparent thickness of the slab • Calculate the refractive
7 . Boyle's law verification (03)	• Note the atmospheric pressure • Fix the Quill tube to retort stand • Find the length of air column • Find the pressure of enclosed air • Find and compare the calculated values of P x l	• Fixing Quill tube in various positions on retort stand. • Find the length of air column • Find the pressure of enclosed air • Find the values of Px l • Verify Boyle's law.
8. Mapping of magnet lines of force (03)	• Draw magnetic meridian • Place the bar magnet in N-N or N-S directions • Draw magnetic lines of force • Locate the neutral points	• Draw the pattern of magnetic lines of force • Locate the neutral points • Calculating pole strength of the bar magnet
9. Velocity of sound in air – Resonance method (03)	• Arrange the resonance apparatus • Adjust the reservoir level for booming sound • Find the first and second resonanting lengths • Calculate velocity of sound .	• Adjust the reservoir level • Find the first and second resonanting lengths • Calculate velocity of sound at room temperature and at 0^0 C
10. Meter bridge(03)	• Make the circuit connections • Find the balancing length • Calculate unknown resistance • Find the radius of wire • Calculate the specific resistance	• Making connections as per circuit diagram. • Find the balancing length • Calculate unknown resistance • Calculate the specific resistance of the given wire

11. Verification of Newton's law of Cooling (03)	• Heating liquid in a beaker using a heating element • Inserting thermometer in liquid in calorimeter • Stirring liquid • Measuring temperatures as a function of time using thermometer • Plotting a cooling curve	• Measuring temperature of a liquid as function of time. • Plotting a cooling curve. • Verifying Newton's law of cooling.
12. Photo electric cell – Study of its Characteristics (03)	• Experimental set up and making connections • Veryfying intensity of light by varying distances between light source and photocell. • Measuring Voltage and current values.	• Making connections for experimental set up. • Varying distances appropriately • Measuring Voltage and current values. • Study of V- I Characteristics form graph.

Scheme of Valuation for End Practical Examination :

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

CHEMISTRY LABORATORY

SUBJECT	SUBJECT CODE	TOTAL PERIODS	NUMBER OF PERIODS PER WEEK
Chemistry Laboratory	M -110	45	03

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

PO- CO mapping

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

COs-POs mapping strength (as per given table)

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

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

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

TIME SCHEDULE

S.No	Name of the Experiment	No. of Periods	Mapped with COs
1.	a) Recognition of chemical substances and solutions used in the laboratory by senses. b) Familiarization of methods for Volumetric analysis.	03	CO1
2.	Preparation of Std.Na_2CO_3solution and making solutions of different	03	CO1
3.	Estimation of HCl solution using Std.Na_2CO_3solution.	03	CO2
4.	Estimation of NaOH using Std. HCl solution.	03	CO2
5.	Determination of acidity of water sample.	03	CO2
6.	Determination of alkalinity of water sample.	03	CO2
7.	Estimation of Mohr's Salt usingStd.$KMnO_4$. Solution.	03	CO3
8.	Estimation of Ferrous ion by using Std. $K_2Cr_2O_7$ solution.	03	CO3
9.	Determination of total hardness of water sample using Std. EDTA solution.	03	CO4
10.	Estimation of Chlorides present in water sample by using Std. $AgNO_3$ solution.	03	CO4
11.	Estimation of Dissolved Oxygen(D.O) in water sample by using Std. hypo solution.	03	CO5
12.	Determination of pH using pH meter..	03	CO5
13.	Determination of conductivity of water and adjusting ionic strength	03	CO5
14.	Determination of turbidity of water.	03	CO
15.	Estimation of total solids present in water sample.	03	CO
	Total:	**45**	

Objectives:

Upon completion of the course the student shall be able to

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

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

3.0 Conduct titrations adopting standard procedures and using Std. Na_2CO_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 to determine the acidity of given samples of water (One ground water and one surface / tap water, and rain water if available).

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

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

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

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

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

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

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

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

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

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

Competencies and Key competencies to be achieved by the student

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

Determination of turbidity of water. (03)	appropriate standard solutions. • Plot the standard curve. • Make measurements accurately. • Follow Safety precautions.	• Make measurements accurately.
Estimation of total solids present in water sample. (03)	• Measuring the accurate volume and weight of sample. • Filtering and air drying without losing any filtrate. • Accurately weighing the filter paper, crucible and filtrate. • Drying the crucible in an oven.	• Measuring the accurate volume and weight of sample. • Filtering and air drying without losing any filtrate. • Accurately weighing the filter paper, crucible and filtrate.

SCHEME OF VALUATION

A) Writing Chemicals, apparatus, principle and procedure.   5M
B) Demonstrated competencies.   20M
   Making standard solutions.
   Measuring accurately the standard solutions and titrants.
   Effectively controlling the flow of the titrant.
   Identifying the end point.
   Making accurate observations.
C) Viva-voce.   5M

Total   **30M**

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Course code	Course Title	No. of Periods/Weeks	Total No. of periods	Marks for FA	Marks for SA
M-111	**Computer Fundamentals Lab**	3	90	40	60

Time schedule:

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

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

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

	At the end of the course students will be able to		
Course Outcomes	CO1	M-111.1	Identify hardware and software components
	CO2	M-111.2	Prepare documents with given specifications using word processing software
	CO3	M-111.3	Use Spread sheet software to make calculation and to draw various graphs / charts.
	CO4	M-111.4	Use Power point software to develop effective

			presentation for a given theme or topic.
	CO5	M-111.5	Edit digital or scanned images using Photoshop

CO-PO/PSO MATRIX

CO NO.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
M-111.1	3	3	3	3	3	3	3	3	2	3
M-111.2	3	3	3	3	3	3	3	3	2	3
M-111.3	3	3	3	3	3	3	3	3	2	3
M-111.4	3	3	3	3	3	3	3	3	2	3
M-111.5	3	3	3	3	3	3	3	3	2	3
Average	3	3	3	3	3	3	3	3	2	3

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

Learning Outcomes:

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

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

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

IV. Practice with MS-EXCEL
13. To familiarize with MS-EXCEL layout
14. To access and enter data in the cells
15. To edit a spread sheet- Copy, Cut, Paste, and selecting Cells
16. To use built in functions and Formatting Data
17. To create Excel Functions, Filling Cells
18. To enter a Formula for automatic calculations
19. To sort and filter data in table.

20. To present data using Excel Graphs and Charts.
21. To develop lab reports of respective discipline.
22. To format a Worksheet in Excel, Page Setup and Print

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

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

Key competencies:

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

		b. Access application programs using Start menu, Task manager c. Use Help support	b. Use taskbar and Task manager
2.	To check the software details of the computer	a. Find the details of Operating System being used b. Find the details of Service Pack installed	Access the properties of computer and find the details
3.	To check the hardware present in your computer	a. Find the CPU name and clock speed b. Find the details of RAM and Hard disk present c. Access Device manager using Control Panel and check the status of devices like mouse and key board d. Use My Computer to check the details of Hard drives and partitions e. Use the Taskbar	a. Access device manager and find the details b. Type /Navigate the correct path and Select icon related to the details required
4.	Working with Files and Folders	a. Create folders and organizing files in different folders b. Use copy / paste move commands to organize files and folders	a. Create files and folders Rename , arrange and search for the required folder/file
	Working with Files and Folders Continued....	c. Arrange icons - name wise, size, type, Modified d. Search a file or folder and find its path e. Create shortcut to files and folders (in other folders) on Desktop f. Familiarize with the use of My Documents g. Familiarize with the use of Recycle Bin	b. Restore deleted files from Recycle bin
5.	To use Windows Accessories: Calculator - Notepad - WordPad - MS Paint	a. Familiarize with the use of Calculator b. Access Calculator using Run command c. Create Text Files using Notepad and WordPad and observe the difference in file size d. Use MS paint and create .jpeg, .bmp files using MS Paint	a. Use windows accessories and select correct text editor based on the situation. b. Use MS pain to create /Edit pictures and save in the required format.
6.	To familiarize with Ribbon layout of MS word. – Home – Insert- page layout-	a. Create/Open a document b. Use Save and Save as features c. Work on two Word documents simultaneously	a. Create a Document and name appropriately and save b. Set paper size and

	References-Review-View	d. Choose correct Paper size and Printing options	print options
7.	To practice Word Processing Basics	a. Typing text b. Keyboard usage c. Use mouse (Left click / Right click / Scroll) d. Use Keyboard shortcuts e. Use Find and Replace features in MS- word f. Use Undo and Redo Features g. Use spell check to correct Spellings and Grammar	a. Use key board and mouse to enter/edit text in the document. b. Use shortcuts c. Use spell check/ Grammar features for auto corrections.
8.	To practice Formatting techniques	a. Formatting Text b. Formatting Paragraphs c. Setting Tabs d. Formatting Pages e. The Styles of Word f. Insert bullets and numbers g. Themes and Templates h. Insert page numbers, header and footer	a. Format Text and paragraphs and use various text styles. b. Use bullets and numbers to create lists c. Use Templates /Themes d. Insert page numbers date, headers and footers
9.	To insert a table of required number of rows and columns	a. Edit the table by adding the fields - Deleting rows and columns -inserting sub table -marking borders. Merging and splitting of cells in a Table b. Changing the background colour of the table c. Use table design tools d. Use auto fit - fixed row/ column height/length - Even distribution of rows / columns features e. Convert Text to table and Table to Text f. Use Sort feature of the Table to arrange data in ascending/descending order	a. Insert table in the word document and edit b. Use sort option for arranging data.
10.	To Insert objects, clipart and Hyperlinks	a. Create a 2-page document. &Insert hyperlinks and t Bookmarks. b. Create an organization chart c. Practice examples like preparing an Examination schedule notice with a	a. Insert hyperlinks &Bookmarks b. Create organization charts/flow charts

		hyperlink to Exam schedule table.	
11.	To Use Mail merge feature of MS Word	a. Use mail merge to prepare individually addressed letters b. Use mail merge to print envelopes.	Use Mail merge feature
12.	To use Equations and symbols features.	a. Explore various symbols available in MS Word b. Insert a symbol in the text c. Insert mathematical equations in the document	Enter Mathematical symbols and Equations in the word document
13.	To Practice with MS-EXCEL	a. Open /create an MS Excel spread sheet and familiarize with MS Excel 2007 layout like MS office Button- b. Use Quick Access Toolbar-Title Bar- Ribbon-Worksheets- Formula Bar-Status Bar	a. Familiarize with excel layout and use b. Use various features available in toolbar
14.	To access and Enter data in the cells	a. Move Around a Worksheets-Quick access - Select Cells b. Enter Data-Edit a Cell-Wrap Text-Delete a Cell Entry-Save a File-Close Excel	a. Access and select the required cells by various addressing methods b. Enter data and edit
15.	To edit spread sheet Copy, Cut, Paste, and selecting cells	a. Insert and Delete Columns and Rows-Create Borders-Merge and Center b. Add Background Color-Change the Font, Font Size, and Font Color c. Format text with Bold, Italicize, and Underline-Work with Long Text-Change a Column's Width	Format the excel sheet
16.	To use built in functions and Formatting Data	a. Perform Mathematical Calculations verify - AutoSum b. Perform Automatic Calculations-Align Cell Entries	Use built in functions in Excel
17.	To enter a Formula for automatic calculations	a. Enter formula b. Use Cell References in Formulae c. Use Automatic updating function of Excel Formulae d. Use Mathematical Operators in Formulae e. Use Excel Error Message and Help	Enter formula for automatic calculations

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

		PowerPoint slide	
25.	To Set up a Master Slide in PowerPoint and add notes	a. Create a PowerPoint Design Template b. Modify themes c. Switch between Slide master view and Normal view d. Format a Design Template Master Slide e. Add a Title Slide to a Design Template f. The Slide Show Footer in PowerPoint f. Add Notes to a PowerPoint Presentation	a. Setup Master slide and format b. Add notes
26.	To Insert Text and Objects	a. Insert Text and objects b. Set Indents and line spacing c. Insert pictures/ clipart d. Format pictures e. Insert shapes and word art f. Use 3d features g. Arrange objects	Insert Text and Objects Use 3d features
27.	To insert a Flow Chart / Organizational Charts	a. Create a Flow Chart in PowerPoint b. Group and Ungroup Shapes c. Use smart art	Create organizational charts and flow charts using smart art
28.	To insert a Table	a. PowerPoint Tables b. Format the Table Data c. Change Table Background d. Format Series Legend	Insert tables and format
29.	To insert a Charts/Graphs	a. Create 3D Bar Graphs in PowerPoint b. Work with the PowerPoint Datasheet c. Format a PowerPoint Chart Axis d. Format the Bars of a Chart e. Create PowerPoint Pie Charts f. Use Pie Chart Segments g. Create 2D Bar Charts in PowerPoint h. Format the 2D Chart e. Format a Chart Background	Create charts and Bar graphs, Pie Charts and format.
30.	To Insert audio & video, Hyperlinks in a slide Add narration to the slide	a. Insert sounds in the slide and hide the audio symbol b. Adjust the volume in the settings c. Insert video file in the format supported by PowerPoint in a slide d. Use automatic and on click options	a. Insert Sounds and Video in appropriate format. b. Add narration to the slide c. Use hyperlinks to switch to different slides and files

		e. Add narration to the slide f. Insert Hyperlinks	
31.	To Practice Animation effects	a. Apply transitions to slides b. To explore and practice special animation effects like *Entrance, Emphasis, Motion Paths &Exit*	Add animation effects
32.	Reviewing presentation	a. Checking spelling and grammar b. Previewing presentation c. Set up slide show d. Set up resolution e. Exercise with Rehearse Timings feature in PowerPoint f. Use PowerPoint Pen Tool during slide show g. Saving h. Printing presentation (a) Slides (b) Hand-out	a. Use Spell check and Grammar feature b. Setup slide show c. Add timing to the slides d. Setup automatic slide show

33	To familiarize withstandard toolbox	a. Open Adobe Photoshop
		b. Use various tools such as
		  i. The Layer Tool
		  ii. The Color& Swatches Tool
		  iii. Custom Fonts & The Text Tool
		  iv. Brush Tool
		  v. The Select Tool
		  vi. The Move Tool
		  vii. The Zoom Tool
		  viii. The Eraser
		  ix. The Crop Tool
		  x. The Fill Tool
			Open a photograph and save it in Photoshop

34	To edit a photograph	a. Use the Crop tool b. Trim edges c. Change the shape and size of a photo d. Remove the part of photograph including graphics and text	a. Able to edit image by using corresponding tools.
35	To insert Borders around photograph	a. Start with a single background layer b. Bring the background forward c. Enlarge the canvas d. Create a border color e. Send the border color to the back f. Experiment with different colors	Able to create a border or frame around an image to add visual interest to a photo
36	To change Background of a Photograph	a. open the foreground and background image b. Use different selection tools to paint over the image	Able to swap background elements using the Select and Mask tool and layers.

		c. Copy background image and paste it on the foreground.	
		d. Resize and/or drag the background image to reposition.	
		e. In the Layers panel, drag the background layer below the foreground image layer.	
37	To change colors of Photograph	a. Change colors using: i) Color Replacement tool **ii) Hue/Saturation adjustment layer tool**	Able to control color saturation
38	To prepare a cover page for the book in subject area	a. open a file with height 500 and width 400 for the cover page. b. apply two different colors to work area by dividing it into two parts using Rectangle tool. c. Copy any picture and place it on work area→ resize it using free transform tool. d. Type text and apply color and style e. Apply effects using blended options	Able to prepare cover page for the book
39	To adjust the brightness and contrast of picture to give an elegant look	a. open a file b. Go to image→ adjustments→ Brightness/Contrast. f. adjust the brightness and contrast g. save the image	Able to control brightness/contrast.
40	To type a word and apply the shadow emboss effects	a. open a file b. Select the text tool and type text. c. Select the typed text go to layer→ layer style→ blended option→ drop shadow, inner shadow, bevel and emboss→ contour→ satin→ gradient overlay d. Save the image.	Able to apply shadow emboss effects

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

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