CURRICULUM - 2023

C -23

DIPLOMA IN
MECHANICAL ENGINEERING

STATE BOARD OF TECHNICAL EDUCATION & TRAINING

ANDHRA PRADESH

DIPLOMA IN MECHANICAL ENGINEERING
CURRICULUM- 2023 (C-23)

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PREAMBLE

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

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

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

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

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

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

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

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

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

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. V. Padma Rao, Joint Director of Technical Education, Sri K.V. Ramana Babu, Secretary, SBTE&T, Andhra Pradesh, Sri K. Vijaya Bhaskar, Deputy Director (Academic) , Andhra Pradesh, officials of Directorate of Technical Education and the State Board of Technical Education, Andhra Pradesh and all teaching fraternity from the Polytechnics who are directly or indirectly involved in preparation of the curricula.

4. RULES AND REGULATIONS OF C-23 CURRICULUM

4.1 Duration and pattern of the courses

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

4.2 Procedure for Admission into the Diploma Courses:

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

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

4.3 Medium of Instruction

The medium of instruction and examination shall be English.

4.4 Permanent Identification Number (PIN)

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

4.5 Number of Working Days Per Semester / Year:

a) The Academic year for all the Courses shall be in accordance with the Academic Calendar.
b) The Working days in a week shall be from Monday to Saturday

c) There shall be 7 periods of 50 minutes duration each on all working days.
d) The minimum number of working days for each semester / year shall be 90 / 180 days excluding examination days. If this prescribed minimum is not achieved due to any reason, special arrangements shall be made to conduct classes to complete the syllabus.

4.6 Eligibility (Attendance to Appear for the End Examination)

a) A candidate shall be permitted to appear for the end examination in all subjects, if he or she has attended a minimum of 75% of working days during the year/Semester.
b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester or 1st year may be granted on medical grounds.
c) A stipulated fee shall be payable towards condonation for shortage of attendance.
d) Candidates having less than 65% attendance shall be detained.
e) Students whose shortage of attendance is not condoned in any semester / 1st year and not paid the condonation fee in time are not eligible to take their end examination of that class and their admissions shall stand cancelled. They may seek re-admission for that semester / 1st year when offered in the next subsequent academic semester/year.

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

4.7 Readmission

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

a) (i) Within 15 days after commencement of class work in any semester (Except Industrial Training).
   (ii) For Industrial Training: before commencement of the Industrial training.
b) Within 30 days after commencement of class work in any year (including D. Pharmacy course or first year course in Engineering and Non-Engineering Diploma streams). Otherwise, such cases shall not be considered for readmission for that semester / year and are advised to seek readmission in the next subsequent eligible academic year.
c) The percentage of attendance of the readmitted candidates shall be calculated from the first day of beginning of the regular class work for that year / Semester, as officially announced by CTE/SBTET but not from the day on which he/she has actually reported to the class work.

4.8 Scheme of Evaluation

a) First Year

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

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

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

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

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

4.9 Internal Assessment Scheme

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

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

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

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

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

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

b) Practical Courses:

(i) **Drawing Courses:**

The award of Sessional marks for internal Assessment shall be as given in the following table:

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

- For first year engineering drawing each unit test will be conducted for a duration of 2 hours with maximum marks of 40.
- (Part - A: 4 questions x 5 marks = 20 Marks; Part –B: 2 questions x 10 marks = 20 marks).
- For the semester drawing examinations, Two Unit tests shall be conducted as per the Board End Examination Question Paper Pattern.
- All Drawing exercises are to be filed in serial order and secured for further scrutiny by a competent authority

(ii) Laboratory Courses:

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

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

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

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

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

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

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

i) Nearby Industry

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

iii) Govt / University Engg College.

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

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

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

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

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

Assessment no	Upon completion of	By	Based on	Max Marks
1	12 weeks	1.The faculty concerned (Guide) and 2. Training in charge (Mentor) of the industry	Learning outcomes as given in the scheme of assessment ,for Industrial Training	120
2	22 weeks			120
3. Final summative Evaluation	24 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.

4.10 Minimum Pass Marks

a) Theory Examination:

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

b) Practical Examination:

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

C) Industrial Training:

I. Monitoring: Similar to project work each teacher may be assigned a batch of 10-15 students irrespective of the placement of the students to facilitate effective monitoring of students learning during industrial training.

II. Assessment: The Industrial training shall carry 300 marks and pass marks is 50% in assessments at industry (first and second assessment) and final summative assessment at institution level put together i.e. 150 marks out of 300 marks. And also student has to secure 50% marks in final summative assessment at institution level.

III. In-Plant Industrial Training for 3-Year Diploma (C-23) Courses is scheduled as per the Academic Calendar of the SBTET every year.

4.11. Provision for Improvement

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

a) Improvement is allowed in any 4 (Four) Courses of the Diploma.
b) The student can avail of this improvement chance **ONLY ONCE**, that too within the succeeding two examinations after the completion of Diploma. However, the duration including Improvement examination shall not exceed **FIVE** years from the year of first admission.
c) No improvement is allowed in Practical / Lab Courses or Project work or Industrial Training assessment. However, improvement in drawing Course(s) is allowed.
d) If improvement is not achieved, the marks obtained in previous Examinations hold good.
e) Improvement is not allowed in respect of the candidates who are punished under Mal-practice in any Examination.
f) Examination fee for improvement shall be paid as per the notification issued by State Board of Technical Education and Training from time to time.
g) All the candidates who wish to appear for improvement of performance shall deposit the original Marks Memos of all the years / Semesters and also original Diploma Certificate to the Board. If there is improvement in performance of the current examination, the revised Memorandum of marks and Original Diploma Certificate will be issued, else the submitted originals will be returned.

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

A) For Diploma Courses of 3 Years duration

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

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

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

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

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

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

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

For IVC & ITI Lateral Entry students:

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

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

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

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

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

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

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

i. A candidate shall be permitted to appear for 1st year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds upto 10%) i.e. attendance after condonation on Medical grounds should not be less than 65% and pay the examination fee.

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

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

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.

4.13. Students Performance Evaluation

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

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

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

4.14. EXAMINATION FEE SCHEDULE:

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

4.15. Structure of Examination Question Paper:

I. Formative assessment (Internal examination)

a) For theory Courses:

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

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

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

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

b) For drawing Courses:

For I year:

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

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

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

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

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

c) For Laboratory /workshop: 50% of total marks for the Course shall be awarded based on continuous assessment of the student in laboratory/workshop classes and

the remaining 50% shall be based on the sum of the marks obtained by the students in two tests.

II. Summative assessment (End examination)

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

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

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

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

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

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

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

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

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

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

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

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

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

III. Question paper for End semester Evaluation shall be prepared as per SBTET rules in vogue.

4.16. ISSUE OF MEMORONDUM OF MARKS

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

4.17. MAXIMUM PERIOD FOR COMPLETION OF DIPLOMA PROGRAMMES:

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

4.18. ELIGIBILITY FOR AWARD OF DIPLOMA

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

i. He / She pursued a course of study for not less than 3 / 3 ½ academic years & not more than 6 / 7 academic years.
ii. He / she have completed all the Courses.
Students who fail to fulfil all the academic requirements for the award of the Diploma within 6 / 7 academic years from the year of admission shall forfeit their seat in the course & their seat shall stand cancelled.

For IVC & ITI Lateral Entry students:

i. He / She pursued a course of study for not less than 2 / 2 ½ academic years & not more than 4 / 5 academic years.
ii. He / she has completed all the Courses.
Students who fail to fulfil all the academic requirements for the award of the Diploma within 4 / 5 academic years from the year of admission shall forfeit their seat in the course & their seat shall stand cancelled.

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

A) FOR ISSUE OF PHOTO COPIES OF VALUED ANSWER SCRIPTS

I. A candidate desirous of applying for Photo copy of valued answer script/s should apply within prescribed date from the date of the declaration of the result.
II. Photo copies of valued answer scripts will be issued to all theory Courses and Drawing Course (s).

III. The Photo copy of valued answer script will be dispatched to the concerned candidate's address as mentioned in the application form by post.

IV. No application can be entertained from third parties.

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

i. A candidate desirous of applying for Re-verification of valued answer script should apply within prescribed date from the date of the declaration of the result.

ii. Re-verification of valued answer script shall be done for all theory Courses' and Drawing Course(s).

iii. The Re-verification committee constituted by the Secretary, SBTETAP with Course experts shall re-verify the answer scripts.

I. **RE-COUNTING**

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

II. RE-VERIFICATION

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

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

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

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

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

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

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

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

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

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

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

4.20. Mal Practice Cases:

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

4.21. Discrepancies/ Pleas:

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

4.22. Issue of Duplicate Diploma

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

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

4.23. Issue of Migration Certificate and Transcripts:

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

4.24. General

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

VISION

Striving continuously in pursuit of excellence in imparting knowledge with skills in Mechanical Engineering at diploma level to improve the opportunities in employment and higher learning.

MISSION

M1	Use of technology enhanced tools and techniques by motivated and qualified faculty for enhancement of knowledge, understanding of principles, concepts and latest trends in mechanical engineering.
M2	Modernization of workshops and laboratories as per the curriculum specified by the State Board of Technical Education, Andhra Pradesh.
M3	Conduct of laboratories, guest lectures, industrial visits and industrial training for better understanding of critical concepts of Mechanical Engineering.
M4	Provide opportunities for developing multidisciplinary skills, communication skills, professional attitude and ethics.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1	Fundamental knowledge of mathematics, Basic sciences and basic interdisciplinary engineering to apply day to day challenges in the field of mechanical engineering.
PEO2	Knowledge in the principles, concepts, and techniques in mechanical engineering area to solve contemporary issues.
PEO3	Applications of the principles, concepts, and techniques in mechanical engineering area to solve contemporary issues and gain on hand experience.
PEO4	Effective Communication on activities regarding planning, designing, manufacturing, and servicing functions with engineering community.

PROGRAMME OUTCOMES (POs)

PO1	**Basic and Discipline Specific Knowledge:** To apply knowledge of mathematics, science and engineering fundamentals and engineering specialization to Engineering Problems.
PO2	**Problem Analysis:** Identify and analyse well-defined engineering problems using codified standard methods mechanical engineering problems for meaningful solutions
PO3	**Design/Development of Solutions:** Design solutions for well defined technical problems and assist with the design of systems components or processes to meet specific needs.
PO4	**Engineering tools, Experimentation and Testing:** Apply modern engineering tools and appropriate techniques to conduct standard tests and measurements.
PO5	**Engineering Practices for Society, Sustainability and Environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.
PO6	**Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well defined engineering activities.
PO7	**Life-long Learning:** Ability to analyse individual needs and engaging updating in the context of technological changes.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1	Ability to employ in fields of engineering such as design, testing, manufacturing, processing, safety, quality control, and other business sectors.
PSO2	Ability to progress through advanced degree or certificate programs or participates in continuing education in engineering, business, and/or other professionally related fields.
PSO3	Achieve positions of increased responsibility within the organizations.

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**

[Note: M-101,102,103,104,109,110,111 are common with all branches
M-107 Common with Mining Branch]

C- 23 :: DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
III Semester

Course Code	Course Title	Instruction periods / week		Total Periods	Scheme of Examination			
		Theory	Practical		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
M-301	Engineering Mathematics – II.	4	-	60	3	20	80	100
M-302	Applied Electrical & Electronics	4	-	60	3	20	80	100
M-303	Thermal Engineering - I	5	-	75	3	20	80	100
M-304	Strength of Materials.	4	-	60	3	20	80	100
M-305	Manufacturing Technology -I	4	-	60	3	20	80	100
PRACTICAL								
M-306	Machine Drawing	-	6	90	3	40	60	100
M-307	Material Testing Lab.	-	3	45	3	40	60	100
M-308	Applied Electrical & Electronics Lab.		3	45	3	40	60	100
M-309	Fuels Lab.	-	3	45	3	40	60	100
M-310	Fabrication Lab Practice	-	3	45	3	40	60	100
Co-Curricular Activities								
1	*Library*		1	15				
2	**Physical Education*		1	15				
3	**Quantitative Aptitude / Seminars / Social Awareness Programmes etc.*		1	15				
TOTAL		**21**	**21**	**630**		**300**	**700**	**1000**

[Note: M-301 is Common with A/AA/CER/EE/M/MET/MNG/TT-301]

C-23 :: DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
IV Semester

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–401	Design of Machine Elements	4	-	60	3	20	80	100
M–402	Hydraulics & Fluid Power Systems.	4	-	60	3	20	80	100
M–403	Thermal Engineering -II	5	-	75	3	20	80	100
M–404	Engineering Materials	4	-	60	3	20	80	100
M–405	Manufacturing Technology -II	4	-	60	3	20	80	100
PRACTICAL								
M–406	Production Drawing	-	6	90	3	40	60	100
M–407	Thermal Engineering Lab	-	3	45	3	40	60	100
M–408	Communication Skills Lab	-	3	45	3	40	60	100
M–409	Hydraulics & Fluid Power Systems Lab	-	3	45	3	40	60	100
M–410	Machining & Metrology Lab	-	3	45	3	40	60	100
Co-Curricular Activities								
1	*Library*		1	15				
2	**Physical Education*		1	15				
3	**Quantitative Aptitude / Seminars / Social Awareness Programmes etc..*		1	15				
TOTAL		**21**	**21**	**630**		**300**	**700**	**1000**

[Note: M-408 is Common with all Branches]

C-23 :: DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
V Semester

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-501	Industrial Management and Entrepreneurship.	4	-	60	3	20	80	100
M-502	Industrial Engineering and Quality Control.	4	-	60	3	20	80	100
M-503	Green Energy & Thermal Systems.	5	-	75	3	20	80	100
M-504	Industrial Automation & 3D Printing.	4	-	60	3	20	80	100
M-505	Refrigeration and Air Conditioning.	4	-	60	3	20	80	100
PRACTICAL								
M-506	CAD Lab Practice	-	3	45	3	20	30	50
M-507	**CAM Lab Practice**		3	45	3	20	30	50
M-508	Life Skills Lab	-	3	45	3	40	60	100
M-509	Refrigeration and Air Conditioning Lab.	-	3	45	3	40	60	100
M-510	*Training cum Production Workshop.*		3	45	3	40	60	100
M-511	*Project Work.*	-	3	45	3	40	60	100
Co-Curricular Activities								
1	*Library*		1	15				
2	**Physical Education*		1	15				
3	**Quantitative Aptitude / Seminars / Social Awareness Programmes etc.*		1	15				
	TOTAL	**21**	**21**	**630**		**300**	**700**	**1000**

[Note: M-508 is Common with all Branches]

C-23 :: DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
VI Semester

INDUSTRIAL TRAINING

Sl. No.	*Course*	*Duration*	*Scheme of Evaluation*		
			Assessment	*Nature*	*Max. Marks*
1	*Industrial Training*	*6 months*	*1.First Assessment at Industry (After 12 Weeks)*	*Assessment of Learning outcomes by both the faculty and training Mentor of the industry*	*120*
			2.Second Assessment at the Industry (After 22 weeks)	*Assessment of Learning outcomes by both the faculty and training Mentor of the industry*	*120*
			Final Summative assessment at institution level	*Training Report*	*20*
				Demonstration of any one of the skills listed in learning outcomes	*30*
				Viva Voce	*10*
				TOTAL MARKS	*300*

- The Industrial Training shall carry 300 marks and pass mark is 50% in assessment at industry (first and second assessment put together) and in final summative assessment at institution put together
- If the student fails to secure 50% marks in final summative assessment at institution level, the student shall reappear for final summative assessment, in the subsequent board examination.
- During Industrial Training the candidate shall put in a minimum of 90% attendance. If the student fails to secure 90% attendance during industrial training, the student should reappear for 6 months industrial training.

I 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**

[Note: M-101,102,103,104,109,110,111 are common with all branches
M-107 Common with Mining Branch]

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

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

2. Living in Harmony

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

3. Connect with Care

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

4. Humour for Happiness

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

5. Never Ever Give Up!

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

6. Preserve or Perish

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

7. The Rainbow of Diversity

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

8. New Challenges – Newer Ideas

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

9. The End Point First!

9.1. Understand the importance of setting goals in life
9.2. Report about what others have said both in speaking and writing

9.3. Write an essay following the structure in a cohesive and comprehensive manner
9.4. Apply the words related to Goal Setting in conversations and in life

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

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

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

Time Schedule : C23-Common- 101 : ENGLISH						
S.no.	Title of the Unit	Periods allotted	Weightage of Marks	No. of Short answer questions	No. of Long Answer questions	Mapping of COs
1	English for Employability	8	16	2	1	CO1, CO2, CO3, CO4, CO5
2	Living in Harmony	8				CO1, CO2, CO3, CO4,

						CO5
3	Connect with Care	8	26	2	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.

1.2 Explain Relations and Functions – examples

1.3 Find Domain & Range of functions – simple examples.

1.4 Define one-one and onto functions.

1.5 Find the inverse of a function – simple examples.

1.6 Define rational, proper and improper fractions of polynomials.

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

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

1.8 Define a matrix and order of a matrix.

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

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

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

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

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

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

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

UNIT - II

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

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

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

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

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

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

2.6 Solve simple problems on compound angles.

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

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

2.9 Solve simple problems using the multiple and submultiple formulae.

Syllabus for Unit test-I completed

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

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

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

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

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

2.15 State various properties of inverse trigonometric functions and identities like

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

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

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

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

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

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

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

2.22 Define arithmetic operations on complex numbers with examples.

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

UNIT - III

Coordinate Geometry

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

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

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

3.3 Define locus of a point and circle.

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

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

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

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

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

Syllabus for Unit test-II

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

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

4.2 Evaluate the limits of the type $\lim_{x\to a}\frac{f(x)}{g(x)}$ and $\lim_{x\to\infty}\frac{f(x)}{g(x)}$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Syllabus for Unit test-III completed

CO/PO – Mapping

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

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

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

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

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

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

PO- CO – Mapping strength

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

COURSE CONTENT

Unit-I

Algebra

1. **Functions**:
   Definitions of Set, Ordered pair, Cartesian product of two sets, Relations, Functions, Domain & Range of functions – One-one and onto functions, inverse of a function.
2. **Partial Fractions:**
   Definitions of rational, proper and improper fractions of polynomials. Resolve rational fractions (proper fractions) into partial fractions covering the types mentioned below.

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

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 - Arithmeticoperations 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, hyperbolicand inverse hyperbolic functions - Derivatives of sum, difference, scalar multiplication, product, quotient of functions - Chain rule, derivatives of parametric functions, derivatives of implicit functions, logarithmic differentiation - Second order derivatives - Functions of several variables, first and second order partial derivatives.

UNIT-V

Applications of Derivatives

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

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

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

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

Textbook:

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

Reference Books:

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

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.

	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

COURSE OUTCOMES		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.

CO – PO Mapping Strength

	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

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% level2 (moderately addressed)
PO3	CO1, CO2,CO3, CO4	10	11.1%	1	
PO4	CO1, CO2,CO4	8	8.9%	1	5% to 25% level1 (Low addressed)
PO5	CO2,CO3, CO4	8	8.9%	1	
PO6					< 5% (not addressed)
PO7	CO1, CO2, CO3, CO4	9	10.0%	1	

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

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

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

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

Learning outcomes

Upon completion of the course the student shall be able to

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

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

3.0 Understand the concepts of Gravitation
3.1 State and explain Newton's universal law of gravitation.
3.2 DefineG and mention its value.

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

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

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

6.0 Understand the concepts of Sound
6.1 Define the term sound
6.2 Define longitudinal and transverse waves with one example each
6.3 Explain the factors which affect the velocity of sound in air
6.4 Distinguish between musical sound and noise
6.5 Explain noise pollution and state SI unit for intensity of sound

6.6 Explain sources of noise pollution
6.7 Explain effects of noise pollution
6.8 Explain methods of minimizing noise pollution
6.9 Define Doppler effect.
6.10 List the Applications of Doppler effect
6.11 Define reverberation and reverberation time
6.12 Write Sabine's formula and name the physical quantities in it.
6.13 Define echoes and explain the condition to hear an echo.
6.14 Mention the methods of reducing an echo
6.15 Mention the applications of an echo
6.16 What are ultrasonics
6.17 Mention the applications of ultrasonics, SONAR
6.18 Solve simple problems on echo

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

8.0 Understand the concepts ofModern physics
8.1 State and explain Photo-electric effect.
8.2 Write Einstein's Photo electric equation and name the physical quantities in it.
8.3 State laws of photo electric effect
8.4 Explain the Working of photo electric cell
8.5 List the Applications of photoelectric effect
8.6 Recapitulate refraction of light and its laws
8.7 Define critical angle
8.8 Explain the Total Internal Reflection
8.9 Explain the principle and working of Optical Fiber
8.10 List the applications of Optical Fiber
8.11 Explain the energy gap based on band structure
8.12 Distinguish between conductors, semiconductors and insulators based on energy gap
8.13 Define doping

8.14 Explain the concept of hole
8.15 Explain the types of semiconductors , Intrinsic and extrinsic
8.16 Explain n-type and p-type semiconductors
8.17 Mention the applications of semiconductors
8.18 Define superconductor and superconductivity
8.19 List the applications of superconductors
8.20 Nanotechnology definition, nanomaterials and applications

COURSECONTENT

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

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

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

4. **Concepts of energy**
Workdone & 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 – Wheatstone'sbridge - 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-104Engineering 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

ENGINEERINGCHEMISTRY AND ENVIRONMENTAL STUDIES

1.0 Atomic structure

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

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

1.3 Explain the significance of four Quantum numbers and draw the atomic structures of Silicon and Germanium.

1.4 Define Orbital of an atom and draw the shapes of s,p and d-orbitals.

1.5 Explain 1. Aufbau principle, 2. Pauli's exclusionprinciple3. Hund's principle.

1.6 Write the electronic configuration of elements up to atomic number 30.

1.7 Explain the significance of chemical bonding.

1.8 Explain the Postulates of Electronic theory of valency.

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

1.10 List out the Properties of Ionic compounds and covalent compounds and distinguish between their properties.

2.0 Solutions, Acids and Bases

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

2.2 Classify solutions based on solubility.

2.3 Define the terms 1. Atomic weight, 2. Molecular weight and 3. Equivalent weight.
Calculate Molecular weight and Equivalent weight of the given acids (HCl, H_2SO_4, H_3PO_4) Bases (NaOH, $Ca(OH)_2$, $Al(OH)_3$ and Salts (NaCl, Na_2CO_3, $CaCO_3$).

2.4 Define mole and solve numerical problems on mole concept.

2.5 Define molarity, normality and solve numerical problems on molarity and normality.
a) Calculate the Molarity or Normality, if weight of solute and volume of solution are given.
b) Calculate the weight of solute, if Molarity or Normality with volume of solution are given.
c) Problems on dilution to convert high concentrated solutions to low concentrated solutions.

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

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

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

3.0 Electrochemistry

3.1 Define the terms1. Conductor 2. Semiconductor 3. Insulator, 4. Electrolyte5. Non-electrolyte.Give two examples each.

3.2 Distinguish between Metallic conduction and Electrolytic conduction.

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

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

3.5 Distinguish between electrolytic cell and galvanic cell.

3.6 Define battery and list the types of batteries with examples.

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

4.0 Corrosion

4.1 Define the term corrosion.

4.2 state the Factors influencing the rate of corrosion.

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

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

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

5. 0 Water Treatment

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

5.2 Define and classify the hardness of water.

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

5.4 State the disadvantages of using hard water in industries.

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

5.6 Solve numerical problems on hardness.

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

6.0 Polymers& Engineering materials.

A) Polymers

6.1 Explain the concept of polymerization.

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

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

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

B) Engineering Materials

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

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

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

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

7.0 Fuels

7.1 Define the term fuel.

7.2 Classify the fuels based on occurrence.

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

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

8.0 ENVIRONMENTAL STUDIES

8.1 Explain the scope and importance of environmental studies.

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

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

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

8.5 State the uses of forest resources.

8.6 Explain the causes and effects of deforestation.

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

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

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

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

COURSE CONTENT

ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES

1. Fundamentalsof Chemistry

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

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

2. Solutions, Acids and Bases

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

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

3. Electrochemistry

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

4. Corrosion

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

5. Water treatment

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

6. Polymers & Engineering materials

Polymers:

Concept of polymerization – Types of polymerization – Addition, condensation with examples – Plastics - Preparation and uses of i).PVC ii) Teflon iii) Polystyrene and iv) Nylon 6,6.

Elastomers: Preparation and application of i)Buna-s and ii) Neoprene.

Engineering Materials:

Alloys- Composition and applications of i) Nichrome, ii)Duralumin and iii) Stainless Steel.

Composite Materials- Properties and applications.

Liquid Crystals- Properties and applications.

Nano Materials- Properties and applications.

7. **Fuels**

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

8. **ENVIRONMENTALSTUDIES**

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

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**

REFERENCEBOOKS

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

M-105 -ENGINEERINGMECHANICS

CourseTitle	CourseCode	Periods/Week	Periodsperyear
M-105 Engineering Mechanics	**M-105**	**04**	**120**

TimeSchedule

SI. No.	Chapter / Unit Title	No. ofPeriods	Weightageo fmarks	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

CourseObjectives		**Uponcompletionofthecoursethestudentshallbeableto** Understand the basic principles of statics and dynamics of rigid bodies. Calculate the reactive forces and motion characteristics for given conditions. Understandtheworkingofsimplemechanisms andmachines.	
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 are as 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 Highlyaddressed
PO2	CO1, CO2, CO3, CO4, CO5	48	40	3	
PO3	CO1, CO2, CO3, CO4, CO5	06	05	1	25%to40%Level 2 ModeratelyAddressed
PO4					
PO5					5 to25% Level1 Low addressed
PO6					
PO7	CO1,CO2,CO3,CO4,CO5	12	10	1	<5% Not addressed

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C01	3	3	1				1	1	3	1
C02	3	3	1				1	1	3	1
C03	3	3	1				1	1	3	1
C04	3	3	1				1	1	3	1
C05	3	3	1				1	1	3	1

3 : High, 2:Moderate, 1: Low

LEARNINGOUTCOMES

Uponcompletionofthecourse thestudentshallbe ableto

1.0 Statics

1.1 Explainthe importanceofEngineeringMechanicsinrealworld

1.2 Explaintheconceptofforce

1.3 Classifythesystemofforces.

1.4 Explainthe systemofforcesa)Co-planarandNon-coplanar,b)ParallelandNon-Parallel, c) LikeandUnlike d)ConcurrentandNon-concurrent.

1.5 ExplainCompositionandResolutionofforcesandresultantofconcurrentcoplanarforces.

1.6 State(a)parallelogram law(b)trianglelaw (c)polygonlawofforces(d)Lami'stheorem.

1.7 Problemson parallelogramlaw and Lami's theorem.
1.8 Explaintheconceptofequilibrium.
1.9 Statetheconditionsofequilibrium ofa bodyacteduponby a number of co-planarforces.
1.10 Solvetheproblemson equilibrium of a body subjected to a number of concurrent coplanarforces.
1.11 Explainmomentofforce andcouple.
1.12 StateVarignon'stheorem.

2.0 Friction

2.1 Explaintheconceptoffriction
2.2 Statethelawsoffriction
2.3 Define i) angleoffrictionii)angle ofrepose
2.4 Identify themachinemembers inwhichfrictionis desirable.
2.5 Resolvethe forcesactingonbodiesmovingonhorizontal plane.
2.6 Resolvetheforcesactingonbodiesmovinguponaninclinedplane when the forceapplied is (a) parallelto theplane(b) Parallel to thebase.
2.7 Resolvetheforcesactingonbodiesmovingdownonaninclined plane when the force applied is (a) paralleltothe plane(b) Parallelto thebase.
2.8 Solvetherelatednumericalproblemsofthe abovecases.

3.0 GeometricalPropertiesofSections

3.1 Definetheterms i)centreof gravityii) centroid.
3.2 Writethe differencesamongcentreof gravityandcentroid.
3.3 Statetheneedforfindingthecentroidandcentreofgravityforvariousengineeringapplications.
3.4 Explainthemethodof determiningthecentroidby'Methodofmoments'
3.5 Determine the position of centroid of standard sections like -T, L, I, Channel section.
3.6 Explainthemeaningoftheterms i)momentof Inertiaii) Polarmomentof inertia
iii) Radius ofgyration.
3.7 StatethenecessityoffindingMomentofInertiaforvariousengineeringapplications
3.8 Statements of (a)Parallelaxestheorem and (b)Perpendicularaxestheorem
3.9. DetermineMomentofInertiaandRadiusofgyrationforstandard sections like -T, L, I, Channel section.

4.0 Dynamics

4.1 Definetheterms Kinematicsand Kinetics
4.2 Classifythetypes of motion
4.3 Definetheterms displacement, velocityand acceleration
4.4 Write equations of motion(withoutderivation)
4.5 Solvetheproblems relatedtotherectilinearmotion of aparticle.
4.6 Definition of energy and momentum
4.7 State with expressions Newton's laws of motion.
4.8 State thelaw ofconservationofenergy

4.9 Explain theWork-Energyprinciple.
4.10 State law ofconservationofmomentum.
4.11 ExplaintheImpulse–momentumequation
4.12 Solveproblemsusingtheaboveprinciples.
4.13 Explainrotarymotionterms involved in rotary motion of a particle.
4.14 Express the equations of rotary motion ofaparticle.
4.15 Differentiate centripetalforce and centrifugalforce.
4.16 Solve simple problems on rotary motion.
4.17 Describesimpleharmonic motion with engineering applications.
4.18 Define the terms related to SHM.
4.19 Solve simple problems on simpleharmonic motion.

5.0 SimpleMechanisms& Machines

A) SimpleMechanisms:

5.1 Definethetermsi)kinematic linkii)kinematic pairiii)Kinematicchainiv)Mechanism v)Machinevi)Structurevii) inversionofmechanism.
5.2 Writeclassificationof kinematicpairsondifferentcriteria.
5.3 Describe the working principle of Quadratic cycle chain.
5.4 Explainwithlegiblesketches the important inversionsofquadriccycle chain.

B) SimpleMachines :

5.5 Definethe importantterms related to Simplemachines
5.6 Illustratethe useofthreeclassesofsimplelever.
5.7 Explain the working and write mathematical expressionsfor the velocityratio of i)wheel&axle, Differential wheel and axle ii)pulleys iii) Worm &Wormwheeliv)winch crabsv) screw jack vi)rack& pinion.
5.8 Calculatetheefficiencyofthe givenmachine.
5.9 Calculatetheeffortrequiredtoraiseandlowertheloadonscrewjackundergivenconditions.
5.10 Explain Law of simple machine.
5.11 Explainthe conditionsforself-locking.
5.12 Statetheconditionsforreversibility.
5.13 Numerical problems on the above simple machines

COURSECONTENTS:

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- Numericalproblemsrelated to the above.

Equilibrium - Condition for equilibrium of a rigid body subjected tonumberof coplanar concurrent forces – Numerical Problems.
Moment of force and moment of a couple – Statement of Varignon'sPrinciple.

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 offrictionandAngle 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 GeometricalPropertiesofSections

Concept GeometricPropertiesofSections - Definitionofthetermscentreofgravityandcentroid– 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, andChannelsections 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 ofInertia of lamina of rectangle, circle, triangle sections- Calculation of Moment of Inertia of T-Section, L-Section (Equal& unequallengths), I-section, andChannelsections only.

4.0 Dynamics

Definitionand classification of Dynamics.
Kinematics: Definition - Classificationofmotion-Definitionofdisplacement,time,velocityandacceleration–Equations of motion(**withoutderivation**)-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 - Lawofconservationof momentum-Impulse–momentumequation-Problemson theabove principles.

Rotary motion of particle - laws of rotary motion – Terms involved in rotary motion – Differentiate centripetal andcentrifugal forces- Simpleproblems.
Simple Harmonic Motion: Definition – Characteristics - Terms of SHM such as frequency, time period, amplitude - Simple problemson SHM.

5.0 SimpleMechanisms&Machines

5.1 SimpleMechanisms

Definethe terms kinematiclink,kinematicpair, Kinematic Chain, Mechanism, Machine,Structureand inversion - classification of kinematic pairs on different criteria – nature of contact, relativemotion 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.

5.2 SimpleMachines

Definition of Simple machine andusesofsimplemachines – Terminology such as Load, effort, Mechanicaladvantage, 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, & Screwjack (**Derivations omitted**) - Simple problems on the above simple machines - Importance of Law of Simple Machine - Conditionsforreversibilityandself-locking of a machine.

REFERENCEBOOKS:

1	EngineeringMechanics	Singer	B.S.Publications
2	EngineeringMechanics	K.L.Kumar	TMH
3	EngineeringMechanics	Timoshenko	MGH
4	MechanicsofSolids	S.S.BHAVIKATTI	New Age
5	TheoryofMachines	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-106Basic 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-COMapping

CourseCode:M-106	**Course Title: Workshop TechnologyNoofCOs:5**				**No.Ofperiods: 90**
POs	**Mapped withCO No**	**COPeriodsAddressingPOin Col1**		**Level (1,2,3)**	**Remarks**
		No	**%**		
PO1	CO1,CO2,CO	56	46.7	3	**>40% Level 3**

	4				**(HighlyAddressed) 25%to 40% Level 2(Moderately Addressed)5% to25%Level1 (LowAddressed) <5%NotAddressed**
PO2		37	30.8	2	
PO3					
PO4	CO3,CO3	21	17.5	1	
PO5					
PO6					
PO7	CO1	6	5	1	

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

3:High,2:Moderate, 1:Low

Note: ThegapsinCOandPOmappingwillbeachievedbyoneormoreappropriateactivities fromthefollowing:

(i) Assignments(ii)Tutorials(iii)Seminars(iv)GuestLectures(v)GroupDiscussions (vi)Quiz (vii)IndustryVisits (viii)TechFest(ix)MiniProjects(x)LibraryVisits.

Learning Outcomes

Upon completion of the course the student shall be able to

1.0.Carpentry

1.1 State various types of manufacturing processes with examples

1.2 Identify various carpentry tools.

1.3 Distinguish between marking tools, measuring tools and cutting tools.

1.4 List out various work holding devices.

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

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

1.7. Explain the working of wood working machines.

2.0.Fitting

2.1. List out various marking and measuring tools.

2.2 Listout various cutting tools

2.3. Listout various work holding devices.

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

3.0.Forging

3.1. List various tools used in black-smithy.

3.2. List equipment used in a forging shop.

3.3. Explain the important smithy operations.

3.4. 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.

4.0.Sheet Metal
4.1. List various marking tools in sheet metal work.
4.2. List various stakes.
4.3. List various sheet metal joints.
4.5. Describe sheet metal operations such as shearing, bending drawing and squeezing.
4.6. Differentiate between riveting, soldering & brazing.

5.0. Drilling& Jig boring
5.1. State the working principle of drilling
5.2. List out various types of drilling machines
5.3. Describe the Sensitive drilling machine with line diagram
5.4. Describe the radial drilling machine with line diagram
5.5. Mention the specifications of drilling machine
5.6. Explain the nomenclature of the drill bit
5.7. Explain different operations on drilling machine
5.8. Differentiate between jigs and fixtures
5.9 List different types of Jigs and fixtures.
5.10 State the principle of working of a jig boring machine.
5.11 Classify the jig boring machines.
5.12 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
6.2. Explain Hot working of metals with advantages and disadvantages
6.3. Explain various hot working processes such as hot rolling, Piercing, Spinning, and hot extrusion processes.
6.4. Explain cold working of metals with advantages and disadvantages.
6.5. 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:Benchvice,leg-vice,handvice,pinvice,toolmakersvice, pipe vice,specificationsanduses.

Fitting Operations

Marking, sawing, chipping, filing and scrapping

3.0Forging

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 boringMachines: 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.

REFERENCEBOOKS

1. ProductionTechnology by Jain&Gupta (KhannaPublishers)
2. ElementaryWorkshopTechnology by HazraChowdary& Bhattacharya (MediaPromoters)
3. ManufacturingTechnology(VolI) by P NRao (McGrawHill)
4. WorkshopTechnologyVolI&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 ENGINEERINGDRAWING

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

TIMESCHEDULE

S.No	Chapter/UnitTitle	No. ofDrawingplates	Periods	WeightageofMarks	ShortAnswerQuestions(5M)	EssayTypeQuestions(10 M)	COs Mapped
1	Importanceof EngineeringDrawing	--	01	-	-	-	C01
2	EngineeringDrawing Instruments	01	05	-	-	-	CO1
3	Freehandlettering& Numbering	01	06	05	1	-	CO2
4	DimensioningPractice	01	09	05	1	-	CO2
5	Geometrical constructions	03	24	15	1	1	CO3
6	Projections of Points,Lines,Planes& AuxiliaryPlanes	03	21	05	1		CO4
7	ProjectionsofSolids	01	12	10		1	CO4
8	SectionsofSolids	01	21	10	-	1	CO4
9	Orthographic Projections	01	30	10	-	1	CO4
10	IsometricViews	01	30	10	-	1	CO5
11	Developmentof surfaces	01	21	10	-	1	CO6
Total		**14**	**180**	**80**	**04**	**06**	

CourseObjectivesandCourseOutcomes

CourseObjectives		**Uponcompletionofthecoursethestudentshallabletounderstand** The basic graphic skills and use the min preparation of engineering drawings, their reading and interpretation	
CourseOutcomes	**CO1**	M-107.1	Describe theuseofengineeringdrawinginstruments
	CO2	M-107.2	Practice the conventions to be followed in engineering drawing as perBIS
	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 isometricviewsofmachinecomponents
	CO6	M-107.6	Drawthedevelopmentsofsurfacesofregularsolidsandusethem tomake thecomponentsusedin daily life

PO-COMapping

CourseCode: M-107	**Course Title: ENGINEERING DRAWINGNumberofCourseOutcomes:06**				**No. of Periods: 180**
POs	**MappedwithCONo.**	**CO Periodsaddressing PO inColumn1**		**Level(1,2,3)**	**Remarks**
		No	**%**		
PO 1	CO2,CO3,CO4,CO5,CO6	50	42	3	**>40% Level 3Highly addressed25% to 40%Level 2ModeratelyAddressed 5to25% Level 1Low addressed <5% Not Addressed**
PO 2	CO1,CO2,CO3,CO4, CO5,CO6	30	25	2	
PO 3	CO1,CO2,CO3,CO4, CO5,CO6	30	25	2	
PO 4					
PO 5					
PO 6					
PO 7	CO1,CO2,CO3,CO4, CO5,CO6	10	08	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3
CO 1	3	2	2				1	2	3	1
CO 2	3	2	2				1	2	3	1
CO 3	3	2	2				1	2	3	1
CO 4	3	2	2				1	2	3	1
CO 5	3	2	2				1	2	3	1
CO 6	3	2	2				1	2	3	1

3:High,2:Moderate,1:Low

Note:

ThegapsinCOandPOmappingwillbeachievedbyoneormoreappropriateactivitiesfromthefollowing:

(i)Assignments(ii)Tutorials(iii)Seminars(iv)GuestLectures(v)GroupDiscussions(vi)Quiz

(vii)IndustryVisits (viii)TechFest(ix)MiniProjects(x)LibraryVisits.

LEARNINGOUTCOMES

Upon completion of the course the student shall able to

1.0 Understand the basic Concepts of Engineering Drawing
- **1.1** State the importance of drawing as an engineering communication medium
- **1.2** State the necessity of B.I.S. Code of practice for Engineering Drawing.
- **1.3** Explain the linkages between Engineering drawing and other subjects of Mechanical Engineering

2.0 Use of Engineering Drawing Instruments
- **2.1** Select the correct instruments to draw the different lines /curves
- **2.2** Use correct grade of pencil to draw different types of lines and for differentpurposes
- **2.3** Select and use appropriate scales for a given application.
- **2.4** Identify different drawing sheet sizes as per I.S. and Standard Lay-outs.
- **2.5** Prepare Title block as per B.I.S. Specifications.
- **2.6** Identify the steps to be taken to keep the drawing clean and tidy. Drawing Plate1: Use of Engineering Drawing Instruments

3.0 Write Free Hand Lettering and Numbers
- **3.1** Write titles using vertical lettering and numerals of 7mm, 10mm and 14mm height
- **3.2** Write titles using sloping lettering and numerals of 7mm,10mm and 14mm height
- **3.3** Select suitable sizes of lettering for different layouts and applications

Drawing plate2: Exercises on Free hand lettering and numbering

4.0 UnderstandDimensioningPractice

4.2 Acquaint with the conventions, notations, rules and methods of dimensioning inengineeringdrawingas pertheB.I.S.

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

DrawingPlate3:ExercisesonDimensioningPractice

5.0 ApplyPrinciplesofGeometricConstructions

5.1 Practicethe basicgeometricconstructionslikei)dividingaline intoequalparts ii) exterior and interior tangents to the given two circlesiii) tangent arcs to twogivenlinesandarcs

5.2 Drawanyregularpolygonusinggeneralmethodwheni) side length isgiven ii)inscribingcircleradius isgiveniii) describingcircleradius isgiven

5.2 Drawtheconicsusinggeneralandspecialmethods,

5.3 Draw the engineering curves like i) involuteii) cycloidiii) helixDrawingPlate-4: Havingproblems upto constructionof polygon

DrawingPlate-5: Havingproblemsof constructionofconics

DrawingPlate-6: Havingproblemsofconstructionofinvolute, cycloidandhelix

6.0 Projectionsofpoints,lines,planes&auxiliaryplanes

6.1 Explainthebasicprinciplesoftheorthographicprojections

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

6.3 Visualise and draw the projections of straight lines with respect to two referencesPlanes(uptolinesparalleltooneplaneandinclined toother plane)

6.4 Visualise and draw the projections of planes (up to planesperpendicular to oneplane andinclined tootherplane)

6.5 Draw the auxiliary views of a given engineering componentDrawingPlate-7: problemsonprojectionof pointsand Lines

Drawing Plate -8: problems on projection of planesDrawingPlate-9: problemsonauxiliary planes

7.0 DrawtheProjectionsofSolids

7.1Visualiseanddrawtheprojectionsofregularsolidslike Prisms,Pyramids,Cylinder,Cone(uptoaxisof solids paralleltooneplaneandinclinedtootherplane)

DrawingplateNo.10:Problemsonprojectionofsolids

8.0 AppreciatetheneedofSectionalViews

8.1 Identifythe need todraw sectionalviews.

8.4 Differentiate betweentrue shapeandapparentshape ofsection

8.5 Draw sectional views and true sections of regular solids by applying

the principles ofhatching.

DrawingPlate–11:Problemson sectionofsolids

9.0 Applyprinciplesoforthographicprojection

9.1 Drawtheorthographicviewsofanobject from itspictorialdrawing.

9.2 Draw the minimum number of views needed to represent a given object fully.DrawingPlate12:Problems on **orthographicprojections**

10.0 Preparepictorialdrawings

10.1 identifythe needofpictorialdrawings.

10.2 Differentiatebetweenisometricscaleandtruescale.

10.3 Prepare Isometric views from the given orthographic drawings.Drawingplate13:ExerciseonIsometric drawingsonly.

11.0 InterpretDevelopmentofsurfacesofdifferentsolids.

11.1 Statetheneedforpreparingdevelopmentdrawing.

11.2 Drawthedevelopmentofsimpleengineeringobjectsandtheirtruncations(cubes,prisms,cylinders,cones,pyramid)

11.3 Preparedevelopmentofsurfaceofengineeringcomponentslikei)funnel ii)90^0elbow iii)Tray

DrawingplateNo.14: ProblemsonDevelopmentofsurfaces

CompetenciesandKeycompetenciestobeachievedby thestudent

S.No	Majortopic	KeyCompetency
1.	ImportanceofEngineeringDrawing	• ExplainthelinkagesbetweenEngineeringdrawing and other subjects of study in Diplomacourse.
2.	Engineering Drawing Instruments	• Select the correct instruments to draw variousentitiesin differentorientation
3.	Freehandlettering& Numbering	• Write titles using sloping and vertical letteringandnumeralsas perB.I.S (BureauofIndianstandards)
4.	DimensioningPractice	• Dimensionagivendrawingusingstandardnotations anddesiredsystemofdimensioning
5.	Geometricalconstruction	• Constructellipse,parabola,rectangularhyperbola, involute, cycloid and helix from thegivendata.
6.	Projection of points, Lines, Planes &Solids	• Drawtheprojectionsofpoints,straightlines,planes & solidswithrespecttoreferenceplanes (HP&VP)
7.	Auxiliaryviews	• DrawtheauxiliaryviewsofagivenEngineeringcomponent • Differentiate between Auxiliary view andapparentview

8.	SectionsofSolids	• Differentiate between true shape and apparentshape ofsection • Applyprinciplesofhatching. • Drawsimple sectionsofregularsolids
9.	OrthographicProjection	• Drawtheminimumnumberofviewsneededtorepresenta givenobjectfully.
10.	IsometricViews	• Differentiatebetweenisometricscaleandtruescale. • Drawthe isometricviews ofgivenobjects,.
11.	Developmentofsurfaces	• PreparedevelopmentofSurfaceofregularsolidsandothercomponentslikei)funnel ii) 90^{0}elbowiii) Tray

COURSECONTENTS:

NOTES:

1. **B.I.SSpecificationshouldinvariablybefollowedinallthetopics.**
2. A-3SizeDrawingSheetsaretobeusedforallDrawingPracticeExercises.

1.0 TheimportanceofEngineeringDrawing

Explanation of the scope and objectives of the subject of Engineering Drawing Its importanceas a graphic communication -Need for preparing drawing as per standards – SP-46 –1988 –MentionB.I.S-Roleofdrawingin-engineeringeducation–LinkbetweenEngineeringdrawingandother subjectsof study.

2.0 EngineeringdrawingInstruments

Classifications: Basic Tools, tools for drawing straight lines, tools for curved lines, tools formeasuring distances and special tools like mini drafter & drafting machine – Mentioning ofnames under each classification and their brief description -Scales: Recommended scalesreduced & 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 oftheTitle blockandits contents -CareandmaintenanceofDrawingSheet,

3.0 Freehandlettering&numbering

Importance of lettering – Types of lettering -Guide Lines for LetteringPracticingofletters&numbersofgivensizes(7mm,10mmand14mm)

Advantagesof singlestrokeor simplestyleof lettering-Useof letteringstencils

4.0 Dimensioningpractice

Purpose ofengineeringDrawing, NeedofB.I.Scodeindimensioning -Shape

description of an Engineering object -Definition of Dimensioning size description -Locationof features, surface finish, fully dimensioned Drawing -Notations or tools of dimensioning,dimension line extension line, leader line, arrows, symbols, number and notes, rules to beobserved in the use of above tools -Placing dimensions: Aligned system and unidirectionalsystem (SP-46-1988)-Arrangement of dimensions Chain, parallel, combined

progressive, anddimensioning by co-ordinate methods-The rules for dimensioning standard, features "Circles(holes)arcs,angles,tapers,chamfers, anddimensionof narrowspaces

5.0 GeometricConstruction

Divisionofaline:to dividea straightlineintogivennumberofequalparts

Construction of tangent lines: to draw interior and exterior tangents to two circles of givenradiiandcentredistance

Constructionoftangentarcs:

i) To draw tangent arc of given radius to touch two lines inclined at given angle (acute, rightandobtuseangles).

ii) Tangent arc of given radius touching a circle or an arc and a given line.iii)Tangent arcsofradius R,touchingtwogiven circlesinternally andexternally.

Construction of polygon: construction of any regular polygon by general method for givenside length,inscribingcircle radiusanddescribing/superscribingcircleradius

Conics: Explanation of Ellipse, Parabola, Hyperbola, as sections of a double cone and a loci ofamoving point,Eccentricityofabovecurves–TheirEngg.Applicationsviz.,Projectiles,reflectors, Cooling Towers, P-V Diagram of a Hyperbolic process - Construction of any conicsection of given eccentricity by general method - Construction of ellipse by concentric circlesmethod - Construction of parabola by rectanglemethodandTangentmethod- Constructionof rectangularhyperbola

General Curves: Involute, Cycloid and Helix, explanations as locus of a moving point, theirengineeringapplication,viz.,Geartoothprofile,screwthreads,springsetc.–theirconstruction

6.0 Projectionofpoints,linesandplanes&auxiliaryviews

Classificationofprojections, Observer,Object,Projectors,Projection,ReferencePlanes,Reference Line, Various angles of projections –Differences between firstangle and thirdangleprojections

Projections of points in different quadrantsProjectionsofstraightline-

(a) Paralleltoboththeplanes.

(b) Perpendiculartooneoftheplanes.

(c) Inclinedtooneplaneandparalleltootherplanes

Projectionsofregularplanes

(a) Planeparalleltooneofthe referenceplanes

(b) Plane perpendiculartoHPandinclinedtoVPandvice versa.

Auxiliaryviews

Need for drawing auxiliary views -Explanation of the basic principles of drawing an auxiliaryviewsexplanationof reference planeandauxiliaryplane-Partial auxiliaryview.

7.0 Projectionsofregularsolids

(a) Axisperpendiculartooneof theplanes

(b) AxisparalleltoVPandinclined to HPandviceversa.

8.0 SectionsofSolids

Needfordrawingsectionalviews–whatisasectionalview-Hatching–Sectionofregularsolidsinclinedtooneplaneandparallel tootherplane

9.0 Orthographic Projections

Meaning of orthographic projection - Using a viewing box and a model – Number of viewsobtained 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 enggobjects - Explanation of first angle projection. – Positioning of three views in First angleprojection -Projection of points as a means of locating the corners of the surfaces of anobject – Use of miter line in drawing a third view when other two views are given -Method ofrepresentinghiddenlines -Selectionofminimum numberofviewstodescribeanobjectfully.

10.0 PictorialDrawings

Briefdescriptionofdifferenttypesofpictorialdrawingviz.,Isometric,oblique,andperspectiveandtheir use-Isometricdrawings:Isometricaxes,anglebetweenthem,meaning ofvisual distortion in dimensions - Need for an isometric scale, difference betweenIsometricscale,andtruescale-differencebetweenIsometricviewandIsometricprojection - Isometric and non-Isometric lines - Isometric drawing of common features likerectangles, circular - shapes, non-isometric lines – Drawing the isometric views for the givenorthographicprojections-Useof box/offsetmethod

11.0 DevelopmentofSurfaces

Need for preparing development of surface with reference to sheet metal work-Concept oftrue length of a line with reference to its orthographicprojection when the line is (i) paralleltotheplaneofprojection(ii)inclinedtooneprincipalandparalleltotheother-Development of simple solids like cubes, prisms, cylinders, cones, pyramid and truncation ofthese solids-Types of development: Parallel line and radial line development -Procedure ofdrawingdevelopmentoffunnels, 90^0elbowpipes,Tray.

REFERENCEBOOKS

EngineeringGraphicsbyPIVarghese– (McGraw-hill)

Engineering Drawing by BasantAgarwal & C.M Agarwal - (McGraw-hill)EngineeringDrawingby N.D.Bhatt.

T.S.M. & S.S.M on " Technical Drawing" prepared by T.T.T.I., Madras.SP-46-1998 –Bureauof IndianStandards.

M 108BASIC 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
1.1 Identify appropriate measuring tool
1.2 Handle appropriate marking tool
1.3 Handle appropriate chipping tool
1.4 Mark the dimensions
2. Cutting with hack saw of MS flats of 6mm thick
2.1 Check the raw material for size
2.2 Fix the work piece in vice
2.3 Mark the work as per given dimensions
2.4 Perform dot punching
2.5 Load and unload hack saw blade from its frame
3. Drilling, chamfering on a MS flat of 2 mm thick

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

4. Tapping and Dieing on a MS flat of 2 mm thick

4.1 Check the raw material for size
4.2 Identify appropriate tap and die
4.3 Secure the tap in the wrench
4.4 Perform Tapping
4.5 Hold the bar in bench vice
4.6 Fix the die in die stock
4.7 Cut external threads using a Die
4.8 Check the fit for accuracy

5. .Assembling of two pieces, matching by filing

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

6. Conversion of Round to Square

6.1 Identify the holding and striking tools
6.2 Heat the specimen to the appropriate temperature
6.3 Remove the specimen and hold it on the anvil
6.4 Hammer the specimen to the required shape

7 Conversion of Round to Hexagon

7.1 Identify the holding and striking tools
7.2 Heat the specimen to the appropriate temperature
7.3 Remove the specimen and hold it on the anvil
7.4 Hammer the specimen to the required shape
8. Preparation of a Chisel from round rod
8.1 Identify the holding and striking tools
8.2 Heat the specimen to the appropriate temperature
8.3 Remove the specimen and hold it on the anvil
8.4 Hammer the specimen to the required shape
9. Preparation of a ring and hook from M.S round
9.1 Identify the holding and striking tools
9.2 Heat the specimen to the appropriate temperature
9.3 Remove the specimen and hold it on the anvil
9.4 Hammer the specimen to the required shape
10. Cutting of wood with hand saw
10.1 Identify the orientation of grains
10.2 Select appropriate saw for cutting in each of the directions viz. across and along the grains
10.3 Select appropriate work holding device
10.4 Handle appropriate measuring and marking tools(Steel rule, Try square, Marking gauge)
10.5 Mark dimensions on work using Marking gauge
10.6 Fix the work in the vice

10.7 Perform cutting along the grains using Rip saw
10.8 Perform cutting perpendicular to the grains using cross cut saw
11. Planning of wood
11.1 Identify the direction for planning wood stock
11.2 Select appropriate jack plane
11.3 Prepare the jack plane for planning
11.4 Load and unload the blade of a jack plane
11.5 Select appropriate work holding device
11.6 Perform marking on work using appropriate tool
11.7 Fix the work in the vice
11.8 Plane the surfaces on all four sides using jack plane
12. .Chiselling of wood
12.1 Select appropriate chisels and saw
12.2 Select appropriate work holding device
12.3 Select appropriate measuring and marking tools
12.4 Fix the work in the vice
12.5 Mark the position of grooves on work using marking gauge
12.6 Cut sides of grooves by hand saw
12.7 Chip the material using firmer chisel by applying pressure with mallet
12.8 Finish the grooves with rasp file
13. Preparation of a Dove-tail joint
13.1 Select the appropriate cutting tools and work holding devices
13.2 Plane the wooden pieces on all sides
13.3 Mark at an angle of 150 with bevel square
13.4 Trim the dovetail by chisel to exact size
13.5 Cut the dovetail groove on second piece
13.6 Finish the groove
13.7 Assemble the two pieces to prepare dovetail halving joint by using mallet
14. Preparation of Mortise and Tenon joint
14.1 Select the appropriate cutting tools and work holding devices
14.2 Plane the two pieces to the required size using jack plane
14.3 Mark the dimensions to make Tenon using mortise gauge
14.4 Cut tenon with tenon saw along the marked lines
14.5 Use firmer chisel to remove the excess material to set finished tenon
14.6 Mark the dimension to make mortise on the second piece with mortise gauge
14.7 Use mortise chisel to provide recess in the second piece to accommodate tenon
14.8 Assemble the two pieces by fitting the tenon into mortise
15. Wood turning on lathe
15.1 Select appropriate tools
15.2 Plane the four corners of the work piece using jack plane
15.3 Mark the centres of the work on either side
15.4 Mount the work between head stock & tailstock centres
15.5 Fix the tool in the tool post & Position it in appropriate height
15.6 Start the lathe to make the work piece to revolve at desired speed
15.7 Feed the bevel gauge against the rotating work to get the required size and shape
15.8 Use outside callipers to check the diameter of the pin
15.9 Use parting off tool to reduce the diameter on either ends of the pin
15.10 Remove the rolling pin between centres and cut off excess material on either sides

16. Preparation of any household article (ex: stool)
16.1 Prepare the drawings of a stool required for a particular drawing table
16.2 State the specifications of the wood stock required
16.3 Identify the type of joints to be made
16.4 Identify the operations to be made and their sequence
16.5 Perform operations to produce pieces of joint
16.6 Assemble all joints as per the drawing
17. Practice on cutting of sheet
17.1 Cut the required sheet from the stock using snip
17.2 Mark the dimensions on the sheet using scriber & steel rule
17.3 Draw the circular shapes using divider
17.4 Perform rough cutting of the curved shapes using chisel and finish cutting using snips
17.5 Cut the straight edges using straight snip

18. Formation of joints like grooved joint, locked groove joint
18.1 Cut the sheet into two halves
18.2 Form the flange on the sheet by folding the sheet along scribed lines using mallet & stakes
18.3 Perform bending edges of sheets applying moderate pressure using mallet
18.4 Interlock the bent edges and apply pressure with mallet to make required joint

19. Preparation of a rectangular open type tray
19.1 Draw the development of the object to be made
19.2 Place the pattern on the sheet
19.3 Mark the dimensions using scriber
19.4 Shear the required piece from the stock using straight snips
19.5 Mark the lines on the sheet to form bends
19.6 Strengthen the sides of sheet by single hem using hatchet stake
19.7 Form the sheet into desired shape using stakes
19.8 Seam the corners by inserting laps of the adjacent sides with single hem
20. Preparation of hollow cylinder
20.1 Draw the development of the object to be made
20.2 Place the pattern on the sheet
20.3 Mark the dimensions using scriber
20.4 Shear the required piece from the stock using straight snips
20.5 Mark the lines on the sheet to form bends
20.6 Strengthen the sides of sheet by single hem on top & bottom side using hatchet stake
20.7 Form the flat sheet into cylindrical shape by cylindrical stake and apply pressure using mallet
20.8 Prepare single hem on to longitudinal sides in opposite directions
20.9 Interlock the sides and apply pressure to make a strong joint
21.. Preparation of pipe elbow
21.1 Draw the development of a cylindrical pipe truncated at an angle of 450 on one side
21.2 Cut the sheet over the marked dimensions using curved snips
21.3 Form the sheet into cylindrical shape using stakes
21.4 Seam the sides of two pipes using mallet
21.5 Seam the two pipes
21.6 Solder the joint to make leak proof
22. Preparation of funnel
22.1 Draw the development of upper and bottom conical parts
22.2 Place the pattern on the sheet and cut to required size

22.3 Form the sheet into conical shape using appropriate stake and mallet
22.4 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
23.1 Draw the development of given dust pan
23.2 Scribe the lines on the sheet and cut to required size
23.3 Hem all the four sides to strengthen the edges
23.3 Form the sheet into designed shape using suitable stakes and mallet
23.4 Solder the corner lap joints to make the required dust pan
24. Preparation of pipe joint with pipe fittings
24.1 Select the plumbing tools: pipe wrench, pipe vice, Hack Saw, Pipe Cutter, pipe Threading Dies
24.2 select pipe fittings: Coupling, union, nipple, Elbow, Tee, Reducer
24.3 Perform pipe fitting operations on the pipe
25. Thread cutting on Pipe
25.1 Select the plumbing tools: pipe wrench, pipe vice, Hack Saw, Pipe Cutter, pipe Threading Dies
25.2 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.

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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 Operation

M-109 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.

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

CO-PO MAPPING

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

CO-PO Mapping Strength

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) 25% to 40% level2 (moderately addressed) 5% to 25% level1 (Low addressed) < 5% (not addressed)
PO2	CO1,CO3, CO4	8	17.8%	1	
PO3	CO1, CO2,CO4	6	13.3%	1	
PO4	CO1, CO2	3	6.7%	1	
PO5	CO1,CO2, CO3	5	11.1%	1	
PO6	CO1, CO2,CO4	3	6.7%	1	
PO7	CO1, CO2, CO4	5	11.1%	1	

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

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

(i) Seminars (ii) Viva-voce (iii) Assignments
(iv) Quiz competitions (v) Industrial visits (vi) Techfest (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 sectionalarea 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 offorce 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 degreeCentigrade 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 (No. of Periods)	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 • Calculate the refractive index of	• Reading the scales on Microscope. • Fiding real and apparent thickness of the slab • Calculate the refractive index of glass slab
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 EndPractical 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**

M-110 CHEMISTRYLABORATORY

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) 25% to 40% Level2 (moderately addressed) 5% to 25% Level1 (Low addressed) < 5%(not addressed)
PO2	CO1,CO2,CO3, CO4,CO5	9	20	1	
PO3					
PO4	CO1,CO2,CO3, CO4,CO5	12	26.66	2	
PO5	CO2,CO3, CO4,CO5	12	26.66	2	
PO6	-	-	-	-	
PO7	-	-	-	-	

COs-POs mapping strength (as per given table)

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

3=strongly mapped2= moderately mapped1= slightly mapped

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

TIMESCHEDULE

S.No	Name of the Experiment	No.ofPeriods	Mapped with COs
1.	a) Recognition of chemical substances and solutions used in the laboratory by senses. b) Familiarization of methods for Volumetricanalysis.	03	CO 1
2.	Preparation of Std.Na_2CO_3solution and making solutions of different	03	CO1
3.	EstimationofHClsolutionusingStd.Na_2CO_3solution.	03	CO2
4.	EstimationofNaOHusingStd. HCl solution.	03	CO2
5.	Determinationofacidityofwatersample.	03	CO2
6.	Determinationofalkalinityofwatersample.	03	CO2
7.	EstimationofMohr'sSalt usingStd.$KMnO_4$ Solution.	03	CO3
8.	Estimation of Ferrous ion by using Std. $K_2Cr_2O_7$solution.	03	CO3
9.	Determinationoftotalhardnessofwatersample usingStd.EDTAsolution.	03	CO4
10.	EstimationofChloridespresentinwatersample by usingStd. $AgNO_3$ solution	03	CO4
11.	EstimationofDissolvedOxygen(D.O)inwatersampleby using Std. hypo solution	03	CO5
12.	Determinationof pH usingpHmeter..	03	CO 5
13.	Determinationofconductivityofwater and adjusting ionic strength required	03	CO 5
14.	Determinationofturbidityofwater.	03	CO 5
15.	Estimationoftotalsolidspresentinwatersample.	03	CO 5
	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_3solutionfor estimation of HCl.

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

5.0 Conduct titrations adopting standard procedures to determine the acidity of 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.$KMnO_4$ solutionfor estimation of Mohr'sSalt.

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

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

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

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

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

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

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

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

Competencies and Key competencies to be achieved by the student

Name of the Experiment (No of Periods)	Competencies	Key competencies
Recognition of chemical substances and solutions. Familiarization of methods for Volumetricanalysis. (03)	-	--
Preparation of Std.Na_2CO_3 solutionand making solutions of different dilutions. (03)	▪ Weighing the salt to the accuracy of .01 mg. ▪ Measuring the water with volumetric flask, measuring jar,	▪ Weighing the salt to the accuracy of 0.01 mg. ▪ Measuring the water with volumetric flask, measuring jar,
EstimationofHClsolution usingStd. Na_2CO_3solution. (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.
Estimationof NaOHusingStd.HClsolution. (03)		
Determinationofacidityofwatersample. (03)		
Determinationofalkalinityofwatersample. (03)		
EstimationofMohr'sSalt usingStd.$KMnO_4$solution. (03)		
Estimation of Ferrous ion by using Std.$K_2Cr_2O_7$solution (03)		
DeterminationoftotalhardnessofwaterusingStd.EDTAsolution. (03)		
EstimationofChloridespresentinwatersample using Std. $AgNO_3$ solution (03)		
EstimationofDissolvedOxygen(D.O)inwatersample (By titration method) (03)		
DeterminationofpHusingpHmeter. (03)	▪ Familiarize with	▪ Prepare standard

Determinationofconductivityofwater and adjusting ionic strength to required level. (03)	instrument. ▪ Choose appropriate 'Mode' / 'Unit'. ▪ Prepare standard solutions / buffers, etc. ▪ Standardize the	solutions / buffers, etc. ▪ Standardize the instrument with appropriate standard solutions. ▪ Plot the standard
Determinationofturbidityofwater. (03)		
Estimationoftotalsolidspresentinwatersample. (03)	▪ Measuring the accurate volume and weight of sample. ▪ Filtering and air drying without losing any filtrate	▪ Measuring the accurate volume and weight of sample. ▪ Filtering and air drying without losing any 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**

M – 111 COMPUTER FUNDAMENTALS LAB

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.	PO 1	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 edita photograph.
35. To insert Borders around photograph.
36. To change Background of a Photograph.
37. To change colors of Photograph.
38. To prepare a cover page for the book in your subject area.
39. To adjust the brightness and contrast of the picture so that it gives an elegant look.
40. To type a word and apply the shadow emboss effects.

Key competencies:

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

	details of the computer	Operating System being used b. Find the details of Service Pack installed	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- References-	a. Create/Open a document b. Use Save and Save as features c. Work on two Word	a. Create a Document and name appropriately and save

	Review-View	documents simultaneously d. Choose correct Paper size and Printing options	b. Set paper size and print options
7.	To practice Word Processing Basics	a. Typing text b. Keyboard usage c. Use mouse (Left click / Right click / Scroll) d. Use Keyboard shortcuts e. Use Find and Replace features in MS- word f. Use Undo and Redo Features g. Use spell check to correct Spellings and Grammar	a. Use key board and mouse to enter/edit text in the document. b. Use shortcuts c. Use spell check/ Grammar features for auto corrections.
8.	To practice Formatting techniques	a. Formatting Text b. Formatting Paragraphs c. Setting Tabs d. Formatting Pages e. The Styles of Word f. Insert bullets and numbers g. Themes and Templates h. Insert page numbers, header and footer	a. Format Text and paragraphs and use various text styles. b. Use bullets and numbers to create lists c. Use Templates /Themes d. Insert page numbers date, headers and footers
9.	To insert a table of required number of rows and columns	a. Edit the table by adding the fields – Deleting rows and columns –inserting sub table –marking borders. 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	a. Insert hyperlinks &Bookmarks

		Bookmarks. b. Create an organization chart c. Practice examples like preparing an Examination schedule notice with a hyperlink to Exam schedule table.	b. Create organization charts/flow charts
11.	To Use Mail merge feature of MS Word	a. Use mail merge to prepare individually addressed letters b. Use mail merge to print envelopes.	Use Mail merge feature
12.	To use Equations and symbols features.	a. Explore various symbols available in MS Word b. Insert a symbol in the text c. Insert mathematical equations in the document	Enter Mathematical symbols and Equations in the word document
13.	To Practice with MS-EXCEL	a. Open /create an MS Excel spread sheet and familiarize with MS Excel 2007 layout like MS office Button- b. Use Quick Access Toolbar-Title Bar- Ribbon-Worksheets- Formula Bar-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	Use built in functions in Excel

		b. Perform Automatic Calculations-Align Cell Entries	
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	Use various options in PowerPoint	Access required options in the tool

	of PowerPoint 2007.	a. Home b. Insert c. Design d. Animation e. Slideshow f. View g. Review	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 PowerPoint slide	a. Create simple PowerPoint presentation with photographs/Clip Art and text boxes b. Use bullets option
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	Create charts and Bar graphs, Pie Charts and format.

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

		vi. The Move Tool vii. The Zoom Tool viii. The Eraser ix. The Crop Tool x. The Fill Tool	
34	To edit a photograph	a. Use the Crop tool b. Trim edges c. Change the shape and size of a photo d. Remove the part of photograph including graphics and text	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 c. Copy background image and paste it on the foreground. d. Resize and/or drag the background image to reposition. e. In the Layers panel, drag the background layer below the foreground image layer.	Able to swap background elements using the Select and Mask tool and layers.
37	To change colors of Photograph	a. Change 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.	Able to prepare cover page for the book

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

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

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

III SEMESTER

C- 23 :: DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
III Semester

Course Code	Course Title	Instruction periods / week		Total Periods	Scheme of Examination			
		Theory	Practical		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
M-301	Engineering Mathematics – II.	4	-	60	3	20	80	100
M-302	Applied Electrical & Electronics	4	-	60	3	20	80	100
M-303	Thermal Engineering - I	5	-	75	3	20	80	100
M-304	Strength of Materials.	4	-	60	3	20	80	100
M-305	Manufacturing Technology - I	4	-	60	3	20	80	100
PRACTICAL								
M-306	Machine Drawing	-	6	90	3	40	60	100
M-307	Material Testing Lab.	-	3	45	3	40	60	100
M-308	Applied Electrical & Electronics Lab.		3	45	3	40	60	100
M-309	Fuels Lab.	-	3	45	3	40	60	100
M-310	Fabrication Lab Practice	-	3	45	3	40	60	100
Co-Curricular Activities								
1	*Library*		1	15				
2	**Physical Education*		1	15				
3	**Quantitative Aptitude / Seminars / Social Awareness Programmes etc.*		1	15				
TOTAL		**21**	**21**	**630**		**300**	**700**	**1000**

[Note: M-301 is Common with A/AA/CER/EE/M/MET/MNG/TT-301]

M-301ENGINEERING MATHEMATICS-II
(common to A/AA/CER/C/EE/M/MET/MNG/TT)

Course Code	Course Title	No. of Periods/week	Total No. of periods	Marks for FA	Marks for SA
M-301	Engineering Mathematics-II	4	60	20	80

S.No.	Unit Title	No. of periods	COs mapped
1	Indefinite Integration	20	CO1
2	Definite Integration	10	CO2
3	Applications of Definite Integrals	10	CO3
4	Differential Equations	20	CO4
	Total Periods	60	

Course Objectives	(i) To understand the concepts of indefinite integrals and definite integrals with applications to engineering problems. (ii) To understand the formation of differential equations and learn various methods of solving first order differential equations. (iii) To learn the principles of solving homogeneous and non-homogeneous differential equations of second order.

Course Outcomes	CO1	Integrate various functions using different methods.
	CO2	Evaluate definite integrals.
	CO3	Solve engineering problems by applying definite integrals.
	CO4	Obtain differential equations and solve differential equations of first order and first degree, and solve homogeneous and non-homogeneous differential equations of second order.

M-301 ENGINEERING MATHEMATICS – II
(common to A/AA/CER/C/EE/M/MET/MNG/TT)

Learning Outcomes

Unit-I

C.O. 1 Integrate various functions using different methods.

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

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

1.3. Solve problems involving standard functions using these properties.

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

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

ii) $\int (f(x))^n f'(x)\,dx,\ n \neq -1$

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

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

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

1.6. Evaluate the Standard integrals of the functions of the type

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

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

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

1.7. Evaluate integrals using decomposition method.

1.8. Solve problems using integration by parts.

1.9 Use Bernoulli's rule for evaluating the integrals of the form $\int u.v\,dx$.

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

Unit-II

C.O.2 Evaluate definite integrals.

L.O.2.1. State the fundamental theorem of integral calculus

2.2. Explain the concept of definite integral.

2.3. Solve simple problems on definite integrals.

2.4. State various properties of definite integrals.

2.5. Evaluate simple problems on definite integrals using these properties.

Syllabus for Unit test-I completed

Unit -III

C.O.3Solve engineering problems by applying definite integrals.

L.O. 3.1. Find the area bounded by a curve and axes.

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

3.3. Solve simple problems using Trapezoidal rule and Simpson's 1/3 rule for the approximation of definite integrals.

Unit -IV

C.O. 4 Form differential equations and solve differential equations of first order and first degree and Solve homogeneous and non-homogeneous differential equations of second order

L.O.4.1. Define a Differential equation, its order and degree

4.2 Find order and degree of a given differential equation.

4.3 Form a differential equation by eliminating arbitrary constants.

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

4.5 Solve linear differential equation of first order of the form $\frac{dy}{dx} + Py = Q$, where P and Q are functions of x only or constants.

4.6 Solve homogeneous second order linear differential equations of the type $(aD^2 + bD + c)\, y = 0$ where $a(\neq 0)$, b, c are real numbers.

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

4.8 Describe the methods of solving f(D) = X, where f(D) is a polynomial of second order and X is a function of the forms k, e^{ax}, $\sin ax$, $\cos ax$ and x and their linear combinations.

Syllabus for Unit test-II completed

Engineering Mathematics – II
(common to A/AA/CER/C/EE/M/MET/MNG/TT)
CO/PO – Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1				3	2	2
CO2	3	2	2	2				3	2	2
CO3	3	3	3	3				3	3	3
CO4	3	3	3	3				3	3	3
Avg.	3	2.5	2.5	2.25				3	2.5	2.5

3 =Strongly mapped (High), **2 =** Moderately mapped (Medium), **1 =** Slightly mapped (Low)

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

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

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

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

Engineering Mathematics – II
(common to A/AA/CER/C/EE/M/MET/MNG/TT)
PO- CO – Mapping strength

PO no	Mapped with CO no	CO periods addressing PO in column I		Level (1,2 or 3)	Remarks
		Number	%		
1	CO1, CO2, CO3,CO4	60 (20+10+10+20)	100%	3	>40% Level 3 Highly addressed 25% to 40% Level 2 Moderately addressed 5% to 25% Level 1 Low addressed <5% Not addressed
2	CO1, CO2, CO3,CO4	37 (6+6+10+15)	61.6%	3	
3	CO1, CO2, CO3,CO4	37 (6+6+10+15)	61.6%	3	
4	CO1, CO2, CO3,CO4	35 (4+6+10+15)	58.3%	3	
5					
6					
7					
PSO 1	CO1, CO2, CO3,CO4	60 (20+10+10+20)	100%	3	
PSO 2	CO1, CO2, CO3,CO4	37 (6+6+10+15)	61.6%	3	
PSO 3	CO1, CO2, CO3,CO4	37 (6+6+10+15)	61.6%	3	

COURSE CONTENTS

Unit-I

Indefinite Integration

1. Integration regarded as anti-derivative, indefinite integrals of standard functions - Properties of indefinite integrals - Integration by substitution or change of variable - Integrals of tan x, cot x, sec x, cosec x.

Evaluation of integrals which are of the following forms:

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

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

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

Integration by decomposition of the integrand into simple rational algebraic functions.

Integration by parts, Bernoulli's rule and integrals of the form $\int e^x [f(x) + f'(x)]\, dx$.

Unit-II

Definite Integration

2. Definite integral, fundamental theorem of integral calculus, properties of definite integrals, evaluation of simple definite integrals.

Unit-III
Applications of Definite Integrals

3. Area bounded by a curve and axes - Mean and RMS values of a function in given intervals - Trapezoidal rule, Simpson's 1/3 rule to evaluate an approximate value of a define integral.

Unit -IV
Differential Equations

4. Definition of a differential equation - Order and degree of a differential equation- Formation of differential equations - Solutions of differential equations of first order and first degree using variables separable method and linear differential equation of the type $\frac{dy}{dx} + Py = Q$ - Solutions of homogenous and non-homogeneous linear differential equations of second order with constant coefficients.

Textbook:

Engineering Mathematics-II, a textbook for second year third semester diploma courses, prepared & prescribed by SBTET, AP.

Reference Books:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Schaum's Outlines Differential Equations, Richard Bronson & Gabriel B. Costa
3. M.Vygodsky, Mathematical Handbook: Higher Mathematics, Mir Publishers, Moscow.

TIME SCHEDULE

S.No.	Chapter/Unit title	No. of Periods	Marks Allotted	Short Type	Essay Type	COs mapped
Unit – I: Indefinite integration						
1	Indefinite integration	20	34	3	2 1/2	CO1
Unit – II: Definite Integration						
2	Definite Integrals	10	16	2	1	CO2
Unit-III: **Applications of Definite Integrals**						
3	Area of curves	3	3	1	0	CO3
4	Mean and RMS values	3	8	1	1/2	CO3
5	Numerical Integration	4	10	0	1	CO3
Unit – IV: Differential Equations						
6	Introduction to Differential Equations	5	6	2	0	CO4
7	Solutions of first order differential equations	4	13	1	1	CO4
8	Solutions of second order homogeneous differential equations	4	10	0	1	CO4
9	Solutions of second order non-homogeneous differential equations	7	10	0	1	CO4
	Total	60	110	10	8	
			Marks	30	80	

Unit Test Syllabus

Unit Test	Syllabus
Unit Test-I	From L.O 1.1 to L.O 2.5
Unit Test-II	From L.O 3.1 to L.O 4.8

M-302 APPLIED ELECTRICAL AND ELECTRONICS

Course code	Course title	No. Of periods/week	Total No. of periods	Marks for FA	Marks for SA
M-302	APPLIED ELECTRICAL AND ELECTRONICS	4	60	20	80

TIME SCHEDULE

S.No	Chapter/ Unit Title	Periods	Weightage Allocated	Short Answer Questions (3 M)	Essay Type Questions (10 M)
1	Electrical Engineering Fundamentals	12	16	2	1
2	DC and AC Machines	14	26	2	2
3	Special purpose machines and Measuring instruments	14	26	2	2
4	Electrical Safety	10	16	2	1
5	Basic Electronics	10	26	2	2
	Total	**60**	**110**	**10**	**08**

COURSE OUTCOMES MAPPING

S.No	Chapter/Unit Title	No. of periods	CO's Mapped
1.	Electrical Engineering Fundamentals	12	CO1
2.	DC and AC Machines	14	CO2
3.	Special purpose machines and Measuring instruments	14	CO3
4	Electrical Safety	10	CO4
5.	Basic Electronics	10	CO5
	Total	**60**	

COURSE OBJECTIVES	To familiarize the basic concepts of electrical circuits, Machines and Concepts of Basic Electronics.
	To understand the construction and working of different measuring instruments and electronic devices and safety of electrical systems.
	To gain the knowledge to operate different electrical equipment and electronic devices.

COURSE OUTCOMES	CO1	M 302.1	Explain the basic concepts of electrical Circuits and their applications.
	CO2	M302.2	Describe the usage of various electrical machines for different applications.
	CO3	M302.3	Illustrate the applications of various special purpose machines in Industries and measuring instruments.
	CO4	M302.4	Select appropriate safety instruments and procedures to prevent electrical hazards and analyse various causes of hazards.
	CO5	M302.5	Describe the Concepts of Basic Electronic Components.

LEARNING OUTCOMES

Upon completion of the Course the student shall be able to

1.0 Electrical Engineering Fundamentals

1.1 Define Ohm's Law and state the laws of resistance.

1.2 State work, power and energy.

1.3 State and explain Kirchhoff's laws.

1.4 Define (a) Flux (b) Inductance (c) Capacitance

1.5 State (a) Faradays laws of Electro Magnetic Induction

(b) Lenz's law (c) Fleming's right hand rule (d) Fleming's left hand rule

1.6 State and explain dynamically induced EMF and statistically induced EMF.

1.7 Define the terms related to Alternating Current

(a) Alternating Current (b) Instantaneous Value (c) Maximum Value
(d) Time Period (e) Power (f) Power Factor

1.8 State power and power factor in

(a) Pure resistor (b) Pure inductor (c) Pure capacitor

1.9 Explain single phase A.C. series circuits consisting of

(a) R-L (b) R-C (c) R-L-C.

1.10 Explain three phase system with voltage, current and power equations.

1.11 Advantages of Three Phase System over Single Phase System.

1.12 Disadvantages of Three Phase System over Single Phase System.

2.0 DC and AC Machines

2.1 Explain the construction and working of D.C. Generator.

2.2 List the type of D.C. Generators

2.3 Explain the working of D.C. Motor.

2.4 List the type of D.C. Motors.

2.5 State the methods of speed control of D.C. Motors.

2.6 Explain the construction and working of Transformer.

2.7 Explain the working of Welding Transformer with circuit diagram.

2.8 Explain the working of Single Phase Induction Motor.

2.9 Explain the working of Three Phase Induction Motor.

2.10 Applications of DC and AC Machines.

3. Special purpose electrical machines and Measuring instruments

3.1 List the types of Servo motors.

3.2 Applications of Servo motors in Industries.

3.3 Describe the working principle of Permanent Magnet Stepper motor.

3.4 State the working principle of AC Servo motor.

3.5 State the working principle of DC Servo motor.

3.6 List the applications of the following Special purposeelectrical machines

(a) AC Servo motor (b) DC Servo motor. (c) Permanent Magnet Stepper motor (d) Brushless servo motor

3.7 Define Transducer and state the need of Transducers in Measurement systems.

3.8 State the classifications of Transducers.

3.9 List the applications of Transducers.

3.10 Define Sensor and list its types.

3.11 List the applications of sensors.

3.12 Need for automation and advantages of automation.

3.13 Define Programmable Logic Controller (PLC)

3.14 State the advantages and applications of PLC.

4.0 Electrical Safety

4.1 The necessity of Fuses and their Selection.

4.2 State the effects of electrical shock and burn.

4.3 Explain the first aid methods to be followed after electrocuted.

4.4 State the Preventive methods to be adopted to avoid electric shock.

4.5 State the Importance of Earthing of electrical equipment and machinery.

4.6 State the need of Miniature Circuit Breaker (MCB)

4.7 State the need of earthing systems and list the earthing systems in common use.

4.8 Explain the procedure of pipe earthing with diagram.

4.9 Explain the procedure of plate earthing with diagram.

5.0 Basic Electronics

5.1 Classify materials as conductor, semiconductors and insulators.

5.2 Distinguish between intrinsic and extrinsic semiconductors.

5.3 Explain the working of PN junction diode with forward bias and reverse bias.

5.4 State the use of Transistors.

5.5 State the function of the terminals of a PNP or NPN transistor.

5.6 Applications of three transistor configurations.

5.7 Explain the working of Zener diode.

5.8 Explain the working of Light Emitting Diode.

COURSE CONTENTS

1. Electrical Engineering Fundamentals

Definition- Fundamentals of Electric Current, Voltage and Resistance - Ohm's Law - the laws of resistance - Work, power and energy - Kirchhoff's laws.

Flux – Inductance – Capacitance - Faradays laws of Electro Magnetic Induction - Lenz's law - Fleming's right hand rule - Fleming's left hand rule. Dynamically induced EMF and statistically induced EMF- Alternating Current - Instantaneous Value - Maximum Value - R.M.S value of sine wave - Time Period - Frequency – Amplitude - Power - Power Factor - Power and Power factor in pure resistor, pure inductor and pure capacitor. Single phase A.C. series circuits - three phase system with voltage, current and power equations - advantages of three phase system over single phase system.

2. DC and AC Machines

Working of DC Generators and Applications - Working of DC Motors and Applications - Working of Transformer and applications -Working of Welding Transformer and applications - Working of Single Phase Induction Motor and applications - Working of Three Phase Induction Motor and applications.

3. Special purpose electrical machines and Measuring instruments

Servo motors – Importance of Servo motors in Industries – Types – Applications. Working Principle of Permanent Magnet Stepper motor- Applications. Working Principle of AC Servo motor – Applications-Working Principle of DC Servo motor – Applications-Differences between AC servomotors and DC servomotors - Definition of transducer-need of transducer - Classification of Transducers-Basic Concept of Sensors and its applications-PLC Definition-advantages-Block diagram.

4. Electrical Safety Procedures.

Fuses and their Selection - Effects of electrical shock and burn - First aid methods to be followed after electrocuted - Preventive methods to be adopted to avoid electric shock - Importance of earthing of electrical equipment and machinery - Miniature Circuit Breaker (MCB) - Types of earthing of electrical equipment and machinery - Procedure of pipe earthing with diagram - Procedure of plate earthing with diagram.

5. Basic Electronics

Classify materials as conductor, semiconductors and insulators - Distinguish between intrinsic and extrinsic semiconductors - Formation of P- type and N- type materials - Working of PN junction diode with forward bias and reverse bias – Transistors - Formation of PNP and NPN transistors –Common Base, Common Emitter and Common Collector configurations (Schematic representation only) - Working of Zener diode - Working of Light Emitting Diode.

REFERENCE BOOKS

1. A Text Book of Electrical Engineering and Electronics - BL Theraja
2. Principles of Electrical Engineering and Electronics - VK Mehta
3. Basic Electrical and Electronics Engineering - DP Kothari & IJ Nagrath
4. A Text Book of Electrical Engineering - JB Gupta
5. A Text Book of Electrical Engineering - BL Theraja & AK Theraja
6. Electric motors and drives - Austin Hughes

Course Title	Course Code	Periods/Week	Periods per Semester
Thermal Engineering - 1	M-303	05	75

TIME SCHEDULE

S. No.	Chapter/Unit Title	Periods	Weightage of Marks	Short Answer Questions (3 M)	Essay Type Questions (10 M)	CO's Mapped
1	Fundamentals of Thermodynamics	14	21	2	1.5	CO1
2	Laws of Perfect Gases	14	21	2	1.5	CO2
3	Thermodynamic Processes on Gases	19	26	2	2	CO3
4	Air Standard Cycles	14	21	2	1.5	CO4
5	Fuels and Combustion	14	21	2	1.5	CO5
	Total	**75**	**110**	**10**	**8**	

Course Objectives and Course Outcomes

Course Objectives		Upon completion of the course the student shall be able to: Analyse the Thermodynamic Processes,Air Standard Cycles and Calorific values of Fuels and Combustion equations of fuels.	
Course contents		Upon completion of the course the student shall be able to:	
	CO1	M-303.1	Explain the basics and laws of thermodynamics and solve problems on thermodynamic laws
	CO2	M-303.2	Apply Gas Laws to solve problems in thermodynamics
	CO3	M-303.3	Solve the problems on Thermodynamic Processes.
	CO4	M-303.4	Discuss Air Standard Cycles in order to compare with the actual cycles used in various thermodynamic systems
	CO5	M-303.5	Explain different methods to determine the calorific values of fuels and know the minimum air required for complete combustion of the given fuel.

PO-CO Mapping

Course Code: M-303		Course Title: THERMAL ENGINEERING - 1 Number of CO's Addressed: 05			No. of Periods:75
PO No	Mapped with CO No.	CO Periods addressing PO in Col 1		Level (1,2,3)	Remarks
		No	%ge		
PO1	CO1– CO5	40	53.33	3	> 40%Level3 Highly addressed 25% to 40%Level 2 Moderately addressed 5 to25% Level-1 Low addressed <5% Not addressed
PO 2	CO1, CO2, CO3	15	20.00	2	
PO 3	CO3	10	13.33	1	
PO 4					
PO 5	CO 4, CO5	5	6.65	1	
PO 6					
PO 7	CO1– CO5	5	6.65	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3						1	1	1	
CO2	3							1	1	
CO3	3	02					1	1	1	1
CO4	3	02					1	1	1	1
CO5	3			01				1	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 on completion of the course the student shall be able to:

1.0 Fundamentals of Thermodynamics.

1.1 Define the system, boundary, universe and working fluid of a thermodynamic system.
1.2 Explain the three types of thermodynamic systems with examples.
1.3 List and explain different Extensive and Intensive properties of a thermodynamic system with examples.
1.4 Define the terms heat, work, quasi-static work and flow work.
1.5 State the Concept of Entropy and change of entropy with mathematic expression.
1.6 Define thermodynamic state, path, process and cycle with graphical representations.
1.7 Differentiate reversible and irreversible processes with examples.
1.8 State the conditions for reversibility of a process and thermodynamic cycle.

1.9 Define the Zeroth law of thermodynamics and Thermal equilibrium.

1.10 State first law of thermodynamics for a cycle, its significance, limitations and applications.

1.11 Write non-flow energy equation (NFEE) stating the units of the terms involved and Solve simple problems on non-flow energy equation applicable to closed systems.

1.12 Write steady flow energy equation (SFEE) stating the units of the terms involved and Solve simple problems on steady flow energy equation only.

1.13 State Clausius and Kelvin-Planck statements of Second law of thermodynamics – Significance – Applications.

1.14 Differentiate heat engine, heat pump and refrigerating machine.

2.0 **Laws of Perfect Gases.**

2.1 State Boyle's Law , Charle's Law, Avogadro's Law , Regnault's Law and Joule's Law with graphical representations and mathematical expressions.

2.2 Define Perfect gas and derive the characteristic gas equation.

2.3 Write universal gas equation.

2.4 State relationship between characteristic gas constant (R), universal gas constant (G) and molecular weight (M).

2.5 Define Specific heat, specific heat at constant pressure (C_p) and specific heat at constant volume (C_v).

2.6 State the reason for C_p is being more than C_v.

2.7 Derive the relationship connecting the two specific heats and characteristic gas constant (R).

2.8 Solve simple problems using gas laws and gas equations.

3.0 Thermodynamic Processes on gases.

3.1 List and define popular thermodynamic processes on gases.

3.2 Explain various thermodynamic processes such as Isochoric, Isobaric, Isothermal Isentropic and Polytropic processes with Pressure -volume and Temperature– entropy diagrams.

3.3 Write mathematical expressions for change in internal energy, work transfer, heat transfer, change in enthalpy and change in entropy for Isochoric, Isobaric, Isothermal, Isentropic and Polytropic processes (Without Proofs)

3.4 Solve Simple Problems on the above thermodynamic processes.

3.5 Description of Hyperbolic, Free expansion and Throttling processes.

4.0 Air Standard Cycles

4.1 Define the term 'Air Standard cycle'.

4.2 List important air standard cycles and their practical applications.

4.3 Define the term Air Standard efficiency.

4.4 State the assumptions made in the analysis of 'Air Standard cycles'.

4.5 State the assumptions made in the analysis of Carnot cycle, Otto cycle and Diesel cycle.

4.6 Explain the thermodynamic processes of Carnot cycle with p-V and T-s diagrams.

4.7 Solve Simple Problems for calculating the air standard efficiency of a Carnot cycle.

4.8 Explain the thermodynamic processes of Otto cycle with p-V and T-s diagrams.
4.9 Solve Simple Problems for calculating the air standard efficiency of an Ottocycle
4.10 Explain the thermodynamic processes of Diesel cycle with p-V and T-s diagrams.
4.11 Solve Simple Problems for calculating the air standard efficiency of a Diesel cycle.
4.12 Compare Otto cycle and Diesel cycle.

5.0 Fuels and Combustion

A) Fuels

5.1 Define the terms fuel and Classify fuels with examples.
5.2 State the advantages, disadvantages and applications of commonly used solid , liquid and gaseous fuels.
5.3 Compare solid, liquid and gaseous fuels.
5.4 Define the term calorific value of a fuel and types of calorific values.
5.5 Define Higher Calorific and Lower Calorific Values of fuel with units.
5.6 Solve simple problems for calculating the higher calorific value of a fuel and then lower calorific value of the fuel by using Dulong's formula.
5.7 Describe Bomb calorimeter for the determination of calorific value of the Solid and Liquid fuels.
5.8 Describe Junker's gas calorimeter for the determination of calorific value of the gaseous fuel.

B) Combustion

5.9 Define Combustion, Reactants and Products of Combustion
5.10 Write Chemical Equations for the combustion of unit mass/Unit Volume of the given fuels.
5.11 Estimate the minimum air required and excess air required for complete combustion of unit mass / unit volume of a fuel of given composition.
5.12 Explain the procedure for the Conversion of volumetric analysis to gravimetric analysis and vice-versa.
5.13 Estimate the percentage composition of dry products of flue gases by mass only during combustion.
5.14 Describe the working of Orsat's apparatus with a line diagram and summarize the procedure for flue gas analysis.

COURSE CONTENT

1.0 Fundamentals of Thermodynamics

Definition of Thermodynamic System, boundary, surroundings, Universe, working fluid of a system- Types of thermodynamic systems: closed, open and isolated systems with examples; -Properties of thermodynamic system: Intensive and Extensive properties with examples;-Definitions of various properties of system namely Pressure, Volume, Specific volume, Density, Specific weight, Specific gravity, Temperature and their units with mathematical expressions.

Definitions for Heat, Work, Entropy and Change in entropy with units and mathematical expressions - Importance of Pressure-volume (p-V) and Temperature- entropy (T-s) diagrams .

Definitions for thermodynamic state, path, process and cycle with graphical representations; - Reversible and irreversible processes – Examples – Conditions for reversibility of a process and a cycle.

Thermal equilibrium and Thermodynamic equilibrium - Statements of Zeroth, First and Second laws of thermodynamics –- Definitions of heat engine, heat pump and refrigerating machine – Non flow energy equation **(without proof)** - Simple problems on NFEE - Steady flow energy equation **(without proof)** - Simple problems on SFEE only.

2.0 Perfect Gas Laws

Perfect gas Laws – Laws of Perfect gases – Boyle's, Charle's, Gay-Lussac's, Joule's, Regnault's and Avogadro's laws – Explanation the above laws on p-V and T-s diagrams – Derive Characteristic Gas Equation pV = mRT - Write universal gas equation- Definition of Specific heat of a gas - Specific heat at constant pressure and Specific heat at constant volume for a gas – Expressions for Change in enthalpy and Change in internal energy – Derive the relation between the two specific heats and characteristic gas constant – Simple problems on the above.

3.0 Thermodynamic processes on Gases

Thermodynamic processes on Perfect Gases: Description of Constant volume, constant pressure, isothermal, isentropic (reversible adiabatic) and Polytropic processes - Explanation of the above thermodynamic processes with Pressure -volume and Temperature– entropy diagrams- Write the mathematical expressions for change in internal energy, work transfer, heat transfer, change in enthalpy and change in entropy for Isochoric, Isobaric, Isothermal, Isentropic and Polytropic processes (Without Proofs) - Simple Problems- Description of Hyperbolic, Free expansion and Throttling processes.

4.0 Air Standard Cycles

Meaning of air standard cycle – Important air standard cycles - Assumptions made in the analysis of various air standard cycles– Air standard Efficiency; Explanation of thermodynamic processes of Carnot cycle on p-V and T-s diagrams – Mathematical expression for Air Standard Efficiency of Carnot cycle (**Derivation Omitted**) – Simple problems on Carnot cycle - Explanation of thermodynamic processes of Otto cycle on p-V and T-s diagrams – Mathematical expression for Air Standard Efficiency of Otto cycle (**Derivation Omitted**) – Simple problems on Otto cycle - Explanation of thermodynamic processes of Diesel cycle on p-V and T-s diagrams – Mathematical expression for Air Standard Efficiency of Diesel cycle (**Derivation Omitted**) - Simple problems on Diesel cycle- Reasons for the highest efficiency of Carnot cycle over other air standard cycles working between same temperature limits - Comparison of Otto cycle and Diesel cycle.

5.0 Fuels and Combustion

Fuels: Definition of Fuel – Renewable energy sources and Non-renewable energy sources of fuels- Classifications of fuels as solid, liquid and gaseous fuels with examples – Merits, Limitations and Applications of the above fuels - Calorific value of fuels – Higher and lower calorific values – Dulong's formula – Simple problems – Determination of calorific values of solid and liquid fuels by using Bomb and gaseous fuels by using Junker's Gas calorimeters. (**Description only**).

Combustion : Definition of Combustion- Write Combustion chemical equations for the combustion of carbon, Hydrogen, sulphur, Methane and Ethane – Calculation of Minimum air required for complete combustion of fuel on mass basis and volume basis – Simple Problems – Need of excess air – Conversion of volumetric analysis to gravimetric analysis and vice-versa - Products of combustion - Calculation of percentage composition of dry flue gases by mass - Brief description of Orsat's apparatus for the analysing of exhaust gases.

REFERENCE BOOKS

1. P. K. Nag, Engineering Thermodynamics, 2017, McGraw Hill Education Publishers
2. C. P. Arora, Thermodynamics, 2004, McGraw Hill Education Publishers
3. Thermal Engineering - J.K.Guptha and R. S. Khurmi, 2015, S.Chand & Company

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II
M-303::THERMAL ENGINEERING - I

UnitTest	Learning Outcomestobecovered
Unit Test –I	From1.1 to3.3
UnitTest –II	From3.4 to5.14

M-304 Strength of Materials

Course Title	CourseCode	Periods/Week	PeriodsperSemester
Strength of Materials	M-304	04	60

TIMESCHEDULE

S. No	Chapter/UnitTitle	Periods	Weightage of marks	Short Answer Questions (3 M)	Essay Type Questions (10 M)	CO's MAPPED
1	Simple Stresses And Strains	19	19	3	1	CO1
2	Strain energy	09	13	1	1	CO2
3	Shear Force and Bending Moment	12	26	2	2	CO3
4	TheoryofSimpleBending & Deflection ofBeams	10	26	2	2	CO4
5	Torsionin Shafts and Springs	10	26	2	2	CO5
	Total	**60**	**110**	**10**	**8**	

CourseObjectivesandCourseOutcomes

CourseObjectives			Uponthecompletionofcoursethestudentshallbeabletounderstand theconceptsofstressandstrainandtofindthemin structuralmembersviz.,bars,beams,shafts forthe givenconditions.
CourseOutcomes	CO1	M-304.1	Explaintheconceptofstressandstrainandvariousconstituent Relations
	CO2	M-304.2	Calculatetheresilienceinthe bars
	C03	M-304.3	Calculate and draw the shear force and bending moment diagrams for theCantilever and SimplySupportedbeamssubjectedto Point loads andUniformly distributed loads.
	CO4	M-304.4	CalculatetheFlexuralstressesinCantileverandSimplySupported Beamsofvariouscross-sections
	CO5	M-304.5	calculatetheTorsionalStresses incircularshafts and Stiffness of the spring.

PO-CO MAPPING:

Course Code : M-304	Course Title : Strength of Materials	Number of course Outcomes : 05			No. of Periods :60
POs	Mapped with CO No.	CO Periods addressing PO in Column1		Level (1,2,3)	Remarks
PO1	CO1, CO2, CO3, CO4, CO5	25	41.67	3	>40% Level 3 Highlyaddressed
PO2	CO1, CO2, CO3, CO4, CO5	20	33.33	2	25%to40%Level 2 ModeratelyAddr essed
PO3	CO1, CO2, CO3, CO4, CO5	5	8.33	1	
PO4					5 to25% Level 1Low addressed
PO5					
PO6					
PO7	CO1,CO2,CO3,CO4,C O5	10	16.67	1	<5%Not addressed

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO2	PSO 3
C01	3	2	1				1	1	2	
C02	3	2	1				1	1	2	
C03	3	2	1				1	1	2	
C04	3	2	1				1	1	2	
C05	3	2	1				1	1	2	

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.

LEARNINGOUTCOMES:

Uponthecompletionofcoursethestudentshallbe able to

1.0 SimpleStressesandStrains

1.1 Classifytheforcesondifferentcriteria

1.2 Differentiatethe rigidbodyfrom thedeformablebody

1.3 Explaintheconceptofstressandstrain

1.4 Drawthestress–straindiagramsforductileandbrittlematerialssubjectedtotensileforces.

1.5 DefineelasticconstantsandPoisonsratio.

1.6 Writeexpressionsrelatingthe elasticconstantsandPoisonsratio.

1.7 Numericalproblemsrelatedtotheabove cases.
1.8 Calculatethestressesandstrainsinbarsofuniformandvaryingcross–sectionsubjectedtoendforcesonly.
1.9 Define composite bar.
1.10 Define thermal stresses.
1.11 Calculatethethermalstresses inuniformbars.
1.12 Calculate thermal stresses in compositeBars.

2.0 StrainEnergy
2.1 Understandtheconceptofstrainenergyanddefinethe termsrelated to it
2.2 Write expressionsforthestressesdevelopedinbarssubjectedtoGradual,SuddenandImpact loads.
2.3 Calculatethestresses andstrainsinthebarsusingthestrainenergyconcepts.

3.0 ShearForceandBendingMoment Diagrams
3.1 Statetheconceptofbeams
3.2 Classifybeamsbasedonsupports.
3.3 Definethe shearforce andbendingmomentinbeams
3.4 Calculate the Shear Force and Bending Moment in Cantilever, Simply Supported subjectedto Concentrated, UDL and combined loads. Draw their variation along the length of thebeams.
3.5 Numericalproblemsrelatedtotheabove cases.

4.0 TheoryofSimpleBendingandDeflectionofBeams

4.1 Define a) Neutral layer, b) Neutral Axis, c) Radius of curvature d) Moment of Resistance, e)Bendingstressf)Momentof Inertiag)SectionModulusf) Flexural Rigidity
4.2 Derivethe expression for the Bending Moment (Flexural Formula) by stating theassumptions.
4.3 Calculatethebendingstressesinbeamsofvariouscross-sections.
4.4 Definethe slopeanddeflectionofbeam.
4.5 Writetheexpressionsforslopeanddeflection in cantileverandsimplysupportedbeamsfor standardcases.
4.3 Numericalproblemsrelatedtotheabove cases.

5.0 TorsioninShafts and Springs

5.1 Define shaft and deriveexpressionforthe Torsionequationbystatingthe assumptions.
5.2 Calculatethedimensionsofthesolidandhallowcircularshaftssubjectedtotorsionandalsoch eckthemfor rigidity.
5.3 Comparethe strengthandweightofthe solidandhallowshaftsforthe givenconditions.
5.4 Numericalproblemsrelatedtotheabove cases.
5.5 Functionof spring
5.6 Typesand applicationsof springs
5.7 Definetheterms relatedto closedcoilhelicalspring
5.8 State the formulaefor thestress anddeflectionofclosedcoilhelicalspring
5.9 Computethestress and deflection oftheclosed coilhelicalspring
5.10 Definetheterms relatedto semi-elliptic orleafspring orlaminatedspring
5.11 Statethe formulaefor the stressanddeflection ofleafspring

5.12 Computethestressand deflectionofleafspring

COURSECONTENTS:

1 SimpleStressesandStrains

Classification of Loads and their effects - Difference between rigid body and deformable body -Concept of stress and strain - Hooke's law - - Stress-strain diagrams for ductile and brittlematerials - elastic constants – Poisons ratio- Factor of safety - Relation between elasticconstants, Stresses and strains in the bars - Stresses and strains in uniform bars and varyingcross-section subjected to end point loads only – concept of composite bars and the stresses and strains in thecompositebars–Numerical problems on Thermalstressesinuniformandcompositebars.

2 StrainEnergy

Strain energy or resilience, proof resilience and modulus of resilience -Strain energy in thebars of uniform cross-sections –Write expressions for the stress in the bars of uniformcross-section using strain energy concept for the following cases - i) Gradually applied load, ii)Suddenlyappliedload,iii)Impact/shockload-Relatednumericalproblems ontheabovecases.

3 ShearForce&BendingMomentDiagrams

Classificationofbeamsbasedonsupports-Typesof Loads–Concentratedload, UDLandUVL- Definition and explanation of shear force and bending moment - Calculation of shear forceand bending moment at any point along the length of the beam and drawing the diagrams bytheanalytical method onlyforthefollowingcases-a)Cantileverwithconcentratedanduniformlydistributedloads,b)Simplysupportedbeam withconcentratedanduniformlydistributedloads.

4 TheoryofSimpleBendingandDeflectionofBeams

Explanation of the terms - a) Neutral layer, b) Neutral Axis, c) Radius of curvature d) Momentof Resistance, e) Bending stress f) Moment of Inertia g) Section Modulusf) Flexural Rigidity -Assumptionsintheoryofsimplebending-Bending/FlexuralEquationM/I=σ/Y =E /R- Problems on calculating the bending stress,dimensions of thecross-section ofbeam,safeloadandradiusofcurvature-Definitionofslopeanddeflectionofbeams-Deflection formulae without proof for cantilever and simply supported beams with point loadanduniformly distributedloadonly(Standardcasesonly)

5 TorsioninShafts and Springs

Definition and functions of shaft - Calculation of polar moment of inertia and polar sectionmodulus for solid and hollow shafts - Assumptions in simple torsion – Derivetorsionalequation T / J = τ / R= G / L - Problems on design of shaft based on strength and rigidity -NumericalProblemsrelatedtocomparisonofstrengthandweightof solidandhollow shafts.

Explanationaboutspring - Classificationofsprings - Nomenclatureofclosedcoilhelicalspring-Deflectionformulaforclosedcoilhelicalspring(without derivation) - Explanationabout stiffnessofspring-Semiellipticalleafspringdeflectionandstressformula(withoutderivation) - Numerical problems on closed coil helical spring and leaf spring to findsafe load,deflection,sizeofcoilandnumberofcoils/plates.

REFERENCEBOOKS:

1. StrengthofMaterials by B.C.Punmia
2. StrengthofMaterials by R.S.Khurmi S& ChandCompany
3. MechanicsofMaterials by Gere McGH

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II
M-304 :: Strength of Materials

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.5
Unit Test – II	From 4.1 to 5.12

CourseTitle	CourseCode	Periods/Week	PeriodsperSemester
MANUFACTURING TECHNOLOGY - I	M-305	04	60

TIME SCHEDULE

SI.No	Major Topics	Periods	Weightage of Marks	Short Answer Questions (3 M)	Essay Type Questions (10 M)	CO MAPPED
1	Production Lathes	14	26	2	2	CO1
2	Shaper, Slotter, and Planer	14	26	2	2	CO2
3	Foundry	09	16	2	1	CO3
4	Cutting Fluids and Metal Coatings	09	16	2	1	CO4
5	Welding	14	26	2	2	CO5
	Total	**60**	**110**	**10**	**8**	

Course Objectives and Course Outcomes

Upon completion of the course the student shall be able to			
COURSE OBJECTIVES	01		Describe the construction details and various operations on Lathe Machines, Shaper, Slotter, Planer, Foundry
	02		Describe the basic workshop operations of foundry andmethods of welding
COURSE OUT COMES	CO1	M305-1	Identify various parts of Lathe Machines, Shaper, Slotter, Planer
	C02	M305-2	Describe various operations on Lathe Machines, Shaper, Slotter, Planer
	C03	M305-3	Describe various moulding sands and its properties, casting and special casting methods. Describe the various casting defects
	C04	M305-4	State the properties and composition of cutting fluids, coolants and Lubricants Select the appropriate metal coating processes .
	C05	M305-5	Explain the working principle of various welding processes and Describe welding operations by using different welding equipment.

PO-COMapping

Course Code: M-305	Course Title: Manufacturing Technology-I NoofCOs:5				No.Ofperiods:60
POs	Mapped with CO No	COPeriodsAddressingPO in Col1		Level (1,2,3)	Remarks
		No	%		
PO1	CO1, CO5	40	66.67	3	>40%Level3 (Highly Addressed) 25%to40%Level2 (ModeratelyAddressed) 5%to25%Level1 (LowAddressed) <5%NotAddressed
PO2					
PO3					
PO4	CO1,CO5	10	16.67	1	
PO5					
PO6					
PO7	CO1 , CO5	10	16.67	1	

	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PSO 1	PSO 2	PSO3
	3			1			1	03	1	1
CO2	3			1			1	03	1	1
CO3	3			1			1	03	1	1
CO4	3			1			1	03	1	1
CO5	3			1			1	03	1	1

3: High, 2: Moderate,1: Low

NOTE: ThegapsinCOandPOmappingwillbeachievedbyoneormoreappropriateactivities fromthefollowing:

(i) Assignments(ii)Tutorials(iii)Seminar (iv)Guest Lecture (v)GroupDiscussions (vi)Quiz (vii)IndustryVisits (viii)TechFest(ix)MiniProjects(x)LibraryVisits.

(ii)

Learning Objectives:

Upon completion of the course the student shall be able to

1.0 Production Lathes

1.1. State a)The working principle of lathe machine
b) The specifications of lathe machine.

1.2. List a) Types of lathe machines
b) The uses of different work holding and tool holding devices.

1.3 Describe the functions of parts of Centre Lathe with legible sketch.

1.4 Explain the operations viz., Turning, Facing, Taper turning, Thread cutting, knurling, forming, drilling, boring, reaming and key way cutting.

1.5 Explain the methods of taper turning on lathe machine with neat sketches.

1.6 Describe the working of Turret and Capstan lathes.

1.7 Explain the Functions of Main parts and working of Single spindle automatic lathe.

2.0. Shaping, Slotting, and Planning

2.1. Describe a) The construction and working principle of shaper with legible sketch
b) The construction and working principle of slotter with legible sketch
c) The construction and working principle of planer with legible sketch
2.2. List the operations performed on shaper, slotter, and planer.
2.3. State a) the specifications of a shaper.
b) The specifications of a slotter.
C) The specifications of a planer.
2.4. Explain a) Crank & slotted lever mechanism for obtaining the quick-return motion of a shaper b) Whit worth mechanism for obtaining the quick-return motion of a slotter.

3.0 Foundry

3.1. State (a) Advantages of casting over other processes
(b) Limitations of casting processes
3.2. List hand moulding tools
3.3 Mention the various properties of good moulding sand and types of moulding sands
3.4 List types of patterns
3.5. Describe the casting process with legible sketch and identify various casting defects
3.6 Explain (a) Principle and application of hot chamber and cold chamber die casting.
(b) Principle and application of centrifugal casting
(c) Principle and application of investment casting

4.0 Cutting Fluids and Metal Coatings

4.1 Define Cutting fluids, coolants and lubricants.
4.2 State the Functions, Properties and Applications of cutting fluids and lubricants.
4.3 List types of cutting fluids and lubricants.
4.4 Select the proper cutting fluids and lubricants used in various machining operations.
4.5 Give examples and applications of solid, liquid and gaseous lubricants.
4.6 State the need of applying metal coatings.
4.7 Explain various metal coating processes with applications.
4.8 Explain various Organic coating processes with applications.

5.0 Welding

5.1. State a) the necessity of welding
b) The advantages and limitations of welding.
c) The principle of flame cutting.
d) The relative advantages of flame cutting over other types of cutting.
5.2. List six welding processes.
5.3. Explain a) the principle of arc welding.
b) The principle of gas welding.
c) The principle of TIG and MIG welding.
d) Different welding procedures in arc and gas welding.
5.4. List a) The tools and equipment of arc welding.
b) The tools and equipment of oxy-acetylene welding.
5.5. Identify a) proper electrodes used for given metals
5.6. The gas cutting equipment.
5.7. List various defect in welds and their remedies.
5.8. Explain Modern welding techniques such as Submerged, CO_2, Atomic – Hydrogen, ultrasonic welding

COURSE CONTENT

1.0 Production Lathes

Working Principle of Lathe. Types of Lathes –Centre lathe – construction details and specifications.

Nomenclature of single point cutting tool - tool signature - Uses of various Work holding and Tool holding devices - General and special operations – (Turning, facing, taper turning thread cutting, knurling, forming, drilling, boring, reaming, key way cutting.)

Methods of taper turning: Tailstock Set over Method and Compound Rest Method.

Semi-automatic lathes: Describe the working of Turret and Capstan lathes.

Automatic lathes: Functions of Main parts and working of Single spindle automatic lathe.

2.0 Shaper, Slotter and Planer

Working Principle, Specifications and Applications of Shaper, Slotter and Planer - Functions of main parts of Shaper, Slotter and Planer – Uses of Work holding and Tool holding devices.

Main Operations performing on the above machines.

Quick Return Mechanisms: Definition –Types - Applications- Working Principle of Crank & Slotted lever mechanism for shaper and Whit worth quick return mechanism for slotter.

3.0 Foundry.

Moulding : Development of foundry as a manufacturing process - Advantages and Limitations of casting over other manufacturing processes- Difference between mould, casting and pattern.

Moulding tools: Uses of shovel, riddle, rammers, trowels, strike - off bar, sprue pin, bellow, swab, gate cutter, mallet, vent rod, draw spike, spirit level and moulding boxes.

Moulding Sands: Properties of moulding sand – Definitions of porosity, flowability, collapsibility, adhesiveness, cohesiveness and refractoriness - Composition and Uses of Green sand, dry sand, loam sand, facing sand, backing sand, parting sand and core sand.

Moulding Patterns: Applications of Solid or Single Piece Pattern, Two- Piece Pattern, Multi Piece Pattern, Match Plate Pattern, Gated Pattern, Skeleton Pattern and Sweep Pattern.

Casting Processes: Steps in making a casting – Working principle and applications of Hot chamber and Cold chamber Die casting, Centrifugal casting and Investment casting - Defects in castings and their remedies.

4.0 Cutting Fluids and Metal Coatings

Definition of Cutting fluids, Coolants and Lubricants – Functions, Properties and Applications of Cutting fluids and coolants – List the names of fluids and coolants used in various machining operations - Selection of cutting fluids - Methods of application of cutting fluids. Classification of Lubricants (solid, liquid, gaseous) - Properties and Applications of lubricants.

Metal Coatings: Galvanizing, Tin coating, Parkerising, Anodizing, Metal spraying, Oil base Paints, Enamels and Rubber base coatings- Applications.

5.0 Welding

Introduction-Classification of welding processes. Advantages and limitations of welding. Principles of arc welding. Arc welding equipment. Choice of electrodes for different metals. Principle of gas (oxy acetylene) welding. Equipment of gas welding. Welding procedures (arc& gas)

Various flame cutting processes - Defects in welding and remedies – safety practices in welding .

Modern welding methods, (Submerged, CO2,Atomic – Hydrogen, ultrasonic welding), Brief description of MIG & TIG Welding.

REFERENCEBOOKS

1. WeldingTechnology byRichardLLittle (TataMcGrawHill)
2. ElementsofWorkShopTechnology vol.I&II byHazraChoudry (Media Promoters and PublishersPvt.Ltd.)
3. EngineeringMetrology byRKJain (KhannaPublications)
4. WeldingTechnology byR SParmar(KhannaPublications)
5. ManufacturingTechnology(volume-1) by PNRao(TataMcGrawHill)

M-306 Machine Drawing

Course Title	Course Code	Periods/ Week	Periods/Semester
Machine Drawing	M-306	06	90

TIME SCHEDULE

Sl.No	Chapter/Unit Title	Periods	Weightage of Marks	CO's Mapped
1	Introduction	06	-	CO1
2	Fastening Devices	24	10	CO2
3	Assembly Drawings	48	40	CO5
4	Piping Layouts and Joints	6	05	CO3
5	Welding Fabrication Drawings	6	05	CO4
	Total	**90**	**60**	

Note:- In the end examination, candidate has to answer all questions in Part- A and one question out of two in Part-B

I.S/B.S latest specification should invariably be followed in all topics.

Course Objectives and Course Outcomes

COURSE OBJECTIVES	On successful completion of the course, the students will be able to:		
	1. Familiarize Conventional symbols of mechanical components, Conventional methods of representing threaded fasteners and riveted joints. 2. Know clear visualization of objects and the proficiency in reading and interpreting assembly drawings 3. Use reinforcing and enhancing the knowledge and skill acquired in the assembly drawings.		
COURSE OUTCOMES	On successful completion of the course, the students will be able to:		
	CO1	M 306.1	Use Conventional symbols as per IS code SP46.
	CO2	M 306.2	Use the Conventional methods of representing fasteners, riveted, welded and pipe joints
	CO3	M 306.3	Prepare the construction piping layouts and joints
	CO4	M 306.4	Draw the welded fabrication drawings
	CO5	M 306.5	Draw the assembly drawing of a machine component for the given details

PO-CO Mapping

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

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.

Blue Print of Model Question Paper

S. No	Chapter Name	Periods Allocated	Weightage Allocated	Question Wise Distribution of Weightage			Question Wise Distribution of Marks		
				R	U	Ap	R	U	Ap
1	Introduction	06		-	-	-	-	-	-
2	Fastening Devices	24	10		02		-	10	-
3	Assembly Drawings	48	80			1	-	-	40
4	Piping Layouts and Joints	6	05	01			5		-
5	Welding Fabrication Drawings	6	05	01			5		-
TOTAL		**90**	**100**	**02**	**02**	**01**	**10**	**10**	**40**

Learning Outcomes

Upon completion of the course the student shall be able to

1.0 Understand the importance of machine drawing

1.1. Know the importance of Machine drawing.
1.2. Review of 1st angle and 3rd angle Projections
1.3. Review of Orthographic Projections and Sectional Views.

2.0 Know about fastening devices

2.1. Draw the standard thread profiles.
2.2. Draw bolted connections to standard proportions.
2.3. Draw different types of screws.
2.4. Draw different types of rivets and riveted connections.
2.5. Draw different types of keys and cotters.

3.0 Understand the assembly drawing practice and procedure

3.1. List the sequence of steps for preparing assembly drawing.
3.2. Practice the assembly drawing for the given components drawing.
3.3. Prepare the list of parts.

4.0 Understand the piping layouts and joints.

4.1. State the distinction between pipes and tubes.
4.2. Identify the common components of a piping layout.
4.3. Identify the conventional symbols used for the various components of piping layout.
4.4. Prepare single line and double line diagrams of piping layouts.
4.5. Explain the use of packing material in joint.

5.0 Appreciate the welded fabrication drawing.
5.1. Identify the different types of welds and their symbolic representation as per B.I.S., SP-46-2003
5.2. Identify the elements of welding symbol and their standard location on the symbol.
5.3. State welding process to be used, surface contour and finish of weld when given in symbolic form.
5.4. Practice the Preparation of working drawing of welded fabrications.

COURSE CONTENT

1.0 Introduction
1.1. Importance of Machine Drawing.
1.2. Brief revision of 1st and 3rd angle projections
1.3. Understand the concepts of Orthographic projections and Sectional views.

2.0 Fastening Devices
2.1. Temporary and Permanent fastenings and their areas of application-thread nomenclature, forms of screw thread profiles, Metric, B.A., Acme, Knuckle, etc.
2.2. Bolts and Nuts: Specification of bolts and nuts, Different types of bolted joints (like using through bolts, studs, screws etc.,) in different applications. Purpose of lock nuts and their Types.
2.3. Keys and cotters: Types of keys and cotters: Difference between key and cotter -uses.
2.4. Rivets and Riveted joints: Types, proportions and specification of rivets: Different types of riveted joints: Lap, Butt-single row, double row etc., chain and zigzag riveting – calculation of diameter of rivet: Pitch and arrangement of rivets in row – use of standard proportions.

Drawing Plate: 1
1. Exercise on Orthographic projections and Sectional views.
2. Thread Nomenclature and forms of screw thread profiles.
3. Exercises in drawing – bolted connections using standard proportions.
4. Drawing of various types of lock nuts & types of keys indicating their proportionate dimensions.
5. Exercise in drawing riveted joints using standard proportions: Single row, Double row (chain and zigzag) in lap and butt joints (single & double strap).

3.0 Assembly Drawings
3.1. Need and functions of assembly and detailed drawings.
3.2. Steps in preparing assembly drawings.
3.3. Bill of materials and parts list.
3.4. Exercises in preparing assembly drawings of commonly available engineering components.
3.5. **Drawing Plate: 2**

Draw the views / sectional views of

Socket and spigot joint	**Sleeve and cotter joint**	**Stuffing box**
Knuckle Joint assembly	**Bush Pin type flanged coupling**	**Muff coupling (solid & split)**
Universal coupling	**Foot step bearing**	**Plummer block**
Eccentric	**Stuffing box**	**Lathe tail stock**
Cross Head	**Gib & Cotter Joint**	**Screw Jack**

4.0 Piping layouts

4.1. Classification of pipes and tubes.
4.2. Components of pipes lay-out.
4.3. Screw fitting bend, elbow, tee, lateral Cross-nipple, reducing socket and plug.
4.4. Unions: Screwed ground and flanged.
4.5. Valves: Gate valve: angle valve, check valve.
4.6. Various conventional symbol used for the above components.

Drawing Plate: 3

1. Single line diagram of pipe layout, two exercises.
2. Double line diagram of pipe layout, one exercise.

5.0 Welded fabrication drawings

5.1. Different types of weld and their basic symbols including sectional representation as per table of I.S. standards, fillet, square butt, single V-Butt, double V-Butt, single bevel butt, double bevel butt, stud, bead (edge or seal), spot, seam.
5.2. Elements of welding symbol and their standard location, the symbol as per IS standards reference Code, arrow head, weld symbol, supplementary symbol, dimensions of welds, method of welding process, special reference.
5.3. Significance of arrow & position of arrow head significance of reference line as per I.S. standards with reference to fillet, V-Butt and stud welds.
5.4. Supplementary symbols and special instructions: Surface of reference line; as per I.S. standards with reference to fillet, V-Butt and stud welds.
5.5. Dimensions of welds: length, location and spacing of welds as per IS: 813-1991 standards with showing dimensions required on a welding.
5.6. Need of special reference

Drawing Plate: 4

1. Drawing tables and figs. Referred in the contents above taking form I.S. standards.
2. Dimensioning a given welding drawings as per I.S., SP-46-2003.
3. Preparing working drawing of welding fabrication from given data.

REFERENCE BOOKS

1. Machine Drawing by **A.C. Parkinson**.
2. Machine Drawing by **Jones & Jones.**
3. Machine Drawing by **N.D. Bhat**.
4. Machine Drawing by **R.B. Gupta.**
5. Engineering drawing practice for schools & colleges: **SP-46-2003**.
6. Machine Drawing by **Bhattacharya** (Oxford Publishers).
7. Machine Drawing by **Ajeeth Singh** (MGH Publishers)
8. Machine Drawing by **N.Siddeswar, Kannaih, Sastri**. (MGH Publishers)

M-307MATERIAL TESTING LAB

Course Title	Course Code	Periods/ Week	Periods/Semester
MATERIAL TESTING LAB	M-307	3	45

TIME SCHEDULE

S.NO	EXPERIMENT TITLE	NO.OF PERIODS
1	Simple Tension Test	09
2	Compression Test	03
3	Impact Test (Charpy & Izod)	06
5	Hardness Test (Brinell & Rockwell Tests)	06
6	Flexural Test on Simply Supported & Cantilever Beams	06
7	Deflection Test on Helical Spring	03
8	Study of Micro Structure of Ferrous and Non-ferrous Metals	12
TOTAL		45

Course Objectives and Course Outcomes

COURSE OBJECTIVE	Upon the completion of the course the student shall be able to conduct tests on various equipmentfor the given sample to find the mechanical properties of the metals and operate the metallurgical microscope to see and draw the microstructure of metals		
COURSE OUTCOMES	CO1	M-307.1	Operate the UTM to conduct various tests like i) Tension test ii) Compression Test iii) Shear test iv) Deflection Test on Spring to get basic mechanical properties of metals
	CO2	M-307.2	Conduct the Hardness tests and Impact tests to find Hardness and Impact Strength of given metals
	CO3	M-307.3	Perform Flexural Test on Simply Supported & Cantilever Beams to determine the Young's Modulus and Stiffness of the beam material
	CO4	M-307.4	Analyse the microstructure of the given metal and acquaint the usage of metallurgical microscope
	CO5	M-307.5	Demonstrate ethics and etiquette while working in a group and display professionalism while communicating as a member and a leader in a group.

PO-CO Mapping

Course Code : M-308	Course Title: Material Testing lab Number of Course Outcomes: 05				No. of Periods 45
POs	**Mapped with CO No.**	**CO Periods addressing PO in Column 1**		**Level (1,2,3)**	**Remarks**
		No	**%**		
PO1	CO1 – CO5	12	27	2	**>40% Level 3 Highly addressed** **25% to 40% Level 2 Moderately Addressed** **5 to 25% Level 1 Low addressed** **<5% Not addressed**
PO2					
PO3					
PO4	CO1 – CO5	27	60	3	
PO5					
PO6					
PO7	CO1 – CO5	5	11	1	

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

3: High, 2: Moderate,1: Low

Learning Outcomes

Upon completion of the course the student shall be able to

1.0 Understand the various material testing methods.

1.1 Conduct the simple tension test to find the various mechanil properties of the given material such as: yield stress, ultimate stress, percentage of elongation, percentage of reduction in area and Young's Modulus.

1.2 Conduct experiments on concrete cube, cast iron, timber to test for its compressive strength.

1.3 Practice the method of determining the Young's modulus of materials by the principle of deflection.

1.4 Determine the modulus of rigidity by the method of deflection of helical springs.

1.5 Conduct the hardness test to find the hardness of given material.

1.6 Perform the impact tests to find the impact strength of given metal

1.7 Practice the method of preparing a specimen for the metallography.

1.8 Interpret the microstructure of specified ferrous and nonferrous materials.

1.9 Handle the metallurgical microscope to study the microstructures.

Key competencies to be achieved by the student

Exercise	Key competencies expected	Max. Marks	Marks awarded
Simple Tension Test	A. Fix the specimen in the jaws of the machine	02	
	B. Fix the strain gauge to the specimen	02	
	C. Apply the load gradually on the specimen	02	
	D. Record the load, elongation without error	01	
	E. Plot the graph stress vs strain	01	
	F. Locate the points - elastic limit, yield stress, ultimate stress on the graph	02	
	Total	10	
Compression test	A. Place the specimen in the machine properly	02	
	B. Apply the load on the specimen gradually	02	
	C. Record the ultimate load	01	
	Total	05	
Shear Test	A. Place the specimen in the correct set of bushes in the shear shackles	02	
	B. Apply the load on the specimen gradually	02	
	C. Record the ultimate load	01	
	Total	05	
Impact test	A. Prepare the specimen as per the specifications	05	
	B. Fix the specimen on the machine appropriately	02	
	C. Release the load to hit the specimen cautiously	02	
	D. Record the energy absorbed by the specimen and find the impact strength	01	
	Total	10	
Hardness test	A. Place the specimen on the anvil of the specimen and fix the indenter	01	
	B. Place the loads on the load pan corresponding to the material of the specimen and size of indenter	01	
	C. Make the indent on the specimen properly	02	
	D. Measure the diameter of indentation with Brinell microscope	03	
	E. Calculate hardness number	03	
	Total	10	
Flexural Test on Beams	A. Measure the cross-sectional dimensions of the beam with vernier caliper	02	
	B. Place the weight pans/hangers at the required positions	01	
	C. Fix the dial indicator at the correct location	02	

	D. Apply the loads gradually (in ascending and descending order)	01	
	E. Note the dial indicator readings(deflections) without parallax error	02	
	F. Plot the graph between load and deflection	01	
	G. Find the Stiffness and Young's Modulus of the beam material	02	
	Total	10	
Torsion test of springs	A. Measure spring diameter and spring wire diameter with vernier callipers	04	
	B. Measure deflection applying load	02	
	C. Calculate modulus of rigidity of spring material	04	
	Total	10	
Study of micro structure of Metals and alloys	A. Prepare specimen	05	
	B. Handling microscope to observe C. microstructure	02	
	D. Draw the microstructure of given material	03	
	Total	10	

COURSE CONTENTS:

1. Determination of yield stress, ultimate stress, percentage of reduction in area, percentage of elongation, Young's modulus by conducting tension test on Universal testing machine.
2. Determination of crushing strength of concrete cube, cast iron, timber etc., using UTM/CTM
3. Determination of Young's Modulus by conducting flexural test on simply supported and cantilever beams of given material
4. Determination of Modulus of rigidity of spring steel by the deflection of springs.
5. Determination of impact strength of the material using Izod and Charpy's tests.
6. Determination of hardness of material using Brinell and Rockwell Testing methods.
7. Specimen preparation for the metallography.
8. Study of microstructures of Mild steel, Pure Iron, Grey Cast Iron, S.G. Iron, Eutectoid steel, Stainless steel, Aluminium, Brass, Bronze

M-308 APPLIED ELECTRICAL AND ELECTRONICS LAB

Course Code	Course Title	No. of periods / Week	Total No. of Periods	Marks for FA	Marks for SA
M- 308	APPLIED ELECTRICAL AND ELECTRONICS LAB	3	45	40	60

COURSE OUTCOMES MAPPING

S.No	EXERCICSE TITLE	No. of periods	CO's Mapped
1.	Basic Electrical Wiring Circuits	12	CO1
2.	DC and AC Circuits	12	CO2
3.	Identification and Testing the terminals of Starters, AC and DC Machines	06	CO3
4	Basic Electronics	09	CO4
5.	Earthing System & Safety	06	CO5
	Total	**45**	

COURSE OBJECTIVES	To familiarize the basic electrical Wiring Circuits
	To familiarize with the usage of various Electrical & Electronic measuring instruments
	To understand the how to test the Electrical Machines and starters.
	To familiarize with few of the basic electronic devices
	To gain the knowledge to operate different electrical equipment with safety.

COURSE OUTCOMES	CO1	M308.1	Connect various electrical wiring circuits.
	CO2	M308.2	To understand the ohms law and Kirchhoff's law
	CO3	M308.3	Able to identify the terminals of various starters and Electrical machines
	CO4	M308.4	To familiarize with few of the basic electronic devices
	CO5	M308.5	Install different Earthing Systems for electrical safety.

LEARNING OUTCOMES

1.0 Basic Electrical Wiring Circuits

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

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

1.3 Make a circuit for Stair case wiring and Go-down wiring

1.4 Make the electrical wiring for Fluorescent Lamp

2.0 D.C. and A.C. Circuits

2.1 Verification of Ohm'S law in a simple circuit.

2.2 Verification of Kirchhoff's laws in a simple circuit.

2.3 Verifying the response in AC circuit at R, L and C in series RLC circuit

3.0 **Identification and Testing of terminals of Starters, DC Machines and AC Machines**

3.1 Identifying the terminals and testing for its operation of Three Point and 4-Point starters.

3.2 Identifying the terminals and testing for its operation of DOL (Direct On Line) starter and Star – Delta Starter.

3.3 Identify of Terminals of the Following Machines with the Use of Test Lamp (a) DC Shunt Motor (b) DC Series Motor (c) 3-Phase Squirrel Cage Induction Motor (d) 3- Phase Slip Ring Induction Motor

3.4 Measure the values of Insulation Resistance of the Following Machines with the Use of Megger.

(a) DC Shunt Motor (b) DC Series Motor (c) 3-Phase Squirrel Cage Induction Motor (d) 3- Phase Slip Ring Induction Motor

4.0 Basic Electronics

4.1 Plot the VI characteristics of PN junction diode.

4.2 Plot the VI characteristics of Zener diode.

4.3 Identification of terminals of PNP and NPN transistors.

5.0 Earthing System & Safety

5.1 Measure the earth resistance at the Place of Pipe Earthing System or Plate Earthing system Using earth Megger .

5.2 Demonstrate the Procedure of First Aid on Electric Shock.

COURSE CONTENT

1.0 Basic Electrical Wiring Circuits

One lamp controlled by one switch- One lamp controlled by one switch and provision

of 2/3-pin socket - Stair case wiring and Godown wiring-Practicing the wiring for Fluorescent Lamp

2.0 DC and AC Circuits:

Verification of Ohm's law and Kirchhoff's laws in a simple circuits - Verifying the response in AC circuit at R, L and C in series RLC circuit

3.0 Identification and Testing of terminals of Starters, DC Machines and AC Machines

Identifying the terminals and testing for its operation of Three Point and 4-Point starters- Identifying the terminals and testing for its operation of DOL (Direct On Line) starter and Star – Delta Starter- Identify of Terminals and Measuring the Insulation Resistance of DC Shunt and Series Motors with the Use of Test Lamp and Megger - Identify of Terminals And measuring Insulation Resistance of the AC Squirrel Cage and Slip-Ring Induction Motors with the Use of Test Lamp and megger.

4.0 Basic Electronics.

Plot the VI Characteristics of PN Junction Diode & Zener Diode – Identification of terminals of PNP and NPN Transistors

5.0 Earthing System & Safety

Measure the earth resistance at the Place of Pipe Earthing System or Plate Earthing system Using earth Megger - Demonstrate the Procedure of First Aid on Electric Shock.

M-309 FUELS LAB

Course Title	Course Code	Total No. of Periods	Total Periods Per Semester
Fuels Lab	M – 309	03	45

TIME SCHEDULE

S. No.	EXERCISE TITLE	Periods
1.	Flash & Fire point tests	12
2.	Viscosity measurement	12
3.	Calorific value tests	09
4.	Carbon residue test	09
5.	Calibration of Pressure Gauge	03

Course Objectives and Course Outcomes

Course Objectives		Upon completion of the course the student shall be able to: (i) To familiarise with the knowledge of materials and tools used in measurement of fuel properties, calibration of pressure gauge (ii) To reinforce the concepts of flash and fire points, viscosity, carbon residue, calorific value and calibration of pressure gauge by conducting corresponding experiments	
Course Outcomes		Upon completion of the course the student shall be able to:	
	CO1	M-309.1	Demonstrate to determine the flash and fire points, viscosity, calorific value and carbon residue of a given sample of fuel using given apparatus.
	CO2	M-309.2	Demonstrate to calibrate the pressure gauge using deadweight pressure gauge
	CO3	M-309.3	Perform precise operations with the flash and fire point devices, viscometers, dead weight pressure gauge tester.
	CO4	M-309.4	Analyse the experimental results to draw inferences, to make recommendations
	CO5	M-309.5	Demonstrate ethics and etiquette while working in a group and display professionalism while communicating as a member and a leader in a group.

Learning Outcomes

Up on Completion of the course the student shall be able to:

1.0 Conduct an experiment to determine the flash and fire point of a given sample of fuel using given apparatus

1.1 Place the oil cup in the apparatus

1.2 Fill the water in water bath through funnel

1.3 Connect the equipment to the power supply

1.4 Fill the oil in the oil cup up to the gauge mark

1.5 Operate the shutter for opening and closing
1.6 Operate the shutter lid to observe vapours
1.7 Operate the stirrer
1.8 Apply the test flame
1.9 Identify the colour change of the flame
1.10 Record the two temperatures of flash and fire point

2.0 Conduct an experiment to determine viscosity of a given sample of oil using given apparatus

2.1 Move and place the collecting flask
2.2 Insert the thermometer and hydrometer in the device
2.3 Fill the oil in the oil cup up to the gauge mark
2.4 Operate the regulator to vary the temperature
2.5 Stir the water to get the uniform temperature
2.6 Record temperature using thermometer
2.7 Open and close the ball valve
2.8 Collect 50 ml of oil in the collecting flask
2.9 Record the time taken to collect 50 ml using stop watch
2.10 Document the readings systematically
2.11 Calculate the Viscosity
2.12 Sketch the related graphs

3.0 Conduct an experiment to determine the calorific value of a given sample of fuel using given apparatus

3.1 Set the thermometers, gas flow meter and regulator in position in the calorimeter
3.2 Move the measuring jar and stop watch in place for ready use
3.3 Operate the water tap for uniform flow of the water into the calorimeter
3.4 Operate the valve to get the uniform flow of gas into the calorimeter
3.5 Maintain constant pressure head in the gas meter by means of water column
3.6 Record the inlet and outlet temperature of water
3.7 Record time taken to consume volume of gas burnt and 1000 ml of water simultaneously
3.8 Record the barometer and manometer readings
3.9 Measure the weight of condensed steam

1.0 **Conduct an experiment to determine the amount of carbon residue of a given sample of petroleum product**

4.1 Place the wire mesh and asbestos block in their respective places
4.2 Cover all the crucibles with hood
4.3 Place the physical balance near the apparatus
4.4 Place inner crucible in outer crucible
4.5 Place sample oil in the porcelain crucible
4.6 Start the burner for heating the crucible
4.7 Stop the supply of fuel to the burner

4.8 Cool the crucible

4.9 Measure the weight of crucible before and after burning of oil

5.0 Conduct an experiment to calibrate the pressure gauge.

5.1 Place the open ended spanner and a needle puller for ready use

5.2 Place the can of gear near the apparatus

5.3 Insert and removal of dead weights on the plunger fat form

5.4 Set the levelling screws for exact levelling of the apparatus

5.5 Fill the oil reservoir without air bubbles by operating the cocks on either side of the oil reservoir

5.6 Operate the screw pump to generate and adjustment of system pressure

5.7 Observe and record the pressure due to mass load

5.8 Record the gauge pressure

COURSE CONTENTS

1. Determine the flash and fire points of the given sample of oil by using
    (a) Able's apparatus
    (b) Pensky Martens apparatus
    (c) Cleveland apparatus
2. Determine the viscosity of the given sample of oil by using
    (a) Redwood viscometer – I,
    (b) Redwood viscometer – II,
    (c) Saybolt viscometer
3. Determine the calorific value of given gaseous fuel by using Junker's gas Calorimeter.
4. Determine the carbon residue of given oil using Conradson's apparatus
5. Calibrate the given pressure gauge by using Dead Weight Pressure gauge.

M-310 FABRICATION LAB PRACTICE

Course Title	Course Code	Total No. of Periods	Total Periods Per Semester
FABRICATION LAB PRACTICE	M -310	03	45

TIMESCHEDULE

S.No	Major Title	No of Periods
1.	Foundry	18
2.	Turning	18
3.	Welding	9
	Total	45

Course Objectives and Course Outcomes

Course Objectives		(i) To Familiarize tools used in Foundry, Machine shop and Welding (ii) To handle the tools appropriately and safely (iii) To reinforce theoretical concepts by practising relevant exercises of foundry, machine shop and welding (iv) Obtain skill in mould Preparation, casting, machining and arc welding	
	CO1	M-310.1	Familiarise with the tools and equipment used in Foundry, Machine shop and welding
Course Outcomes	CO2	M-310.2	Practice the casting principles and operations and prepare the mouldsfor the given patterns
	CO3	M-310.3	Practice the turning operations and prepare simple turning objects on Lathe machine
	CO4	M-310.4	Prepare the job for doing welding operation
	CO5	M-310.5	Practice the joining of metals by Arc Welding and prepare different welded joints

Learning Outcomes:

Perform mould preparation for Solid Bearing

1.1 Write the sand moulding procedures in foundry.
1.2 Prepare a mould sand mix.
1.3 Identify various tools used in foundry shop.
1.4 Select the moulding boxes
1.5 Prepare a mould ready for casting with proper provision for runners, risers and gates

1.6 Locate the cope over the drag without any mismatch

Perform mould preparation for Flange Coupling

2.1 Write the sand moulding procedures in foundry.
2.2 Prepare a mould sand mix.
2.3 Identify various tools used in foundry shop.
2.4 Select moulding boxes
2.5 Prepare a mould ready for casting with proper provision for runners, risers and gates
2.6 Locate the cope over the drag without any mismatch

Perform mould preparation for Split Bearing

3.1 Write the sand moulding procedures in foundry.
3.2 Prepare a mould sand mix.
3.3 Identify various tools used in foundry shop.
3.4 Select moulding boxes.
3.5 Prepare a mould ready for casting with proper provision for runners, risers and gates
3.6 Locate the cope over the drag without any mismatch

Perform mould preparation for Connecting Rod

4.1 Write the sand moulding procedures in foundry.
4.2 Prepare a mould sand mix.
4.3 Identify various tools used in foundry shop.
4.4 Select moulding boxes.
4.5 Prepare a mould ready for casting with proper provision for runners, risers and gates
4.6 Locate the cope over the drag without any mismatch

Perform mould preparation for V-Pulley

5.1 Write the sand moulding procedures in foundry.
5.2 Prepare a mould sand mix.
5.3 Identify various tools used in foundry shop.
5.4 Select moulding boxes.
5.5 Prepare a mould ready for casting with proper provision for runners, risers and gates
5.6 Locate the cope over the drag without any mismatch

Perform mould preparation for Gear Pulley

6.1 Write the sand moulding procedures in foundry.
6.2 Prepare a mould sand mix.
6.3 Identify various tools used in foundry shop.
6.4 Prepare mould in two boxes, three boxes.
6.5 Prepare a mould ready for casting with proper provision for runners, risers and gates
6.6 Locate the cope over the drag without any mismatch

Perform Plain Turning Operations

7.1 Select proper tool to perform the job.
7.2 Centre the job by dial gauge
7.3 Select the suitable speed for different operations
7.4 Practice plain turning operation on a lathe machine
7.5 Use measuring instruments for taking dimensions.

Perform Step Turning Operations

8.1 Select proper tool to perform the job.

8.2 Centre the job by dial gauge
8.3 Select the suitable speed for different operations
8.4 Practice step turning operation on a lathe machine
8.5 Use measuring instruments for taking dimensions

Perform Taper Turning Operations

9.1 Select proper tool to perform the job
9.2 Calculate the taper angle.
9.3 Perform job setting on Lathe machine
9.4 Perform step turning operation on lathe.
9.5 Practice different taper turning methods on lathe
9.6 Perform taper turning for the required tapers by swivelling the compound rest.
9.7 Use measuring instruments for taking dimensions

Perform Collar Turning Operations

10.1 Select proper tool to perform the job.
10.2 Perform job setting on the lathe machine
10.3 Select the suitable speed for different operations
10.4 Practice step turning operation on a lathe machine for collars
10.5 Use measuring instruments for taking dimensions.

Perform Knurling Operations

11.1 Select proper tool to perform the job.
11.2 Perform job setting
11.3 Perform tool setting
11.4 Centre the job by dial gauge
11.5 Select the suitable speed for different operations
11.6 Practice knurling operation on a lathe machine
11.7 Use measuring instruments for taking dimensions

Perform Facing Operations

12.1 Select proper tool to perform the job.
12.2 Perform job setting
12.3 Perform tool setting
12.4 Centre the job by dial gauge
12.5 Select the suitable speed for different operations
12.6 Practice facing operation on a lathe machine
12.7 Use measuring instruments for taking dimensions

Welding beads layout

13.1 Perform Edge preparation
13.2 Attach clamps on workpieces and grounding
13.3 Select the correct rod and amperage range for the work you are attempting. ...
Rod Angle (lead angle) ...
13.4 Hold the electrode at suitable angle and distance with respect to the work piece to maintain the arc
13.5 Perform Arc welding
13.6 Identify the weld bead shape

Perform Lap Joint

14.1 Perform Edge preparation
14.2 Arrange the work pieces for lap joint

14.3Attach clamps on work pieces and grounding
14.4Select the correct rod and amperage range for the work you are attempting. ...
Rod Angle (lead angle) ...
14.5Hold the electrode at suitable angle and distance with respect to the work piece to maintain the arc
14.6 Perform Arc welding
14.7Identify the weld bead shape

Perform Butt Joint

15.1 Perform Edge preparation
15.2 Arrange the work pieces for butt joint
15.3 Attach clamps on work pieces and grounding
15.4 Select the correct rod and amperage range for the work you are attempting. ...
Rod Angle (lead angle)
15.5 Hold the electrode at suitable angle and distance with respect to the work piece to maintain the arc
15.6 Perform Arc welding
15.7 Identify the weld bead shape
15.8 Perform spot welding

COURSE CONTENT

1 Foundry

Moulding and casting of
1.1 Solid bearing
1.2 Flange coupling
1.3 Split bearing
1.4 Connecting rod
1.5 V – Pulley
1.6 Gear pulley

2 Turning

2.1 Plain Turning
2.2 Step Turning
2.3 Taper Turning
2.4 Turning Collars
2.5 Knurling
2.6 Facing

3. Welding

3.1 Layout of Beads
3.2 Lap joints
3.3 Butt joints.
3.4 T- joint

IV SEMESTER

C-23 :: DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
IV Semester

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-401	Design of Machine Elements	4	-	60	3	20	80	100
M-402	Hydraulics & Fluid Power Systems.	4	-	60	3	20	80	100
M-403	Thermal Engineering -II	5	-	75	3	20	80	100
M-404	Engineering Materials	4	-	60	3	20	80	100
M-405	Manufacturing Technology -II	4	-	60	3	20	80	100
PRACTICAL								
M-406	Production Drawing	-	6	90	3	40	60	100
M-407	Thermal Engineering Lab	-	3	45	3	40	60	100
M-408	Communication Skills Lab	-	3	45	3	40	60	100
M-409	Hydraulics & Fluid Power Systems Lab	-	3	45	3	40	60	100
M-410	Machining & Metrology Lab	-	3	45	3	40	60	100
Co-Curricular Activities								
1	*Library*		1	15				
2	**Physical Education*		1	15				
3	**Quantitative Aptitude / Seminars / Social Awareness Programmes etc..*		1	15				
TOTAL		**21**	**21**	**630**		**300**	**700**	**1000**

[Note: M-408 is Common with all Branches]

M–401 Design of Machine Elements

CourseTitle	CourseCode	Periods/Week	Periods/Semester
DesignofMachine Elements	M–401	04	60

TIMESCHEDULE

Sl. No	MajorTopics	Periods	Weightage of Marks	Short Answer Questions (3 M)	Essay Type Questions (10 M)	CO's Mapped
1	Threaded Joints	8	13	1	1	CO1
2	Shafts, Keys and Couplings.	14	26	2	2	C02
3	**Power Transmission Drives** (a) Belt and Chain Drives.	10	16	2	1	CO3
	(b) Gear Drives	08	16	2	1	
4	Cams	08	13	1	1	C04
5	Elements of Internal Combustion Engines.	12	26	2	2	CO5
Total		**60**	**110**	**10**	**8**	

CourseObjectives	Upon completion of the course the student shall be able to Understand the design philosophyanddesignthebasicmachine elements viz., bolts, shafts,keys,couplings, belts, chains, gears, cams, beaings, flywheels and governors.		
CourseOutcomes	**CO1**	**M-401.1**	Designthe threaded joints in assembling the mechanical parts.
	CO2	**M-401.2**	Designthemachine members viz,. 1. Shafts,2.Keys,3. Couplings and 4.Bearings.
	CO3	**M-401.3**	Designthe beltdrives, simple, compound and reverted gear trains used for transmission for thegivenpower.
	CO4	**M-401.4**	Draw the Cam Profile for the given roller motion.
	CO5	**M-401.5**	Explainthe functionsofthe Elements of Internal Combustion engines.

PO-CO MAPPING:

Course Code : M-401	Course Title : Design of Machine Members	Number of course Outcomes : 05			No. of Periods :60
POs	Mapped with CO No.	CO Periods addressing PO in Column1		Level (1,2,3)	Remarks
PO1	CO1, CO2, CO3, CO4, CO5	10	16.67	1	>40% Level 3 Highlyaddressed 25%to40%Level 2 Moderatelyaddressed 5 to25% Level 1Low addressed <5%Notaddressed
PO2	CO1, CO2, CO3, CO4, CO5	15	25	2	
PO3	CO1, CO2, CO3, CO4, CO5	25	41.67	3	
PO4					
PO5	CO1, CO2, CO3, CO4, CO5	05	8.33	1	
PO6					
PO7	CO1,CO2,CO3,CO4,CO5	05	8.33	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C01	1	2	3		1		1	2	3	1
C02	1	2	3		1		1	2	3	1
C03	1	2	3		1		1	2	3	1
C04	1	2	3		1		1	2	3	1
C05	1	2	3		1		1	2	3	1

3: High, 2: Moderate, 1: Low

LEARNINGOUTCOMES

Uponcompletionofthecourse thestudentshallbe ableto

1.0 Threaded Joints

1.1 Define the term Machine Design.
1.2 Explainthefactors governing the design of machine members.
1.3 Explainthe basicprocedure of designing of machine members.
1.4 Classifythefasteners.
1.5 Statethe advantages,disadvantages andapplicationsof threaded joints.
1.6 Explainscrewthreadnomenclatureandspecificationofscrewthreads.
1.7 ExplainModesof failure and Strength of bolts.
1.8 Designofboltssubjectedto tensile loadonly–Simpleproblems.
1.9 Designthe eyeboltusedforliftingthegivenload.
1.10 Drawaneye bolt(nottoscale)showingtheproportions.

2.0 Shafts,KeysandCouplings

2.1 Define and State the functions of i)Shaft ii)Axle iii) Spindle
2.2 State the stresses induced in the shafts.
2.3 Writetheformulafor the powertransmittedbythe solid and hollow shafts subjected to pure torsion from the torque equation.
2.4 Design the Solid shaft and hallow shaft subjected to pure bending from bending equation.
2.5 Design the Solid shaft subjected to Combined Torsion and Bending usingRankineandGuest theories of failures based on Strength **(for static load only) –** Numerical problems.
2.6 Design the hallow shaft subjected to Combined Torsion and Bending usingRankineandGuest theories of failures based on Rigidity (**for static load only) -** Numerical problems.
2.7 Explainthe functions and classification ofkeys.
2.8 Explain stresses induced and modes of failure of keys.
2.9 Writethe Proportions of rectangular sunk key, Square sunk key and Gib-Headed Key forgiven diameterofthe shaft.
2.10 List the functions and classification of couplings.
2.11 Design the muff coupling for a shaft of given size using empirical relations.
2.12 Design the C.I Protected Flange Coupling (Hub, Key, Flange and Bolts) for a shaft of given size using empirical relations.

3.0 POWER TRANSMISSION DRIVES

(A) Belt and Chain Drives

3.1 List the different power drives and compare the flexible drives with the rigid drives
3.2 Classify the belt drives on different criteria and list the belt materials
3.3 Write the expression for calculating the length of open and cross belts.
3.4 Write the expression for calculating the angle of contacts of open and cross belts.
3.5 Write the expression for i) ratio of belt tensions ii) centrifugal tension in the belt
3.6 Explain the effect of centrifugal tension on power transmission.
3.7 Write the conditions for maximum power transmission.
3.8 Solve the numerical problems related to the lengths, angle of contact, ratio of tensions, maximum power transmitted.
3.9 Numerical problems on cross sectional dimensions of open and crossed belt drives.
3.10 List advantages and limitations of chain drives
3.11 List Types of chain drives
3.12 Identify the elements of drive Roller and silent chains.

(B) Gear Drives

3.13 List the advantages and disadvantages of gear drives over flexible or belt drives.
3.14 Define gear train and List different types of gear trains with applications.

3.15 Write the expression for the velocity ratio / Train value for different gear trains except Epi-cyclic gear trains

3.16 Explain the working of simple, compound, epy-cyclic and reverted gear trains- Solve Simple problems related to simple, compound and reverted gear trains only.

3.17 Design a 3-Speed gear box of automobile – Simple problems.

3.18 Explain the nomenclature of spur gear tooth.

3.19 Design the Spur gear based on Lewis bending equation for static load.

4.0 Cams.

4.1 Explain the function of cam assembly.

4.2 Classify the cams and followers.

4.3 Define the terms related to cam profile.

4.4 Draw displacement diagram for the following motion of the knife edge and roller followers only

a) Uniform velocity. b) S.H.M. c) Uniform acceleration & retardation

4.5 Draw cam profiles in above three cases for knife edge and roller followers only when the axis of the follower passes through the axis of the cam.

5.0 Elements of Internal Combustion Engines

5.1 Write the functions and classification of bearings.

5.2 Advantages and disadvantages of sliding contact bearings.

5.3 Design of a simple journal bearing using McKee's equation for loss of power.

5.4 State advantages and disadvantages of anti-friction bearings.

5.5 State the function of flywheel and governor and list their applications.

5.6 Explain the terms related to design of flywheel.

5.7 Write the expression for maximum fluctuation of energy- Simple Problems.

5.8 Classify the governors.

5.9 Distinguish Governor from Flywheel.

5.10 Describe the working of Watt and Porter governor with a legible sketches.

5.11 Explain the sources of vibrations in mechanical systems.

5.12 Explain the methods of controlling the vibrations in mechanical systems.

COURSE CONTENT

1.0 Threaded Joints

Machine Design - Factors governing the design of machine elements- General sequence of steps in designing a machine element.

Types of Fasteners - Advantages, disadvantages and applications of threaded joints - Nomenclature of screw thread – Specifications of screw thread – Bolt Materials -Specification of bolt - Stresses induced in the bolted joints – Failure of bolted joints - Design of bolts subjected to initial tightening and external tensile forces - Design of bolts for Cylinder covers – Bolt of Uniform strength - Simple problems.

Design and Draw of an eye bolt for a given tensile load using empirical proportions - Applications of eye-bolt.

2.0 Shafts, Keys and Couplings

2.1 Shafts: Functions of shaft and materials used for shafts - Standard sizes of shafts as per I.S – Stresses induced in shafts – Torque and Bending equations for the Shafts subjected to pure twisting and pure bending.

Design of Solid shaft subjected to both twisting and bending using Rankine's and Guest's theories of failures to transmit a given power at given rpm., based on (a) Strength and (b) Rigidity - Simple problems considering mean and maximum torques.

2.2 Keys: Functions of keys Materials of keys – Stresses induced in keys - Failure of keys Empirical proportions of rectangular sunk key, Square sunk key and Gib headed key for given diameter of the shaft.

2.3 Couplings: Functions of coupling – Types of couplings – Requirements of a good coupling.

Design of Muff Coupling and C.I Rigid Protected flange coupling for a given torque using empirical proportions – Simple problems.

3.0 Power Transmission Drives

3.1 Belt and Chain Drives

Belt Drives: Factors to be considered while selecting the type of power drive – Advantages and Disadvantages of Belt drives - Types of belt drives - Belt materials.

Mathematical expressions for the length and angle of contacts of open and crossed belts - Mathematical expression for the limiting ratio of belt tensions, centrifugal tension and initial tension – Conditions and Mathematical expression for the maximum power transmission.

Simple Numerical Problems on finding the length, angle of contact, stresses, cross-sectional dimensions, power transmission and maximum power transmission considering with or without the centrifugal tension for flat belts.

Chain drives - Types of chain drives – Advantages and limitations - Advantages of chain drives -– Elements of Roller and silent chains.

3.2 Gear Drives : Advantages and disadvantages of gear drives over other drives - Gear train - Simple, compound, reverted & Epi-cyclic gear trains. – Applications of gear trains - Calculating the number of teeth for simple, compound and reverted gear trains for the given speed ratio and sketching the arrangement.

Design of 3-Speed gear box of automobile – Simple problems.

Nomenclature of spur gear tooth – Gear materials – Empirical Proportions of nomenclature in terms of module.

Design of spur gear (calculating the module face width) based on Lewis bending equation by considering static load and neglecting velocity factor.

4.0 Cams :

Functions of cam - Classification of cams and followers – Working principle of plate and cylindrical cams - Nomenclature of radial cam profile.

Time vs displacement diagrams only for the Motions of the followers: Uniform velocity, Uniform acceleration and retardation and Simple harmonic motion.

Construction of Cam profile of a radial cam with knife edge and Roller follower for all the three types of motions.

Problems on drawing the cam profiles for all the three types of motions for knife edge and & roller followers only when the axis of the follower passes through the axis of the cam.

5.0 Elements of Internal Combustion Engines.

5.1 Bearings: Functions, Types of bearings - Journal bearing – Advantages, disadvantages and applications - McKee's Equation, Bearing Modulus - Simple Problems on Power lost in friction and Heat to be removed in journal bearings - Thrust bearings - Classification and Applications of Thrust Bearings – Rolling contact bearings – advantages disadvantages and applications.

5.2 Flywheels: Function and applications of fly wheels -Definition of Coefficient of fluctuation of speed, maximum fluctuation in energy and Coefficient of fluctuation of energy – Mass Moment of Inertia - Mathematical expression for kinetic energy stored in the flywheel - Simple Problems on the above.

5.3 Governors: Functions – Differences between Flywheel and Governor - Classification – Working Principle of Watt governor and Porter governor.

5.4 Mechanical Vibrations: Vibrations – Positive and Negative Effects of vibrations - Sources of vibrations in mechanical systems - Methods of controlling the vibrations in mechanical systems.

REFERENCES:

1. MachineDesign-R.S.Khurmi., SChand&Company
2. Design of Machine Elements-PandyaandShah, CharotarPublishing House.
3. DesignofMachineElements–VBBhandari,TataMcGrawHill.
4. MachineDesign–R.K.Jain,KhannaPublications

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.12
Unit Test – II	From 3.13 to 5.12

M-402 HYDRAULICS & FLUID POWER SYSTEMS

Course Title	Course Code	Periods/Week	Periods per Semester
Hydraulics & Fluid Power Systems	M-402	04	60

TIME SCHEDULE

S. No	Chapter/Unit Titles	Periods	Marks Allocated	Short Answer Questions (3 M)	Essay Type Questions (10 M)	CO's Mapped
1	Fluid Statics	10	16	2	1	CO1
2	Fluid Dynamics	14	26	2	2	CO2
3	Flow through Pipes	14	26	2	2	CO3
4	Hydraulic Machines	14	26	2	2	CO4
5	Fluid Power Systems	08	16	2	1	CO5
Total		**60**	**110**	**10**	**8**	

Course Objectives and Course Outcomes

COURSE OBJECTIVES	Upon completion of the course the student shall be able to		
	01		Understand the basic knowledge on properties of fluids, fluid statics, dynamics and various losses in pipes
	02		Understand construction Details and working of Hydraulic Machines.
	03		Understand the basic components of Fluid Power control systems.
COURSE OUTCOMES	CO1	M-402.1	Explain the basics of fluid Statics
	C02	M-402.2	Explain the basics of fluid Dynamics
	C03	M-402.3	Calculate Various Losses in flow through pipes
	C04	M-402.4	Describe the working of Hydraulic Turbines and Pumps
	CO5	M-402.5	Explain the layout and Functions of each component of Fluid power control systems

PO-CO Mapping

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

Suggestive activities for further strengthening of CO-PO mapping:

1. Assignment may be given to suggest the capacity of an electrical motor / hydraulic pump to lift the water to a particular building in the college.
2. Guest lecture by an industrial expert may be arranged to understand the industrial applications of fluid power systems.

Learning Outcomes:

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

1.0 Fluid Statics

1.1 Define fluids
1.2 Classify fluids
1.3 Define fluid mechanics
1.4 Classify fluid mechanics
1.5 Define statics, kinematics and dynamics
1.6 Define 1. Density 2. Specific volume 3. Specific weight 4. Specific gravity 5. Surface tension 6. Capillarity 7. Compressibility8.bulk modulus and state formulae with units.
1.7 Define viscosity
1.8 State Newton's law of Viscosity
1.9 Define dynamic viscosity, kinematics viscosity and state their units
1.10 Define fluid pressure and its units
1.11 Explain pressure head of a liquid
1.12 State Pascal's law
1.13 Classify pressure measuring instruments with examples.
1.14 Explain simple and differential U-Tube manometers with sketches and Solve Simple problems .

2.0 Fluid Dynamics

2.1 State types of fluid flow
2.2 Define steady flow and unsteady flow -Define uniform flow and non- uniform flow -one, two- and three-dimensional flow rotational and irrotational flow, laminar and turbulent flow -compressible and incompressible flows
2.3 Define rate of flow or discharge
2.4 State law of continuity and explain continuity equation and Solve simple problems on discharge and law of continuity.

2.5 Mention various types of heads of liquid in motion

2.6State the assumptions and limitations of Bernoulli's theorem

2.7 State Bernoulli's theorem

2.8 Write Bernoulli's equation (without proof) and solve simple problems.

2.9 Mention the practical applications of Bernoulli's theorem.

2.10 Explain working principle of horizontal venturi meter.

2.11 Coefficient of Discharge of Venturi meter – Simple Problems.

2.12 Explain working principle of Bourdon Pressure gauge and Pitot Tube.

3.0 Flow through pipes

3.1 Define loss of head in pipes

3.2 Mention major energy losses and minor energy losses in fluid flow.

3.3 Define loss of head in pipes due to friction (major energy losses)

3.4 State the Darcy- Weisbach's formula (without proof) – Simple Problems.

3.5 StateChezy's equation for frictional losses - Simple Problems.

3.6 Pipes in series, pipes in parallel, concept of equivalent pipe with applications - Simple Problems.

3.7 State the condition for maximum transmission of power and maximum efficiency (without proof)

3.8 Solve simple problems on Power Transmission.

4.0 Hydraulic Machines

4. 1State the Impact of jet on fixed vertical plate - Impact of jet on moving vertical flat plates in the direction of jet - Impact of jet on a series of moving plates or vanes (description only)

4.2 Explain the schematic layout of Hydraulic Power plant.

4.3 Define hydraulic turbine.

4.4 Classification and Applications of Hydraulic Turbines.

4.5Explain the working principles of Pelton wheel, Francis turbine and Kaplan turbine with legible sketches with advantages and disadvantages.

4.6Define and Classify pumps

4.7. Explain the Principle of operation of a centrifugal pump with advantages and disadvantages.

4.8Explain Priming and Cavitation effects in centrifugal pump.

4.9 Define and Classify Reciprocating pumps and state its applications.

4.10 Explain the Principle of operation of Single Acting Reciprocating pump with advantages and disadvantages

5.0 Introduction to Fluid Power Engineering

5.1 Explain the meaning of fluid power systems.

5.2 List advantages, disadvantages and applications of fluid power systems.

5.4 Explain the components of a hydraulic system with a schematic diagram.

5.5 Explain the components of a Pneumatic system with a schematic diagram.

5.6 Classify valves and actuators used in Fluid Power Systems.

5.7 State the functions of Valves and Actuators used in Fluid Power Systems.

Course Contents

1.0 Fluid Statics

Fluid, Properties of fluids - Definitions, units and formulae of Mass Density, Specific Volume, Specific Weight, Specific Gravity, Viscosity, Newton's law of viscosity, Kinematic Viscosity, cohesion and adhesion, Surface Tension, Capillarity, Compressibility and Bulk Modulus and their units - classifications of fluids,- simple problems.

Pressure and units of pressure - Relation between vacuum, absolute and atmospheric pressure, Pressure head of a liquid, Pascal's law - Pressure measuring instruments: Piezometer, Manometers –Simple U-tube and Differential U-tube - Simple problems on U-tube manometers – Working Principle of Bourdon Pressure gauge and Pitot Tube.

2.0. Fluid Dynamics

Types of fluid flow, Steady and unsteady flow, Uniform and non-uniform flow - laminar and turbulent flows, Rotational and Irrotational flow , Compressible and in-compressible flow - Rate of flow or discharge , Continuity equation , Simple problems .

Various forms of energy present in fluid flow, Pressure energy, Potential energy, Kinetic energy, total energy, Bernoulli's equation, assumptions made in Bernoulli's equation, Flow measurements: coefficient of discharge of Venturi meter -Simple problems.

3.0 Flow through Pipes

Losses in pipe lines, minor losses in pipe lines: Loss due to sudden enlargement and sudden contraction, Major losses Loss of head in pipes due to friction, Darcy-Weisbach's formula (without proof), Chezy's equation for frictional losses (without proof) - coefficient of friction and friction factor -Simple Problems ; Pipes in series, pipes in parallel, concept of equivalent pipe–Simple Problems - Hydraulic Gradient Line and Total Energy lines - Maximum power transmission, , power transmitted through the pipe, Condition for maximum power transmission, Simple problems.

4.0 Hydraulic Machines:

Hydraulic Turbines

State the Impact of jet on fixed vertical plate - Impact of jet on moving vertical flat plates in the direction of jet - Impact of jet on a series of moving plates or vanes (description only)

Schematics Layout of Hydraulic Power Plant.

Definition of a Turbine, Classification of hydraulic turbine and applications

Impulse turbines: Working of a Pelton wheel (Impulse turbine) with a neat sketch

Reaction turbines -Working of Kaplan and Francis turbines with neat sketches.

Hydraulic Pumps

a) Centrifugal Pumps

Pumps, Classification of pumps, differentiate positive and non-positive displacement of pumps, Working of a centrifugal pump- Priming of centrifugal pump, Cavitations .

b) Reciprocating Pumps

Reciprocating pumps and its applications - Types of reciprocating pumps- Principle of operation of a single acting reciprocating pump-

5.0. Introduction to Fluid Power Engineering

Fluid power systems - advantages , disadvantages and applications of fluid power systems - Components of hydraulic system with a schematic diagram - Components of Pneumatic system with a schematic diagram - Functions and Classifications of Control Valves and Actuators.

REFERENCE BOOKS

1	Fluid Mechanics	Dr. A. K. Jain	Khanna Publishers, Delhi
2	Fluid Mechanics and Machinery	B C S Rao	Tata McGraw Hill Publishers
3	Fluid Mechanics and Hydraulic Machines	R.K.Bansal	Laxmi Publications(P)Ltd New Delhi
4	Fluid Mechanics and Hydraulic Machines	Dr.D.S.Kumar	S.K KATARIA &SONS. New Delhi

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II
M-402 :: Hydraulics & Fluid Power Systems

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.8
Unit Test – II	From 4.1 to 5.7

M-403 - THERMAL ENGINEERING-II

Course Title	Course Code	Periods per Week	Periods per Semester
Thermal Engineering- II	M-403	05	75

TIME SCHEDULE

Sl. No.	Chapter/Unit Title	Periods	Weightage of Marks	Short Answer Questions (3 M)	Essay Type Questions (10 M)	CO'S Mapped
1	Internal Combustion Engines.	19	26	2	2	CO 1
2	Performance of IC Engines.	12	16	2	1	CO 2
3	Air Compressors.	16	26	2	2	CO 3
4	Gas Turbines & Jet Propulsion.	14	21	2	1.5	CO 4
5	Automobile Technology	14	21	2	1.5	CO 5
	Total	**75**	**110**	**10**	**8**	

Course Objectives and Course Outcomes

Course Objectives			Upon completion of the course the student shall be able to: apply the principles and concepts of thermodynamic systems to solve the real time applications
Course Outcomes	CO 1	M-403.1	Describe the working of I.C. Engines and various systems of I.C. Engines.
	CO 2	M-403.2	Solve numerical problems related to performance of I.C. Engines.
	CO 3	M-403.3	Describe the working of Air compressors and solve numerical problems.
	CO 4	M-403.4	Describe the working of Gas turbines and Jet propulsion
	CO 5	M-403.5	Explain the Elements of Automobiles and importance of alternative fuels used in automobiles.

PO-CO Mapping

Course Code: M-403		Course Title: Thermal Engineering- II Number of CO's Addressed:05			No. of Periods:75
PO No	Mapped with CO No.	CO Periods addressing PO in Col1		Level (1,2,3)	Remarks
		No	%ge		
PO1	CO1– CO5	40	53.33	3	>40% Level -3 Highly addressed
PO 2	CO1,CO3,CO4	15	20.00	2	
PO 3	CO3,CO4	10	13.33	2	25% to 40% Level -2 Moderately addressed
PO 4					
PO 5					5 to25% Level-1 Low addressed
PO 6					
PO 7	CO1– CO5	10	13.33	1	<5% Not addressed

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

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.

Suggestive activities for further strengthening of CO-PO mapping:

1. Seminars may be arranged on the subject of emerging bio fuels, compatibility with conventional fuels and their effect on pollution.
2. Students shall be advised to go through the videos on jet propulsion

Learning Outcomes

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

1.1 **Internal Combustion Engines**Define "Heat Engine" and classify heat engines based on the type of combustion.

1.2 State the advantages of internal combustion engines over external combustion engines.

1.3 Classify Internal Combustion Engines.

1.4 Describe the working of four-stroke petrol and diesel engines with line diagrams.

1.5 Describe the working of two-stroke petrol engine with line diagrams.

1.6 Compare two stroke engines with four stroke engines

1.7 Draw the valve timing diagrams and port timing diagrams for C.I and S.I engines.

1.8 Describe the working of fuel system of diesel engine with a legible sketch.

1.9 Describe the working of fuel system of petrol engine with a legible sketch.

1.10 Describe the working of Zenith carburettor with a neat sketch.

1.11 Explain different methods of cooling systems of I.C engines.

1.12 Explain different methods of Ignition systems of IC engine.

1.13 Explain different methods of lubricating systems in I.C. engines.

1.14 Explain different methods of governing of I.C. engines.

2.0 Performance of Internal Combustion Engines

- 2.1 State the objectives of testing of I.C engines
- 2.2 List performance parameters of an IC engine.
- 2.3 Write the mathematical formulae for the performance parameters of an I.C engine .
- 2.4 Solve simple problems on various performance parameters.
- 2.5 Describe the Morse test on multi-cylinder engine and solve simple problems
- 2.6 Know the Parameters of Heat balance sheet (Description only)

3.0 Air compressors

- 3.1 List the functions of air compressors and the uses of compressed air.
- 3.2 Categorize the different types of air compressors.
- 3.3 Describe the working of a single stage reciprocating air compressor with a line diagram
- 3.4 State the formula for work done and power required to compress the air in a single stage air compressor. (No derivation).
- 3.5 Solve simple problems on single acting single stage reciprocating air compressors. (Neglecting clearance volume).
- 3.6 Summarize the advantages of multi-stage compression over single stage compression.
- 3.7 Explain the use of intercooler.
- 3.8 Explain the condition for minimum work done in two stage compression.
- 3.9 State the formula for work required, minimum work required and power required in two stage compressor (no derivation)
- 3.10 Solve simple problems on work required, minimum work required and power required in a two stage air compressor with or without perfect inter cooling.(neglecting clearance volume).
- 3.11 List the types of rotary compressors- Distinguish reciprocating air compressors with rotary air compressors.

3.12 Describe the working of a centrifugal compressor, axial flow type compressor and vane type compressor with a line diagrams.

4.0 Gas turbines & Jet Propulsion.

4.1 Define and classify the gas turbines.
4.2 Differentiate the gas turbines with the I.C. engines.
4.3 State the advantages and limitations of gas turbine.
4.4 Describe the working of an open cycle constant pressure type gas turbine with a line diagram.
4.5 Describe the working of a closed cycle constant pressure type gas turbine with a line diagram.
4.6 Explain Joule's cycle on p-V and T -s diagrams.
4.7 Explain the concept of jet propulsion.
4.8 Describe the principle of operation of Ram jet engine with a line diagram.
4.9 Describe the principle of operation of Turbo- jet engine with a line diagram.
4.10 State the applications of jet engine.
4.11 Describe the working of a rocket engine with a line sketch.
4.12 List the fuels used in Gas turbines and jet propulsion.

5.0 AUTOMOBILE TECHNOLOGY

5.1 Describe the functions of components of conventional automobile transmission system
5.2 Write the Impact of conventional vehicles on Environment
5.3 Explain the Working of Single plate Clutch and Differential of an automobile transmission system.
5.4 Explain various Alternative Fuels with properties, merits demerits and applications.
5.5 Explain the concepts of different Fuel injection systems such as MPFI, CRDI, EGR and VVT.
5.6 List Salient features of BS-VI Regulations.

COURSE CONTENTS:

1.0 Internal Combustion Engines

Heat engines – Classification - Internal combustion engines: Classification of I.C. engines – Components of I.C engine - Functions of each part and materials used for the parts – Working of four-stroke diesel engine, four stroke and two stroke petrol engines with line diagrams - Comparison of two stroke engines and four stroke engines - Comparison of diesel engine and petrol engine - Valve timing diagram for four stroke petrol and diesel engines – Port timing diagram for two stroke petrol engines.

Description of diesel engine fuel system - Description of petrol engine fuel system - Working of Zenith Carburettor – Cooling system of I.C. engines: Working of Air cooling and water cooling systems- Ignition systems: Working of Battery coil ignition system and magneto ignition systems - Lubricating systems: Principle of operation of Splash and Pressure systems - Governing of I.C. engines: Explanation of quantitative method and qualitative methods of governing.

2.0 Performance of I.C Engines:

Objectives of Testing – Mathematical Expressions for I.P, B.P, F.P, Mechanical efficiency, indicated thermal efficiency, Brake thermal efficiency, Air standard efficiency, Relative efficiency and Specific fuel consumption- Simple problems on the above parameters.

Procedure to conduct Morse test on multi cylinder Petrol engine and Simple problems - Parameters of Heat balance sheet (**Description only**)

3.0 Air Compressors

Functions of air compressor – Uses of compressed air – Types of air compressors –Working of Single stage reciprocating air compressor (with line-diagram) using p-V diagram.

Formulae for work required and power required for compressing the air in the following cases: Isothermal compression, Adiabatic compression and polytropic compression. (**Derivations omitted**) - Simple problems on calculation of work done and power required for single acting single stage air compressors. (Neglecting clearance volume).

Multi stage compressors – advantages over single stage compressors - Use of inter cooler – Formulae for work done and power required in two stage compressors - conditions for minimum work required in two stage compressor (without proof) - Simple problems on work required, minimum work required and power required in a two stage air compressor with or without perfect intercooling. (Neglecting clearance volume).

Rotary compressors – Types – Describe the working of Centrifugal compressor - Axial flow type compressor - Vane type compressors- Advantages, disadvantages and applications.

4.0 Gas Turbines & Jet Propulsion

Gas turbines : Purpose - Classification –Comparison of gas turbines with reciprocating I.C. engines - Fuels used - Applications and limitations of gas turbines- Working of Open cycle constant pressure gas turbine – Working of Closed cycle Constant pressure gas turbine – Thermodynamic processes of Joule's cycle on p-V and T-s diagrams.

Jet Propulsion: Concept of Jet Propulsion – Principle of operation of jet engine – Applications- Types of Jet Propulsion - Principle of operation of Ram jet engine and Turbojet engines – Principle of working & applications of Rocket engine - Fuels used in jet propulsion.

5.0 AUTOMOBILE TECHNOLOGY

Layout of components of conventional automobile transmission system- Functions of principal components such as Clutch, Gear box, Propeller shaft, Universal joint, Slip joint, Differential, Front axle, Rear axle, Brake system and Suspension system - Impact of conventional vehicles on Environment - Working of Single plate Clutch and Differential.

Alternative Fuels: Definition – Need – Requirements of good fuels - Properties, Merits and demerits of alternative fuels such as Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas, Vegetable Oils and Bio Diesel.

Recent advances in I.C. engines: Super charging and Turbocharging- Concept of different Fuel injection systems such as MPFI, CRDI, EGR and VVT – Salient features of BS-VI Regulations.

REFERENCE BOOKS

1. R.S.Khurmi & J K Guptha, Thermal Engineering, 2006, S CHAND publishers
2. Mahesh M Rathore, Thermal Engineering, 2010, MGH Publishers
3. Mathur & Mehtha, Thermal Engineering, 2009, Jain Brothers
4. Heywood, Internal Combustion Engines Fundamentals, 2017, MGH Publishers
5. P.L.Ballaney, Thermal Engineering, 1966, Khanna Publishers
6. Automobile technology – Narang.

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II

M-403 :: Thermal Engineering- II

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.5
Unit Test – II	From 3.6 to 5.6

M-404 ENGINEERING MATERIALS

Course Title	Course Code	Periods per week	Periods per Semester
Engineering Materials	M-404	04	60

TIME SCHEDULE

SI NO	Chapter/Unit Title	No. of Periods	Weightage of Marks	Short Answer Questions (3 M)	Essay Type Questions (10 M)	CO's Mapped
1	Properties and Testing of Engineering Materials	12	26	2	2	CO1
2	Plastics and Powder Metallurgy	14	26	2	2	CO2
3	Production of Iron and Steel	12	21	2	1.5	CO3
4	Heat treatment of Steel	12	21	2	1.5	CO4
5	Ferrous, Non-Ferrous Metals and their alloys	10	16	2	1	CO5
	Total	**60**	**110**	10	8	

Course Objectives and Course Outcomes

Course Objectives	*Upon completion of the course the student shall be able to* Understand mechanical properties of engineering materials, the testing of materials, atomic structure of materials, Iron carbon equilibrium dagram, production of iron and steel, heat treatment methods and classification of various ferrous and non-ferrous materials.		
Course Outcomes	CO1	M-404.1	Explain the procedure to find the mechanical properties of the materials by destructive and non-destructive tests
	CO2	M-404.2	Explain the use of Plastics and importance of Powder metallurgy in manufacturing.
	CO3	M-404.3	Describe iron and steel production processes
	CO4	M-404.4	Discuss the iron-carbon equilibrium diagram and heat treatment processes
	CO5	M-404.5	Classify ferrous, non-ferrous metals and their alloysand explain theirproperties.

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3				1		1	2	2	1
CO2	3				1		1	2	2	1
CO3	3				1		1	2	2	1
CO4	3	1			1		1	2	2	1
CO5	3		1		1		1	2	2	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.

Suggestive activities for further strengthening of CO-PO mapping:

1. Guest lectures may be organized by industrial experts on composite materials
2. Industrial visits may be organized to gain practical knowledge on the production of various metals and alloys and Students are advised to go through the videos on production of iron and steel

Learning Outcomes

Upon completion of the course the student shall be able to

1.0 Properties and Testing of Engineering Materials

1.1 State the importance of various Engineering Materials used in Mechanical processes/industries.
1.2 Classify various engineering materials as metals, non-metals, composites and reinforcements with examples and applications.
1.3 Define different mechanical properties of engineering materials with examples.
1.4 Define the terms space lattice and unit cell.
1.5 List various types of unit cells of metal structures.
1.6 Describe main types of space lattices with examples.
1.7 State the objectives of testing of engineering materials.
1.8 Differentiate between destructive and non-destructive tests.
1.9 Describe the destructive testing procedure to know the tensile strength, compression strength, shear strength, Impact strength, and hardness of the materials.
1.10 Describe the non-destructive testing procedure to know the defects in the materials by conducting X-Ray, gamma–Ray, magnetic flux, Ultrasonic and penetrant tests.

2.0 Plastics and Powder Metallurgy:

2.1 Differentiate between thermosetting plastics and thermoplastics.
2.2 State the principle of manufacturing of plastic products.
2.3 List Types of engineering plastics.
2.4 List methods of processing of plastics.
2.5 Explain injection moulding, compression moulding and transfer moulding with legible sketches.
2.6 List Engineering applications of plastics.
2.7 Explain the applications of powder metallurgy as a primary manufacturing process.
2.8 State the important characteristics of metal powders.
2.9 Explain various methods of producing metal powders.
2.10 Write steps in making products by using power metallurgy technique.
2.11 Explain the following processes i) Blending ii) Centrifugal compacting iii) Gravity sintering iv) Finishing.
2.12 State Advantages, Limitations and Applications of powder metallurgy.

3.0 Production of Iron and Steel

3.1 Name the various raw materials required for production of iron.
3.2 Describe the method of producing Pig Iron in Blast furnace.
3.3 Describe the puddling furnace to produce wrought iron.
3.4 Explain the process of manufacturing cast iron in Cupola.
3.5 Describe the manufacturing of steel by Bessemer process, L.D. process, Open Hearth and Electric Process.

4.0 Heat treatment of Steel

4.1 Explain the cooling curves of pure metal.
4.2 Mention the allotropic forms of pure iron with temperatures and their crystal structures.
4.3 Draw the iron carbon equilibrium diagram, identify various structures of the iron carbon system.
4.4 State the importance of heat treatment for steels.
4.5 Explain Annealing, Normalising, Hardening and Tempering.
4.6 Explain use of case hardening processes like; carburizing, nitriding and Cyaniding.

5.0 Ferrous, Non-Ferrous Metals and their alloys

5.1 Explain the composition, properties and applications of Cast Iron–Grey, White, Malleable, and Spheroidal.
5.2 Classification of carbon steels.
5.3 State the properties and applications of Carbon steels.
5.4 Explain the need for alloying the steel with other elements.
5.5 State the properties, and industrial applications of alloy steels.
5.6 Write the Properties and applications of non-ferrous metals viz., Copper, Aluminium, Tin, Zinc, Lead, Nickel, Magnesium and Chromium.

5.7 List the properties and applications of bearing metals.

Course Contents

1.0 Properties and Testing of Engineering Materials

1.1 Classification of Engineering Materials: Metals, Non-metals, Composites, Reinforcements and Nano-materials – Examples.

1.2 Mechanical Properties of Materials: Tensile strength, Compressive strength, Ductility, Malleability, Hardness, Toughness, Brittleness, Impact strength, Fatigue, Creep resistance- Examples.

1.3 Structure of Materials: Definition of Space lattice and Unit cell – Types of unit cells - Structure of Simple cubic lattice, Face CenteredCubic, Body Centered Cubic, and Hexagonal Closed Packed- Examples.

1.4 Testing of Materials: Differentiate between destructive and non-destructive tests. Destructive testing tests on UTM to determine tensile, shear strengths – Hardness Tests on Brinell & Rockwell testing machines – Impact test on Izod & Charpy testing machines.Non-destructive testing – Procedure for testing materials by X-ray, gamma ray, magnetic flux and ultrasonic testing and Penetrant test.

2.0 Plastics and Powder Metallurgy:

2.1 Plastics- Thermosetting plastics and thermoplastics – Applications – Types of Engineering plastics – Processing of Plastics: Methods – Working principle of Compression moulding, Injection moulding and Transfer moulding- Applications.

2.2 Powder Metallurgy: Definition - Methods of producing metal powders - Steps in making products by using power metallurgy technique - Advantages, Limitations and Applications of powder metallurgy.

3.0 Production of Iron and Steel

Raw materials, iron ores, Lime stone, Manufacturing of pig iron from blast furnace.Wrought iron by pudding furnace. Cast Iron from cupola. Production of steel by Bessemer, L.D. process; Open hearth and Electric processes.

4.0 Heat treatment of Steel

Cooling curve for pure metal. Allotropic forms of pure Iron. Iron carbon equilibrium diagram. Importance of heat treatment. Heat treatment processes – annealing, normalizing, hardening, tempering, carburizing, nitriding and cyaniding.

5.0 Ferrous, Non-Ferrous metals and their alloys

Ferrous metals and Alloys: Cast iron -Types of cast iron - Properties and applications of Grey, White, Malleable, and Spheroidal cast irons.

Steels : Uses of steels - Effect of carbon in steels - Classification - Properties and applications of Mild steel, High carbon Steels.

Alloy Steels: Purpose of alloying - Effect of alloying elements on Steel - Properties of 18/8 stainless steel, High Speed Steels - Applications.

Non-ferrous metals and Alloys: Definition - Properties and uses of Copper, Aluminium, Tin, Zinc, Brass, Bronze, Lead, Nickel, Magnesium , Chromium, Bearing metals and Babbit metals.

REFERENCEBOOKS

1. Material Science and Engineering Raghavan PHI Publishers
2. Introduction to Physical Metallurgy Avner Tata McGraw Hill Publishers
3. Material science and metallurgy O P Khanna Dhanpati Rai Publishers

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II
M-404 :: Engineering Materials

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.5
Unit Test – II	From 4.1 to 5.7

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M – 405 MANUFACTURING TECHNOLOGY-II

Course Title	Course Code	Periods Per Week	Periods Per Semester
MANUFACTURING TECHNOLOGY-II	M – 405	04	60

TIME SCHEDULE

Sl. No.	Chapter/Unit Title	Periods	Weightage of Marks	Short Answer Questions (3 M)	Essay Type Questions (10 M)	CO's Mapped
1	Milling Machines	12	26	2	2	CO1
2	Gear Generating Processes	12	16	2	1	CO2
3	Grinding and Broaching Machines	14	26	2	2	CO3
4	Measurements and Metrolog	12	26	2	2	CO4
5	Nonconventional Machining Processes	10	16	2	1	CO5
	Total	**60**	**110**	**10**	**8**	

Course Objectives and Course Outcomes

Upon completion of the course the student shall be able to			
COURSE OBJECTIVES	01		Describe construction and working of milling machines, Gear generating processes, Grinding and various surface finishing processes.
	02		Explain the importance of metrology and surface finishing processes and applications of nonconventional machining processes.
COUR/SE OUTCOMES	CO1	M405-1	Describe the constructional features of Milling machines
	C02	M405-2	Describe the constructional features of Gear Generating Processes.
	C03	M405-3	Describe the working of different grinding machines and surface finishing processes.
	C04	M405-4	Describe the importance of Metrology and working of different measuring instruments.
	C05	M405-5	Describe different Nonconventional machining processes.

PO-CO Mapping

Course Code: M-405	Course Title: Production Technology-II No of Cos: 4				No. of periods: 60
POs	**Mapped with CO No**	**CO Periods Addressing PO in Col 1**		**Level (1,2,3)**	**Remarks**
		No	%		
PO1	CO1- CO5	34	52	3	**> 40% Level 3 (Highly Addressed)** **25% to 40% Level 2 (Moderately Addressed)** **5% to 25% Level 1 (Low Addressed)** **<5% Not Addressed**
PO2					
PO3					
PO4	CO1- CO5	15	26.7	2	
PO5					
PO6					
PO7	CO1- CO5	11	21.3	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			2			1	03	1	1
CO2	3			2			1	03	1	1
CO3	3			2			1	03	1	1
CO4	3			2			1	03	1	1
CO5	3			2			1	03	1	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.

Suggestive activities for further strengthening of CO-PO mapping:

1. Guest lectures and seminars may be organized on modern machining processes
2. Engineering industry visits may be organized to know the technological advancements in machine tools and machining processes

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

1.0 Milling Machines

1.1. Explain the working principle of a Milling machine

1.2. Explain the constructional details and Principle of operation of Column and knee type and Universal milling machines with legible sketches.

1.3. State the purpose and list the methods of indexing.

1.4. List different types of milling cutters and their applications.

1.5. State the functions of different tool holding devices.

1.6. State the functions of different work holding devices.

1.7. Explain various milling operations.

1.8. List specifications of milling machines.

2.0. Gear Generating Processes

2.1. List methods of producing gears.

2.2. Describe the method of gear manufacturing by Gear shaping.

2.3. Describe the method of gear generation by Gear hobbing.

2.4. Explain various gear finishing operations.

2.5.

3.0. Grinding and Broaching Machines:

3.1 Explain the principle of metal removal by grinding

3.2 Explain the working of Cylindrical and Centreless grinding machines.

3.3 List types of abrasives with examples.

3.4 List types of bonds in grinding wheel.

3.5 Explain the standard marking system of a grinding wheel.

3.6 List the uses of different work holding devices.

3.7 Explain (a) Balancing (b) Dressing (c) Truing of the grinding wheel.

3.1 State the principle of broaching.

3.9 List types of broaching machines

3.10 Explain Horizontal type duplex ram broaching machine.

3.11 Explain working of Vertical type broaching machine.

3.12 List elements of broach tool with a neat sketch.

4.0 Measurements and Metrology:

4.1 Define Measurementand Metrology

4.2 Explain the Significance of measurement

4.3 Classify measuring Instruments

4.4 List the Applications of measurement systems.

4.5 Define Precision, Accuracy, Reliability and Error.

4.6 Explain various sources of errors.

4.7 State the applications of linear measuring instruments such as Steel rule -Outside caliper, insidecaliper, Odd leg caliper - Combination set - Feeler gauge - Pitch screwgauge - Vernier caliper - Vernier height gauge- Vernier gear tooth caliper – Micrometre **- S**lip gauges, Ring and plug gauges, feeler gauge, and snap gauge.

4.8 State the applications of angular measuring instruments such as Bevel protractor, Sine Bar, Angle Slip Gauges.

4.9 Explain the working of Mechanical comparator, Optical comparator and Electrical comparator.

4.10 Explain the working principle and applications of Interferometer and Measuring Microscope.

4.11 Explain the working principle and applications of Autocollimator

4.12 Explain the working principle and applications of Coordinating Measuring Machine (CMM) .

5.0 Nonconventional Machining Processes

5.1 Distinguish between nonconventional machining processes and conventional methods.

5.2 State the relative advantages and applications of nonconventional machining processes.

5.3 Describe Ultrasonic machining (USM) Process with advantages and disadvantages.

5.4 Describe Electrical Discharge Machining (EDM) Process with advantages and disadvantages

5.5 Describe of Abrasive jet machining (AJM) with advantages and disadvantages

5.6 Describe of Laser beam machining (LBM) with advantages and disadvantages

COURSE CONTENTS

1.0 Milling Machines

Definition - Types of Milling machines: Constructional details and Principle of operation of Column and knee type and Universal milling machines - Specification of milling machines – Purpose of indexing – Methods of indexing - Work holding and Tool holding devices – Types of milling cutters – Cutter materials - Milling Operations :Face Milling, Plain Milling, Side Milling, Straddle Milling and Gang Milling.

2.0 Gear Generating Processes

Definition of Gear - Methods of manufacturing of gears – Gear generating processes: Principle of operation of Gear Shaping and Gear hobbing – Gear materials - Gear finishing processes: Burnishing, Shaving, Honing, Lapping and Super finishing.

3.0 Grinding and Broaching Machines:

Grinding machines: Principle of Grinding – Abrasives: Natural and Artificial - Types of Bonds and Applications – Grit, Grade and Structure of wheels - Standard marking systems of grinding wheel – Selection of grinding wheel.

Grinding machines classification and applications – Specifications - Principle of operation of Cylindrical grinder and Centreless grinder- Advantages & Limitations of centreless grinding - Work holding devices - Balancing of grinding wheels – Dressing and Truing of grind wheels.

Broaching machines: Principle of Broaching- Types of Broaching Machines – Working of Horizontal type duplex ram and Vertical type broaching machines - Elements of broach tool – Materials.

4.0 Measurements and Metrology:

Definitions of Measurements and Metrology**-** Importance and Need for measurement - Scope of Metrology - International standardization and Bureau of Indian standards- Definitions of Precision, Accuracy, Reliability and Error – Sources of errors- Common types of measuring tools - Classification of Measuring instruments.

Linear measuring instruments: Applications of Steel rule - Combination set - Feeler gauge - Pitch screwgauge - Vernier caliper - Vernier height gauge- Vernier gear tooth caliper – Micrometer **- S**lip gauges, Ring and plug gauges, feeler gauge, and snap gauge.

Angular measuring instruments: Applications of Bevel protractor, Sine Bar, Angle Slip Gauges - Mechanical comparator, Optical comparator and Electrical comparator.

Working Principles and Applications of: Interferometer, Measuring Microscope, Autocollimator and Coordinating Measuring Machine (CMM).

5.0 Nonconventional Machining Processes

Introduction – Comparison with Conventional machining processes – Methods of Nonconventional Machining Processes – Applications.

Description of Ultrasonic machining (USM) Process - advantages – disadvantages.

Description of Electrical Discharge Machining (EDM) Process – advantages – disadvantages.

Description of Abrasive jet machining - advantages – disadvantages.

Description of Laser beam machining - advantages – disadvantages.

REFERENCE BOOKS

1. Manufacturing Technology - P N Rao (MGH Publishers)
2. Production Technology - R.C.Patel
3. Production Technology - Jain & Gupta.
4. Gear Technology - Charrathi
5. A Text Book of Production Engg . - Dora
6. Tool Design - Donaldson
7. Manufacturing Technology - HajraChowdhary,Volume I & II
8. Manufacturing Technology - P.N.Rao Volume II
9. Mechanical Measurements & Control-Dr.D.S.Kumar (Metropolitan book co.Pvt.Ltd)
10. Mechanical & Industrial Measurements -- R.K.Jain

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II

M-405 :: Manufacturing Technology-II

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.7
Unit Test – II	From 3.8 to 5.6

Course Title	Course Code	Periods/Week	Periods per Semester
Production Drawing	M-406	06	90

M-406 Production Drawing

TIME SCHEDULE

Sl.No	Chapter/Unit Title	Periods	Weightage of Marks		Short answer Questions	Essay type Questions
			PART A	PART B		
1	Introduction to Production Drawing	06	-		-	-
2	Limits, Fits & Dimensional Tolerances	06	05	05	02	-
	Geometrical Tolerances	06	05	03		
	Surface finish	06	05	03	01	
3	Specification of materials and Standard Components	06	05	04	01	-
4	Preparation of Process sheet	12		05		-
5	Detailed and Part Drawings	48		20		02
Total		90	**20**	**40**	**04**	**02**

Course objectives and Course Outcomes

COURSE OBJECTIVES	Upon the completion of the course the student shall be able to	
	1. Familiarize with knowledge of the conventional representation of different materials and machine parts. 2. Familiarize with limits, fits, tolerances, surface treatment symbols adopted in the production drawings. 3 .Demonstrate the above skills in preparation of detailed drawings	
COURSE OUTCOMES	At the end of the course students shall be able to:	
	CO1	Use the conventions used in a production drawing
	CO2	Use the specifications of material and geometrical tolerances
	CO3	Specify the limits, fits and allocate tolerances for machine components
	CO4	Apply concepts and methods in the preparation of production drawings
	CO5	Convert machine drawings into production drawings

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

PO-CO Mapping

3: High, 2: Moderate, 1: Low

Learning outcomes

Upon completion of the course the student shall be able to

1**. 0 Introduction to Production Drawing**

1.1 Differentiate between machine drawing and production drawing.

1.2 Explain abbreviations for materials, draughting abbreviations

1.3 State the factors that govern the preparation of a production drawing.

1.4 Identify the components of a production drawing

2.0 Limits, Fits &Tolerances and Surface Finish

2.1State definition of limits, allowance, tolerance and fits.

2.2Select dimension from standards to give different type of fit for a given mating parts.

2.3Systems of fits-problems relating Hole basis and Shaft basis system and schematic diagrams-

Select dimensions from B. I. S. Tables to obtain clearance, transition and interference fit for a given set of mating parts.

2.4 Selection of fits and tolerances form B. I. S. tables.

2.4Indicate fits on the drawings

2.5 Introduction and indication of form and position tolerances on drawings

2.6 Types of run-out, total run-out and their indication.

2.7 Explain Surface roughness terminology- surface roughness values, Grades and symbols.

2.8 Explain Symbols indicating surface texture

2.9 Surface roughness obtainable from various manufacturing processes, recommended surface roughness on mechanical components.Symbols representing direction of lay.

2.10 Heat treatment and surface treatment symbols used on drawings.

3.0 Specification of Materials

3.1 Identify the materials of various components

3.2 Specify the Raw materials as per Commercial/ BIS Standards

3.3 Identify the standard part that can be procured directly from the market and specify the part as per Commercial/ BIS Standards

4.0 Preparation of process sheet.

4.1 Indicate the sequence of process of production.

4.2 Specify the relevant tools to obtain the accuracy and finish.

4.3 Indicate the suitable equipment.

4.4 Specify the type of measuring instruments to be used to check the prescribed accuracy.9.

Specification of standard components,

5.0 Detailed and part drawings

5.1 Interpretation of Drawings

5.2 Exercises in identifying the type of production, extracting important functional dimensions, checking the number of parts in an assembly. Checking and listing missing dimensions. Identifying the sectional views.

5.3 Prepare the relevant views of the parts of assembly drawing of Rigid Flange Couplings.

5.4 Prepare the relevant views of the parts of assembly drawing of flexible Flange Couplings.

5.5 Prepare the relevant views of the parts of assembly drawing of Universal Coupling,

5.6 Prepare the relevant views of the parts of assembly drawing of Eccentric,

5.7 Prepare the relevant views of the parts of assembly drawing of Foot Step bearing,

5.8 Prepare the relevant views of the parts of assembly drawing of Stuffing box,

5.9 Prepare the relevant views of the parts of assembly drawing of Knuckle Joint,

5.10 Prepare the relevant views of the parts of assembly drawing of Plummer Block

5.11 Prepare the relevant views of the parts of assembly drawing of Screw jack

5.12 Prepare the relevant views of the parts of assembly drawing of revolving centre

5.13 Prepare the relevant views of the parts of assembly drawing of Drill Jig

COURSE CONTENT

1.0 INTRODUCTION TO PRODUCTION DRAWING

Drawing Sheet Sizes, Drawing sheet layout, Title block: 1.Title of the drawing, 2. Sheet number, 3. Scale (s), 4. Symbol, denoting the method of projection, 5. Name of the firm, and 6. Initials of the staff designed, drawn, checked and approved, Standard abbreviations: Draughting, material abbreviations, and shape identification symbols, Conventional representation of materials and machine components, method of indication notes on drawings, welding symbols.

2.0 LIMITS, FITS, TOLERANCES AND SURFACE FINISH

State definition of limits, allowance, tolerance and fits, Select dimension from standards to give different types of fit for a given mating parts, Systems of fits-problems relating Hole basis and Shaft basis system and schematic diagrams- Select dimensions from B. I. S. Tables to obtain clearance, transition and interference fit for a given set of mating parts, Selection of fits and tolerances form B. I. S. tables, Indicate fits on the drawings. Definition of datum, datum feature, datum triangle, datum letter, indication of geometrical tolerance on the drawing, indication of feature controlled, indication of form and position tolerances on drawings, types of run-out, total run-out and their indication.

Explain Surface roughness terminology- surface roughness values, Grades and symbols, indicating surface texture, surface roughness obtainable from various manufacturing processes, recommended surface roughness on mechanical components. Symbols representing direction of lay. Heat treatment and surface treatment symbols used on drawings.

3.0 SPECIFICATIONS OF MATERIALS AND STANDARD COMPONENTS

Materials of the parts of the assembly-size of part, estimation of Raw material required for a component and specification. Standard components Parts like bolts, nuts, and Bearings etc.- specification

4.0 PREPERATION OF PROCESS SHEET

Indicate the sequence of processes of production, specify the relevant tools to obtain the accuracy and finish.

Indicate the suitable equipment, specify the type of measuring instruments to be used to check the prescribed accuracy, Specification of standard components.

5.0 DETAILED AND PART DRAWINGS

Interpretation of Drawings, Exercises in identifying the type of production, extracting important functional dimensions, checking the number of parts in an assembly. Checking and listing missing dimensions. Identifying the sectional views.

Rigid Flange Coupling	Flexible Flange Coupling	Universal Coupling
Eccentric	Foot Step bearing	Stuffing box
Knuckle Joint	Plummer Block	Screw jack
Revolving Center	Drill Jig	Lathe Tool Post

REFERENCE BOOKS

IS 696 – 1972-Code of Practice for General Engg. Drawing & B.I.S Code– SP. 46. IS 696– 1988-IS Code on fits and tolerances.

K.L. Narayana & P. Kannaiah, Production and Drawing, 3rd edition New Age international Publisher

R.K. Jain, Engineering Metrology, 2016 Khanna Publications

M-407 Thermal Engineering Lab

CourseTitle	CourseCode	TotalNo.ofPeriods	TotalPeriodsPer Semester
ThermalEngineering Lab	M–407	03	45

TIMESCHEDULE

S. No.	EXPERIMENT	Periods
1.	ValvetimingdiagramandPorttimingdiagram	06
2.	Performance tests on S.I and C.I engines	09
3.	Economic Speed Test on S. I and C.I engines	09
4.	HeatBalance Sheet	09
5.	Morse Test	06
6.	PerformanceofAircompressor	09
TotalNo.Periods		**45**

Course Objectives and Course Outcomes

CourseObjectives		Uponcompletionofthecoursethestudentshallbeable to: (i) To familiarise with the knowledge of materials and tools used inconductingperformancetestsonI C EnginesandonAircompressors. (ii) To reinforce the concepts performance parameters, economic speed, heat balance, valve timing and porttimingdiagramsbyconductingcorrespondingexperiments	
Course Outcomes		Uponcompletionofthecoursethestudentshallbeable to:	
	CO1	M407.1	Conductthe teststodeterminetheperformanceofICEngines using givenapparatus.
	CO2	M407.2	Conduct the teststodeterminetheperformanceofAircompressors.
	CO3	M407.3	Perform preciseoperationswithI CEnginesandAirCompressors.
	CO4	M407.4	Analysestheexperimentalresultstodrawinferences,tomake recommendations
	CO5	M407.5	Follow ethics and etiquette while working in a group and displayprofessionalism whilecommunicatingasamemberanda leaderina group.

LearningOutcomes

Upononcompletionofthecoursethestudentshall beableto:

1.0 Conductanexperimenttodrawthevalveandporttimingdiagrams
- 1.1 Placethespirit level,metaltapeandpieceof chalk near theengine
- 1.2 Erasethe previouschalkmarksonthe flywheel
- 1.3 Apply lubrication inthe pistonandvalvemechanism
- 1.4 Fixthegraduateddisctothe crankshaft
- 1.5 Adjust thepointertozeropositionofgraduateddisc
- 1.6 Markthe TDCandBDConthedisc usingthespirit level
- 1.7 Mark the operations (Suction, Compression, Ignition, Expansion andExhaust)
- 1.8 Measurethecircumferenceofflywheel
- 1.9 Locate exact position of inlet valve/port opening and inlet valve/port closingbyinsertingfeelergaugebetweeninletroller andcam
- 1.10 FindexactpositionofIgnitionstartingandignitiontripping
- 1.11 Locate exact position of exhaust valve/port opening and exhaust valve/ portclosingbyinsertingfeelergaugebetweenoutlet roller andcam
- 1.12 Measure the circumferential distances between the valve/port opening,closing, ignition starting and ignition tripping with respect to the TDC andBDC
- 1.13

2.0 Conductanexperimenttodeterminetheperformanceparameters

- **2.1** Apply lubricantbetweenthe matingpartsoftheengine
- 2.2 Checkthe fueloilsupplyline
- 2.3 Placethethermometersatrequiredpositions

2.4 Circulating the cooling water through the engine jacket before starting engine and after shutting down the engine

2.5 Start the engine using decompression lever

2.6 Run the engine for a certain period of time before loading

2.7 Measure speed of the engine with tachometer

2.8 Adjust spark timing in case of SI engine

2.9 Adjust the throttle valve to control the fuel supply in case of CI engine

2.10 Apply the load

2.11 Record brake load, speed of rotation (RPM) and the rate of fuel consumption

2.12 Remove the load

3.0 Conductanexperimenttodeterminetheeconomicalspeedtestongiven ICEngine

3.1 Apply lubricant betweenthe matingpartsoftheengine

3.2 Checkthe fueloilsupplyline

3.3 Placethethermometersatrequiredpositions

3.4 Circulating the cooling water through the engine jacket before starting engine and after shutting down the engine

3.5 Start the engine using decompression lever

3.6 Run the engine for a certain period of time before loading

3.7 Measure speed of the engine with tachometer

3.8 Adjust spark timing in case of SI engine

3.9 Adjust the throttle valve to control the fuel supply in case of CI engine

3.10 Apply the loads

3.11 Record brake load, speed of rotation (RPM) at different loads and the rate of fuel consumption

3.12 Remove the load

4.0 Conductanexperimenttodrawtheheatbalancesheetforgiven ICEngine

4.1 Apply lubricantbetweenthe matingpartsoftheengine

4.2 Checkthe fueloilsupplyline

4.3 Placethethermometersatrequiredpositions

4.4 Circulating the cooling water through the engine jacket before startingengineandaftershuttingdownthe engine

4.5 Starttheengineusingdecompressionlever

4.6 Runthe enginefora certainperiodoftimebefore loading
4.7 Measurespeed oftheenginewithtachometer
4.8 Adjust sparktimingincaseofSIengine
4.9 Adjust thethrottlevalve tocontrolthe fuelsupplyincaseofCIengine
4.10 Apply the load
4.11 Record brake load, speed of rotation (RPM), the rate of fuel consumption,the rate of flow of cooling water and water inlet and outlet temperatures ofengine jacket
4.12 Recordexhaustgastemperatureatcalorimeteroutlet

5.0 Conductanexperimenttofindtheperformanceonamulticylinderengine

5.1 Apply lubricantbetweenthe matingpartsoftheengine

5.2 Check the fuel oil supply line

5.3 Placethethermometersatrequiredpositions

5.4 Circulating the cooling water through the engine jacket before starting engine and after shutting down the engine

5.5 Start the engine using decompression lever

5.6 Run the engine for a certain period of time before loading

5.7 Measure speed of the engine with tachometer

5.8 Apply the load

5.9 Record brake load, speed of rotation (RPM), the rate of fuel consumption

5.10 Cut off the first cylinder

5.11 Record brake load, speed of rotation (RPM), the rate of fuel consumption

5.12 Repeat the above operations for all the cylinders

6.0 Conduct performance test onAircompressor
6.1 Checkthelubricatingoillevel inthecrankcase
6.2 Openingandclosingofstorageoutletvalve
6.3 Checkingorifice anditsdiaphragm condition
6.4 FillwaterinU-tubemanometer
6.5 Check functionandusage oftachometer
6.6 Checkfunctionandusage ofstopwatch
6.7 Recordtimetakenfor10revolutionsofenergymeterdisc
6.8 Recordcompressorspeed (RPM)usingtachometer
6.9 Recordmanometerreadings
6.10 Recordpressuregaugereading

COURSE CONTENT

1. Experiment to draw valve timing diagram of petrol and Diesel engines
2. Experiment to draw Port timing diagram of petrol and Diesel engines
3. Load test to determine performance parameters of petrol and Diesel engines
4. Economic speed test
5. Load test to draw heat balance sheet
6. Morse test to determine IP of multi cylinder petrol engine
7. Performance test on Air compressor

M-408: English Communication Skills (Lab Practice)

Course Title : English Communication Skills	**Course code: C23-Common- 408 (Common to all Branches)**
Year/ Semester : IV Semester	**Number of Periods : 45 (3 periods per week)**
Type of Course : Practical	**Max Marks : 100 (Internal 40 + External 60)**

Course Objectives:	- to communicate effectively in diverse academic, professional and everyday situations
	- exhibit appropriate body language and etiquette at workplace
	- be employable through preparing appropriate job applications and attend interviews confidently with all necessary skills

CO No.	
CO1	Listen and comprehend the listening inputs related to different genres effectively
CO2	Communicate effectively in interpersonal interactions, interviews, group discussions and presentations
CO3	Acquire employability skills: job hunting, resume writing, attending interviews
CO4	Practise appropriate body language and professional etiquette

Course Delivery: Text book: **"English Communication Skills"**
by State Board of Technical Education and Training, AP

Sl No	Unit	Teaching Hours
1	Listening Skills	6
2	Workplace Etiquette	3
3	Introducing Oneself	3
4	Short presentation (JAM)	6
5	Group Discussion	6
6	Resume Writing and Cover Letter	3
7	Interview Skills	9
8	Presentation Skills	9
	Total	*45*

Course Content:

UNIT I:Listening Skills **6 periods**

Pre – While- Post-listening activities- Listening to audio content (dialogues/ speech/ narrations) - answering the questions and fill in the blanks- vocabulary

UNIT 2: Workplace Etiquette **3 periods**

Basics of Etiquette- politeness/ courtesy, good manners- features of work place etiquette- adaptability, positive attitude, body language.

UNIT 3: Introducing Oneself **3 periods**

Speak about oneself - introduce oneself to a gathering/ formal & informal situations- Know about others- filling in the grid- introducing oneself in interviews

UNIT 4: Short Presentation **6 periods**

Dos and Don'ts in short presentation- speak for a minute without repetition, deviation & hesitation - the techniques to speak fluently – defining and describing objects, people, phenomena, events.- speaking on randomly chosen topics.

UNIT 5: Group Discussion **6 periods**

Fundamentals of Group Discussion- Dos and Don'ts- filling the Grid- possible list of topics- practice sessions- sample videos-Group activity

UNIT 6: Resume Writing and Cover Letter **3 periods**

Pre activity: answer the questions- jotting down biographical information- sample resumes- tips, Dos and Don'ts- model resumes- practice exercises on Resume writing

UNIT 7: Interview Skills **9 periods**

Pre –while-post activities: - things to do at three stages – respond to notifications- know the information about the organisation-practice FAQs - preparation of good/ suitable C V, Body language, tips for success in interviews, model / mock interviews.

UNIT 8: Presentation Skills **9 periods**

Preparatory work: observe pictures and answer questions- different kinds of presentations- PPTs, Flash cards, Posters, Charts. - tips to prepare aids, slide show, model PPTs, - checklist on pre, while and post presentations.

Mapping Course Outcomes with Programme Outcomes:

PO	1	2	3	4	5	6	7
CO	POs 1 to 5 are applications of Engineering Principles, can't be directly mapped to English Communication Skills					1,2,3,4	1,2,3,4

Unit wise Mapping of CO –PO

CO	**Course Outcome**	**COs / Unit Mapped**	**POs** mapping	**Cognitive levels as per Bloom's Taxonomy R/U/A/An (Remembering / Understanding / Applying/ Analysing)**
CO 1	Listen and comprehend listening inputs related to different genres effectively	Unit 1	6,7	R/U/A
CO2	Communicate effectively in interpersonal interactions, interviews, group discussions and presentations	Units 3,4,5,7,8	6,7	R/U/A/An
CO3	Acquire employability skills: job hunting, resume writing, attending interviews	Units 6,7	6,7	R/U/A/An
CO4	Practise appropriate body language and professional etiquette	Units 2, 3, 4,5,7,8	6,7	R/U/A

M-409 HYDRAULICS & FLUID POWER SYSTEMS LAB

Course Title	*Course Code*	*Periods/Week*	*Periods/Semester*
HYDRAULICS & FLUID POWER SYSTEMS LAB	M-409	*03*	45

TIME SCHEDULE

S.No	EXERCISE TITLE	Periods allocated
1	Verification of Bernoulli's Theorem	06
2	Determination of Coefficient of Discharge of Venturi Meter	03
3	Determination of Friction Factor for a Given Pipe Line	03
4	Performance Test on Pelton Wheel	03
5	Performance Test on Francis Turbine	06
6	Performance Test on Kaplan Turbine	06
7	Performance Test on Centrifugal Pump	06
8	Performance Test on Reciprocating Pump	06
9	Demonstration of Hydraulic Circuits	03
10	Demonstration of Pneumatic Circuits	03
Total		**45**

Course Objectives and Course Outcomes

COURSE OBJECTIVES	Upon completion of the course the student shall be able to	
	Familiarize with knowledge in verification of principles of fluid flow	
	Use skills in measuring pressure, discharge and velocity of fluid flow	
	reinforce theoretical concepts by conducting experiments for Major and Minor Losses	
	reinforce theoretical concepts by conducting experiments in performance testing of Hydraulic Turbines and Hydraulic Pumps	
	Familiarize with the main components of the hydraulic and pneumatic systems and design, draw circuits and demonstrate hydraulic and pneumatic circuits for a given problem.	
COURSE OUTCOMES	CO1	Perform experiments to determine the coefficient of discharge of Venturi meter.
	C02	Demonstrate the experiments to determine the co-efficient of friction of flow in a pipe and minor losses in pipe joints
	C03	Demonstrate the experiments on hydraulic turbines to draw characteristic curves
	C04	Demonstrate the experiments on pumps to draw characteristic curves

	C05	Identify the common hydraulic and pneumatic components, their uses and symbols

PO-CO Mapping

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

3: High, 2: Moderate,1: Low

Learning outcomes

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

1.0 Verification Of Bernoulli's Theorem

1.1 State Bernoulli's theorem

1.2 Identify the apparatus required

1.3 Explain the Test procedure to verify Bernoulli's experiment.

2.0 Determination of C_d of Venturimeter

2.1 State the practical applications of venturimeter.

2.2 Record the manometric head readings from U-tube manometer

2.3 Record the time taken for collecting discharge by varying the discharge

2.4 Calculate the areas of the pipe and throat of the given venturimeter

2.5 Calculate coefficient of discharge of venturimeter.

3.0 Determination of loss of head due to friction in a given pipe

3.1 Measure the length of the given pipe

3.2 Record the pressure head readings from U-tube manometer

3.3 Record the time taken for collecting discharge by varying the discharge

3.4 Calculate the loss of head through the pipe

3.5 Calculate the friction factor

4.0 Determination of Power and Efficiency of Pelton Wheel

4.1 Identify the components of Pelton wheel

4.2 Start turbine by switching on jet of water slowly

4.3 Apply load steadily

4.4 Record load, speed

4.5 Calculate brake power and efficiency of turbine

5.0 Determination of Power and Efficiency of Kaplan Turbine

5.1Identify the components of Kaplan Turbine

5.2 Start turbine by giving input water supply

5.3 Apply load steadily

5.4 Record load, speed

5.5 Calculate power and efficiency of turbine

6.0 Determination of Power and Efficiency of Francis Turbine

6.1 Identify the components of Francis Turbine

6.2 Start turbine by switching on jet of water slowly

6.3 Apply load steadily

6.4 Record load, speed

6.5 Calculate power and efficiency of turbine

7.0 Determination of Power required and Efficiency of Centrifugal Pump

7.1 Identify the components of centrifugal pump
7.2 Record the suction and delivery pressures from pressure gauges
7.3 Record the time taken for collecting the discharge
7.4 Record the energy meter readings and calculate input power
7.5 Calculate the power input
7.6 Calculate the efficiency

8.0 Determination of of Power required and Efficiency of Reciprocating Pump

8.1 Identify the components of reciprocating pump
8.2 Record the suction and delivery pressures from pressure gauges
8.3 Record the time taken for collecting the discharge
8.4 Record the energy meter readings and calculate input power
8.5 Calculate the power input
8.6 Calculate the efficiency

9.0 Identification of Hydraulic circuits

9.1 Explain Hydraulic Circuit
9.2 Identify & List Symbols used in Hydraulic circuits.
9.3 List all the hydraulicapplications.
9.4 Classify the actuators.
9.5 List different types of valves.
9.6 Explain the function of a valve.
9.7 Identify the components of a valve.
9.8 Identify about ports and positions.
9.9 List the Applications of valves.

10.0 Identification of Pneumatic Circuits

10.1 Explain Pneumatic Circuit
10.2 Identify & List Symbols used in Pneumatic circuits.
10.3 Explain the phenomena of compressed air for transmitting power.
10.4 List all the pneumatic applications.
10.5 Define Pneumatic actuator.
10.6 Classify the actuators.
10.7 Explain Linear actuators and Rotary actuators.
10.8 List different types of valves.
10.9 Explain the function of a valve.
10.10 Identify the components of a valve.
10.11 Identify about ports and positions.
10.12 List the Applications of valves.

COURSE CONTENT

1. Verification of bernoulli's theorem
2. **V**enturimeter
3. Determination of friction factor for a given pipe line
4. Performance test on pelton wheel
5. Performance test on francies turbine
6. Performance test on kaplan turbine
7. Performance test on centrifugal pump
8. Performance test on reciprocating pump
9. Hydraulic circuit
10. Pneumatic circuit

M-410 Machining & Metrology Laboratory

Course Title	*Course Code*	*Periods/Week*	*Periods/Semester*
Machining& Metrology Laboratory	M-410	*03*	45

TIME SCHEDULE

Course Objectives		Upon the completion of the course the student shall able to To Familiarize Milling Machine • To handle milling, Slotting, Grinding and Welding Operations safely • To reinforce theoretical concepts by practising relevant exercises of Milling, slotting, Grinding and Welding Operations • Obtain skill in Milling, slotting, Grinding, Shaping and Welding Operations	
Course Outcomes	CO1	M-410.1	Perform the operations on milling Machine
	CO2	M-410.2	Perform the operations on Slotting Machine &shaper
	CO3	M-410.3	Perform the operations on Grinding Machine
	CO4	M-410.4	Fabrication of joints by welding
	CO5	M-410.5	Perform measurements using various measuring instruments

S.NO	EXPERIMENT TITLE	NO.OF PERIODS
1	Hands on practice on Milling Machine • T-Slot cutting • Spur Gear Cutting • Helical Gear Cutting	9
2	Hands on practice on Slotting Machine • Keyway Cutting	9
3	Hands on practice on shaper • Preparation Keyway Cutting	9
4	Hands on practice on Surface Grinding Machine • Preparation of Rectangular Block	6
5	Hands on practice on Arc Welding Machine • T-joint • H-joint	6
6	Hands on practice on various measuring instruments • Sine bar, Micrometer, gauges • Tool makers microscope	6
	TOTAL	**45**

Learning outcomes:
Upon completion of the course the student shall be able

Perform T-slot cutting on milling machine

1.1 Select proper tool to perform the job
1.2 Set the Job on Machine
1.3 Select the speed for milling operation
1.4 Practice T-slot cutting operation on a milling machine
1.5 Use measuring instruments for checking dimensions.
1.6 Indexing methods explanation and application on milling machine

Perform Spur gear cutting on milling machine

2.1 Select milling cutter to perform the job
2.2 Set the Job on Machine
2.3 Index the job
2.4 Select the speed for gear cutting operation
2.5 Practice gear cutting operation on a milling machine
2.6 Use measuring instruments for checking dimensions

Perform helical gear cutting on milling machine

3.1 Select milling cutter to perform the job
3.2 Set the Job on Machine
3.3 Index the job
3.4 Select the speed for helical gear cutting operation
3.5 Practice helical gear cutting operation on a milling machine
3.6 Use measuring instruments for checking dimensions

Perform keyway cutting on slotting machine

4.1 Select cutter to perform the job
4.2 Set the Job on Machine
4.3 Select the speed for Slotting operation
4.4 Practice slotting operation on a slotting
4.5 Use measuring instruments for checking dimensions

Perform surface grinding on rectangular block

5.1 Explain the constructional features, working principles and safety aspect of Surface grinder
5.2 Explain functional application of different levers, stoppers, adjustment Practice grinding operation
5.3 Identify different lubrication points of surface grinder
5.4 Identify lubricants and their usage for application in surface grinder
5.5 Identify different work and tool holding devices and acquaint with functional application of each device
5.6 Mount the work and tool holding devices with required alignment and check for its functional usage to perform surface grinding operations
5.7 Observe safety procedure during mounting as per standard norms

Perform keyway cutting on shaping machine

6.1 Select cutter to perform the job
6.2 Set the Job on Machine
6.3 Select the speed for Shaping operation

6.4 Practice key way cutting on a shaper
6.5 Use measuring instruments for checking dimensions

Fabrication of T-joint and H-joint by arc welding method

7.1 Plan and select the type & size of electrode, welding current.
7.2 Prepare edge as per requirement
7.3 Prepare, set arc welding machine as per sketch.
7.4 Deposit the weld maintaining appropriate arc length, electrode angle, welding speed,
weaving technique and safety aspects.
7.5 Clean the welded joint thoroughly.
7.6 Carry out visual inspection for appropriate weld joint

Fabrication of stool frame by arc welding method

8.1 Prepare the angle iron pieces as per drawing
8.2 Plan the sequence of steps
8.3 Plan and select the type & size of electrode, welding current.
8.4 Prepare edge as per requirement
8.5 Prepare, set arc welding machine as per sketch.
8.6 Deposit the weld maintaining appropriate arc length, electrode angle, welding speed, weaving technique and safety aspects.
8.7 Clean the welded joint thoroughly.
8.8 Carry out visual inspection for appropriate weld joint

METROLOGY: Measuring Instruments

9.1 Measuring the given component using Combination square, universal bevel
protractor, sine bar.
9.2 Measuring the given componentusing slip gauges, Ring and plug gauges,
snap gauges
9.3 Measuring the given componentusing vernier height gauge, vernier depth gauge, micrometre
9.4 Measuring the given component using Tool Makers Microscope

V SEMESTER

C-23 :: DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
V Semester

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-501	Industrial Management and Entrepreneurship.	4	-	60	3	20	80	100
M-502	Industrial Engineering and Quality Control.	4	-	60	3	20	80	100
M-503	Green Energy & Thermal Systems.	5	-	75	3	20	80	100
M-504	Industrial Automation & 3D Printing.	4	-	60	3	20	80	100
M-505	Refrigeration and Air Conditioning.	4	-	60	3	20	80	100
PRACTICAL								
M-506	CAD Lab Practice	-	3	45	3	20	30	50
M-507	**CAM Lab Practice**		3	45	3	20	30	50
M-508	Life Skills Lab	-	3	45	3	40	60	100
M-509	Refrigeration and Air Conditioning Lab.	-	3	45	3	40	60	100
M-510	***Training cum Production Workshop.***		3	45	3	40	60	100
M-511	***Project Work.***	-	3	45	3	40	60	100
Co-Curricular Activities								
1	*Library*		1	15				
2	**Physical Education*		1	15				
3	**Quantitative Aptitude / Seminars / Social Awareness Programmes etc.*		1	15				
	TOTAL	**21**	**21**	**630**		**300**	**700**	**1000**

[Note: M-508 is Common with all Branches]

M-501 Industrial Management and Entrepreneurship

Course Title	Course Code	Periods per Week	Periods per Semester
Industrial Management and Entrepreneurship	M-501	04	60

TIME SCHEDULE

Sl. No.	Chapter/ Unit Title	Periods	Weightage of Marks	Short Answer Questions (3 M)	Essay Type Questions (10 M)	CO's Mapped
1.	Principles of Management.	08	16	2	1	C01
2	Organization Structure & Organizational Behaviour.	15	26	2	2	CO2
3.	Production Management.	14	26	2	2	CO3
4.	Engineering Ethics & Safety and Labour Codes.	15	26	2	2	CO4
5.	Entrepreneurship & Start-ups.	08	16	2	1	CO5
Total		**60**	**110**	**10**	**8**	

Course Objectives and Course Outcomes

COURSE OBJECTIVES		Upon completion of the course the student shall be able to (i) Familiarize the concepts of management, and organization structures. (ii) Explain organizational behavioural concepts, basics of production management in industries. (iii) Understand the Engineering Ethics, Industrial Safety, Labour codes and entrepreneurial developmentprogrammes.	
COURSE OUTCOMES	CO1	M-501.1	Understand the principles of management as applied to industry.
	C02	M-501.2	Explain types of the industrial organization structures and the behaviour of an individual in an organization, motivational and leadership styles.
	C03	M-501.3	Explain the different aspects of production management.

	CO4	M-501.4	Explain Engineering Ethics, Industrial Safety and industrial Labour Codes.
	CO5	M-501.5	Explain Entrepreneurial development programmes and Start-ups.

CO and PO Mapping

	PO 1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO 6**	**PO7**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1							1		
CO2		1								2
CO3	3								2	2
CO4						3		1	2	
CO5							2	1	2	

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

Understand the principles of management as applied to industry.

1.0 Principles of Management
- **1.1** Define industry, commerce and Trade.
- **1.2** Know the need for management.
- **1.3** Understand functions of Management.
- **1.4** List the principle of scientific management by F.W.Taylor
- **1.5** List the principle of modern management by Henry Foyal.
- **1.6** Differentiate management, administration and organization
- **1.7** Differentiate Lower, Middle and Top level management
- **1.8** Explain the importance of Managerial skills (Technical, Human, Conceptual)
- **1.9** Know the objectives of Management Information Systems.
- **1.10** Know the Characteristics of Management Information Systems.

2.0 Organization Structure & Organizational Behaviour
- **2.1** Define organization structure.
- **2.2** Explain line, staff and line & staff organization structures with advantages, disadvantages and applications.
- **2.3** List various Motivation theories.

2.4 Explain Maslow's Hierarchy of needs.
2.5 Explain Different leadership styles.
2.6 Explain Trait theory of leadership
2.7 Explain Behavioral theory of Leadership.
2.8 Explain the importance of human resource management.
2.9 Understand the process of recruitment, selection and training
2.10 State the Objectives of Job Analysis.

3.0 Production Management

3.1 Define Production, Planning and Control.
3.2 Explain Mass production, Batch production and Job order production.
3.3 Define the terms Routing, Scheduling and Dispatching.
3.4 List applications of network diagrams
3.5 Draw PERT and CPM Network Diagrams – Simple Problems.
3.6 Know the functions of Materials Management.
3.7 Explain ABC analysis of Inventory.
3.8 Explain concept of Economic ordering quantity.
3.9 Explain meaning of Supply chain management.
3.10 Write processes of Supply Chain Management
3.11 List the Functions of Purchase Department.
3.12 Write functions of Stores Department.

4.0 Engineering Ethics & Safety and Labour Codes

4.1 Definition of Engineering Ethics.
4.2 Understand Core qualities of Professional Engineers.
4.3 Explain Different types of Ethics in Engineering.
4.4 Explain the meaning of Intellectual Property Rights
4.5 List common types of Intellectual Property Rights.
4.6 List Activities of Corporate Social Responsibility (CSR).
4.7 State the need of Human values in engineering fields.
4.8 Comprehend the importance of safety at Workplace.
4.9 ListDifferent hazards in the industry.
4.10 State the causes of accidents, costs of accidents and their prevention.
4.11 List Salient features of Code on Wages, 2019.
4.12 List Salient features of Industrial Relations Code, 2020,
4.13 List Salient features of Code on Social Security, 2020
4.14 List Salient features of Occupational Safety, Health and Working Conditions Code, 2020.

5. **Entrepreneurship & Start-ups**

5.1 Define the word Entrepreneur and Entrepreneurship.
5.2 Explain various self - employment schemes
5.3 List the Financial assistance programmes provided by the Governments.
5.4 Explain the concept of TQM and ISO 9000 series and BIS 14000 Series.
5.5 List the Advantages and Drawbacks of ISO 9000 series of standards.
5.6 Explain the Concept of Incubation center's.
5.7 Explain Startup and its stages.
5.8 Explain Break Even Analysis to make or buy the products.
5.9 State the Importance of Branding.
5.10 State the significance of Business name, logo and tag line.
5.11 Explain the Concepts of Digital Marketing.
5.12 Know the Role of E-commerce and Social Media.

Course Content

1.0 Principles of Management

Introduction: Industry, Commerce and Trade; Definition of management; Functions of management; Principles of Scientific Management: F.W. Taylor - Principles of Modern Management: Henry Fayol; Administration organization and management; Levels of management - Managerial skills - Management Information Systems: Objectives and Characteristics.

2.0 Organization Structure & Organizational Behaviour

Organization Types: Line, Staff and Line & Staff Organizations – Maslow's motivational theory; Leadership Styles – Trait theory of leadership – Behavioural theory of Leadership.
Job Analysis –Importance of human resource management - Selection procedure – Training of Workers: Apprentice Training – On job training.

3. Production Management.

Production, Planning and Control – Types of Production - Routing, Scheduling and Dispatching - PERT and CPM Network Diagrams – Applications - –Calculate Project Duration and identify the critical path of the Project – Simple Problems; Functions of Materials Management - ABC analysis of Inventory. - Economic ordering quantity- Meaning of Supply Chain Management – Processes of Supply Chain Management - Functions of Purchase Department - Purchasing Procedure -Functions of Stores Department – Bin Card.

4. Engineering Ethics & Safety and Labour Codes

Engineering Ethics: Definition – Classification of Engineering Ethics - Personal and Business ethics –Value based ethics - Environmental ethics – Meaning of Intellectual Property Rights – Common types of Intellectual Property Rights - Activities of Corporate Social Responsibility (CSR).

Human values : Morals – Values –Character- Caring –Courage - Cooperation – Commitments –Empathy – Honesty- Integrity - Respect for others – Sharing–Service learning.

Industrial Safety: The importance of safety at Workplace -Hazard and accident - Different hazards in the industry -The causes of accidents and prevention of accidents - Direct and indirect cost of accidents.

Industrial Labour Codes: Meaning of Employer and Employee - Objectives of Industrial Labour Codes – Salient features of Code on Wages, 2019 - Salient features of Industrial Relations Code, 2020 - Salient features of Code on Social Security, 2020 - Salient features of Occupational Safety, Health and Working Conditions Code, 2020.

5. Entrepreneurship & Start-ups

Entrepreneur - Entrepreneurship - Role of Entrepreneur - Qualities of an entrepreneur- Requirements of an entrepreneur - Expectations of Entrepreneure - Self-employment schemes - Institutional support - Concept of TQM –Pillars of TQM- Importance of ISO 9000 certification - Concepts of ISO 9000 Series and BIS 14000 Series- Advantages and Drawbacks of ISO 9000 series of standards - List the beneficiaries of ISO 9000.

Financial assistance programmes - Concept of Incubation center's – Start-up and its stages –– Make or Buy Decision – Break Even Analysis - Branding – Business name, logo and tag line – Concepts of Digital Marketing - Role of E-commerce and Social Media.

REFERENCEBOOKS

1. Industrial Engineering and Management -by O.PKhanna
2. Production Management-by Buffa.
3. Engineering Economics and Management Science-by Banga & Sharma.
4. Personnel Management by Flippo.
5. Production and Operations Management–S.N.Chary
6. Converging Technologies for Smart Environments and Integrated Ecosystems IERC Book Open Access 2013 pages-54-76.

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II
M-501 :: Industrial Management & Entrepreneurship start-ups

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.12
Unit Test – II	From 4.1 to 5.12

M-502Industrial Engineering and Quality Control

Course Title	Course Code	Periods/Week	Periods per Semester
Industrial Engineering and Quality Control	**M-502**	**04**	**60**

TIME SCHEDULE

Sl. No.	Chapter/Unit Title	Periods	Weightage of Marks	Short Answer Questions (3 M)	Essay Type Questions (10 M)	CO's Mapped
1	Work Study	14	26	2	2	C01
2.	Plant Engineering and Factory Costing.	12	21	2	1.5	CO2
3	Quality Control Techniques	12	21	2	1.5	CO3
4	Estimation of Weights and Machining Times.	12	21	2	1.5	CO4
5	Estimation of Forging and Welding Costs.	10	21	2	1.5	CO5
	Total	**60**	**110**	**10**	**8**	

Course Objectives and Course Outcomes

Course Objectives			**Upon completion of the course the student shall be able to** • Contribute to improving efficiency, productivity and/or quality of products manufactured or services provided in the organizations. • Address the underlying concepts, methods and application of Engineering Costing & Estimating
Course Out Comes	CO1	M-502.1	Explain principle of work study and contribution of work study to productivity and wage systems.
	CO2	M-502.2	Explain Break down maintenance, preventive maintenance and scheduled maintenance. Explain how to estimate the cost of a manufactured product.
	CO3	M-502.3	Illustrate various statistical quality control methods.
	CO4	M-502.4	Estimate weight of material and machining times for a product to be manufactured or machined.
	CO5	M-502.5	Estimation the cost of a product manufactured or fabricated by using Forging and Welding Techniques.

CO-PO MAPPING

POs	Mapped with CO No	Course Title : Industrial Engineering and Quality Control No of COs:05			Course Code : M-502 No. of periods: 60
		CO Periods Addressing PO in Col 1		Level (1,2,3)	Remarks
		No	%		
PO1	CO1-CO5	41	54.7	3	>40% Level 3 (Highly Addressed) 25% to 40% Level 2 (Moderately Addressed) 5% to 25% Level 1 (Low Addressed) <5% Not Addressed
PO2					
PO3	CO2-CO5	19	25.33	2	
PO4					
PO5	CO1, CO4,CO5	15	20	1	
PO6					
PO7	-			-	

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

Suggestive activities for further strengthening of CO-PO mapping:

1. Seminars may be arranged by industrial experts to make case studies on method study and time study.
2. Students shall be asked to carry a mini project on estimation and costing of an item.

3. Assignment on approaching the industries for obtaining assistance under corporate social responsibility.

Learning Outcomes

Upon completion of the course the student shall be able to

1.0. Work Study

1.1 Define Production, Productivity, Work study, Method Study and Work Measurement

1.2 State objectives and applications of Work study, Method Study and Work Measurement

1.3 Explain the Steps: Define, Record, Critical Examination, Develop, and Install and maintain for conduct of method study to increase the productivity.

1.4 Explain process chart symbols with examples.

1.5 Explain the use of flow diagram and string diagram.

1.6 Explain Time study Procedure by using a stop watch.

1.7 Compute the standard time for an operation by adding its constituent elements.

1.8 Explain the procedure of Predetermined Motion Time Standards (PMTS)

1.9 Explain the method of conducting work sampling.

1.10 State the terms involved in wage systems.

1.11 State different incentive plans.

2.0 Plant Engineering and Factory Costing.

2.1. Define Plant and Plant layout.

2.2. List the factors for the selection of site for an industry

2.3. Explain various types of plant layouts with applications.

2.4. State the importance of Plant maintenance.

2.5. Briefly explain Break down maintenance, preventive maintenance and scheduled maintenance.

2.6. State the Principles of material handling equipment.

2.7 Define Estimation and Costing.

2.8. Solve simple numerical problems on selling price of the products.

2.9 Define Depreciation.

2.10. List the causes of depreciation

2.11. List various methods of calculating depreciation.

2.12 Compute depreciation charges by 1) Straight Line method 2) Sinking Fund Method and

3) Sum of Years' Digits method.

3.0 Quality Control Techniques

3.1 Define the term Quality given by P.Crosby , W. Edward, Deming and Joseph M. Juran.

3.2 Define Vision, Mission and Strategic Planning.

3.3 Define the terms used in Quality Systems.
3.4 Define the term Quality Control and Inspection.
3.5 List basic quality control tools.
3.6 State the Concept of Make in India, ZERO defect and ZERO Effect.
3.7 Write the characteristics of Normal Distribution Curve.
3.8 Explain the Concept of six sigma.
3.9 Explain the 5-S concepts of improving quality in the organisation.
3.10 Explain control charts with classification, advantages and applications.
3.11 Construct Control charts for variables data and attributes data.
3.12 Interpret control charts for "Process in control" or Process out of control".

4.0 Estimation of Weights and Machining Times

4.1 Calculation of Volume, Weight and Material cost of manufacturing a given component.
4.2 Estimation of machining times: General Formulae for calculating the Machining time for the given job.
4.3 Calculation of machining time required for turning, knurling, facing, drilling, boring, reaming, threading, and tapping operations to be performed on the given component without considering the allowances.

5.0 Estimation of Forging and Welding Costs

5.1 Explain various forging losses.
5.2 Estimate the length for a given component by forging.
5.3 Estimate the cost of forging.
5.4 Estimate the cost of Fabrication by Gas welding.
5.5 Estimate the cost of Fabrication by Arc welding.

COURSE CONTENT

1.0 Work Study

Industrial Engineering: Definition of Production and productivity;
Work Study: Definition, objectives and scope of work study.
Method Study: Definition, objectives, procedure of conducting method study.
Process chart symbols – Explanation with Operation process chart, Flow process chart and Two handed process charts only - Uses of flow diagram and string diagram.
Work Measurement or Time study: Definition, objectives - Work measurement techniques.
Time Study: Procedure by using a stop watch to measure the standard time- Constituents of standard time: Normal time- rating factor- allowances – Simple Problems.
Standard data: Determination of standard time by using Predetermined Motion Time Standards (PMTS) - Determination of standard time by using work sampling. – Applications.

Wage and Incentive plans: Definitions of wage, nominal wage, real wage, living wage, minimum wage , fair wage and incentive - List different incentive plans – problems on wage system deleted

2.0 Plant Engineering and Factory Costing.

Plant Engineering: Plant – Selection of site of industry – Plant layout – Types: process, product and fixed position –Importance of Plant maintenance – Break-down maintenance, preventive maintenance and scheduled maintenance - Principles of material handling equipment.

Factory Costing: Estimating and Costing - Elements of costs – Components of costs – Procedure for estimation of selling price of the given product - Numerical Problems on calculating the selling price of the given Product.

Depreciation: Definition – Causes - methods of depreciation - Simple problems on calculation of depreciation Fund by 1) Straight Line method 2) Sinking Fund Method and 3) Sum of Years' Digits method.

3.0 Quality Control Techniques

Meaning of Quality - Objectives- Vision, Mission and seven steps in Strategic Planning.

Quality systems: Definitions of the terms used in quality systems like, quality policy, quality planning, and quality improvement, quality control and quality assurance - Seven Quality control tools.

Distinguish Inspection and Quality Control.

Concept of Make in India, ZERO defect and ZERO Effect – Benefits.

Characteristics of Normal Distribution Curve-Concept of Six sigma - Objectives – advantages.

5-S Principles – Importance – Meaning – Approach – Benefits.

Statistical Quality Control: Definition - Chance and assignable causes –Types of statistical data – variables and attributes data.

Control Charts for variables data- Construction of Control Charts for X-Bar and R- Charts. Interpretation of control charts to know whether the process is out of control or in control - Simple Numerical Problems.

Control charts for attributes data: Fraction defective (p), percent defective (100p) , Number of Defectives (np) charts - Interpretation - Simple Numerical Problems.

4.0 Estimation of Weights and Machining Times

Estimation of Weight of given component: Calculation of volume, weight and material cost of manufacturing a given component - Simple Numerical Problems.

Estimation of Machining Times - Calculation of machining time required for turning, knurling, facing, drilling, boring, reaming, threading, and tapping operations to be performed on the given component - Simple Numerical Problems.

5.0 Estimation of Forging and Welding Costs.

Estimation of the Forging Cost: Estimation procedure – Forging losses - Estimating forging cost of given component by considering losses – Simple Numerical Problems.

Estimation of the Welding cost: Estimation procedure - Calculate arc welding and gas welding costs for making the given joint by considering material, labour, and power costs - Simple numerical problems.

REFERENCE BOOKS

1. Work study – by Ralph Banes.
2. Work study – by I.L.O.
4. Industrial Engineering & Management Science - by T.R. Banga
5. S.Q.C – by Grant & Levenworth
6. S.Q.C -by Juran
7. S.Q.C -by Gupta
8. Mechanical Estimating & Costing - B.P.Sinha
9. Estimating & Costing - Agarwal.
10. Estimating & Costing - Narang & charya.
11. Estimating & Costing - T.R. Banga – Sharma.

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II

M-502 :: Industrial Engineering and Quality Control

Unit Test	Learning Outcomes to be covered
Unit Test – I	1.1 – 3.12
Unit Test – II	4.1 – 5.5

M-503 GREEN ENERGY AND THERMAL SYSTEMS

Course Title	Course Code	Periods per Week	Periods per Semester
GREEN ENERGY AND THERMAL SYSTEMS	M-503	5	75

TIME SCHEDULE

S. No.	Chapter/Unit Title	Periods	Weightage of Marks	Short Answer Questions (3 M)	Essay Type Questions (10 M)	CO's Mapped
1	Thermodynamic Processes of Vapour	15	16	2	1	CO 1
2	Steam Boilers	10	16	2	1	CO 2
3	Steam Turbines	15	26	2	2	CO 3
4	Thermal and Nuclear Power Plants	15	26	2	2	CO 4
5	Green Energy and E-Vehicles.	20	26	2	2	CO 5
	Total	**75**	**110**	**10**	**8**	

Course Objectives and Course Outcomes

Course Objectives			Upon completion of the course the student shall be able to: Apply the principle and concepts of thermal engineering to solve the Contemporary real time applications. Understand the need of Green (Renewable) energy sources. Understand the need and implementation of E-vehicles.
Course Outcomes	CO 1	M-503.1	Determine the properties and thermodynamic processes on pure substances
	CO 2	M-503.2	Explain the working of modern high pressure Steam Boilers
	CO 3	M-503.3	Explain the working of Steam Turbines and Steam Condensers.
	CO 4	M-503.4	Describe the functions of elements of thermal power plant and Nuclear power plants.
	CO 5	M-503.5	Appreciate the sources of green energy and importance and implementation of E- vehicles.

PO-CO Mapping

Course Code: M-503		Course Title: GREEN ENERGY AND THERMAL SYSTEMS.			No. of Periods: 75
PO No	Mapped with CO Number	CO Periods addressing PO in Col 1		Level (1,2,3)	Remarks
		No	%ge		
PO1	CO1 – CO4	15	25	2	>40% Level 3 Highly addressed 25% to 40% Level 2 Moderately Addressed 5 to 25% Level 1 Low addressed <5% Not addressed
PO2	CO1 – CO4	30	50	3	
PO3	CO4	05	08	1	
PO4					
PO5					
PO6					
PO7	CO1 – CO4	10	17	1	

PO-CO Mapping

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

Learning Outcomes

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

1.0 Thermodynamic Processes of Vapour

1.1 Define the term Pure Substance and give examples for pure substances.

1.2 Explain phase change process of steam.

1.3 Define the terms (a) Dryness fraction (b) Degree of superheat of vapour.

1.4 Represent Isochoric, Isobaric, Isothermal, Adiabatic, Polytrophic and Throttling processes of vapour on p-V and T-s diagrams

1.5 Write Mathematical Expressions for Heat transfer, Work transfer, change in internal energy, change in enthalpy and change in entropy of vapour in the above cases.

1.6 Solve simple problems by using Steam tables and Mollier chart for the above cases.

1.7 State the purpose of a calorimeter and list different types of calorimeters.

2.0 Steam Boilers

2.1 State the functions of a boiler

2.2 Distinguish between water-tube and fire-tube boilers

2.3 State the need of high pressure modern boilers

2.4 Explain the working principle of Lamont and Benson Boilers with legible sketches.

2.5 State the function of the mountings such as pressure gauge, water level indicator, safety valve, fusible plug, blow down cock and stop valve

2.6 State the function of the accessories such as feed pump, air preheater, economizer, super heater, steam traps and steam separators.

2.7 Define and explain the terms (a) Equivalent evaporation (b) Factor of evaporation (c) Boiler power (d) Boiler efficiency.

2.8 List the factors influencing boiler efficiency.

3.0 Steam Turbines

3.1 Explain the Flow of steam through nozzle.

3.2 Write the expression and calculate Velocity of steam at the exit of nozzle in terms of heat drop analytically and by using Mollier chart.

3.3 Write the expression for 1. Discharge of steam through nozzles and 2. Critical pressure ratio.

3.4 Calculate cross-sectional area at throat and at exit for the maximum discharge.

3.5 Solve simple problems on flow through nozzles without friction.

3.6 Explain the principle of working of a steam turbine.

3.7 Classify the turbines with examples.

3.8 Explain the principle of working of a simple De-Laval turbine with a line diagram.

3.9 Explain the working principle of Parson's Reaction turbine with a line diagram.

3.10 State the function of Steam Condensers and give classification of steam condensers

3.11 List sources of leakage of air in condensers.

3.12 Explain the working of Jet and surface condensers.

4.0 Thermal and Nuclear Power Plants

4.1 Describe the functions of elements of a thermal power plant.

4.1 Describe working of nuclear reactor.

4.2 Explain with the help of legible sketches the working principles of PWR and BWR.

4.3 Compare nuclear power plants with thermal power plants.

5.0 Green Energy and E-vehicle Technology

5.1 Explain the Importance of Green (Renewable) energy.

5.2 State Advantages and disadvantages of renewable and non-renewable energy sources

5.3 State different types of renewable energy sources.

5.4 List the Advantages, Disadvantages and Applications of Solar energy.

5.5 Explain the working principle of focusing type concentrating collector and flat plate collectors.

5.6 Explain the construction details and working principle with a sketch of solar water heater and Solar Still.

5.7 List the Advantages, Disadvantages and Applications of Wind energy.

5.8 Explain the construction details and working principle of Horizontal axis wind mills.

5.9 Explain the construction details and working principle of Vertical axis wind mills.

5.10 State the principle of photovoltaic cell and list types of PV technologies.

5.11 List different types of fuel cells with Advantages, Disadvantages and Applications.

5.12 Explain the working principle of Working of Bacon's High pressure fuel cell with a legible sketch.

5.13 Explain the necessity of E-Vehicles and list types of Electric Vehicles.

5.14 Write differences between BEV and Conventional Vehicles.

5.15 Explain the functions of parts of a Battery Electric Vehicle (BEV) with a Block diagram.

5.16 Explain Hybrid Electric Vehicle (HEV), Plug-in Hybrid Electric Vehicle (PHEV) and Fuel Cell Electric Vehicle (FCEV).

COURSE CONTENT

1.0 Thermodynamic Processes of Vapour

Steam - Properties – Formation of steam– Saturation temperature – Enthalpy of water – Enthalpy of evaporation – Conditions of steam: wet, dry and superheated steam - Dryness fraction –Enthalpy and Entropy of wet, dry and superheated steam - Advantages of superheated steam.

Thermodynamic Expansion Processes of Vapour : Mathematical Expressions for Heat transfer, Work transfer, change in internal energy, change in enthalpy and change in entropy of vapour in Isochoric, Isobaric, Isothermal, Adiabatic, Polytrophic and Throttling processes - Simple problems by using Steam tables and Mollier chart – Purpose of calorimeter – Classification of calorimeters.

2.0 Steam Boilers

Definition of steam boiler - Functions and Classification of steam boilers – Examples - Comparison of water tube and fire tube boilers.

Modern high pressure boilers –Examples – Advantages - Working Principle of Lamont and Benson boilers with line diagrams.

Boiler Mountings: Functions of pressure gauge, water level indicator, fusible plug, blow down cock, stop valve, safety valves.

Boiler accessories: Functions of feed pump, economiser, super heater and air pre-heater, steam trap and steam separator- Comparison of boiler mountings and boiler accessories – Definition of Boiler efficiency - Factors influencing boiler efficiency- Safety precautions in boiler operation.

3.0 Steam Turbines.

Flow of steam through nozzle - Velocity of steam at the exit of nozzle in terms of heat drop by analytical and Mollier diagram - Discharge of steam through nozzles -Critical pressure ratio -Methods of calculation of cross – sectional areas at throat and exit for maximum discharge - Simple problems on nozzles neglecting friction.

Steam Turbines: Classification - Working principle of a simple De-Laval turbine - Working principle of a Parson's Reaction turbine - Difference between Impulse & Reaction turbines.

Steam Condensers: Functions – Elements of condensing plant- Classification – Working of Low level Parallel flow and counter-flow Jet condensers – Working of Surface condensers- Sources of leakage of air in condensers.

4.0 Thermal and Nuclear Power Plants

Thermal Power Plants: Selection of site for thermal power plant – Functions of the elements of a Thermal Power Plant – Effects of Pollutants - Advantages and Disadvantages of thermal power plants.

Nuclear Power Plants: Nuclear fuels –fissile and fertile fuels – Nuclear fission and fusion – Working of Nuclear reactor – Working principle of pressurized water reactor – Working principle of boiling water reactor – Advantages and Disadvantages of nuclear power plants.

5.0 Green Energy and E-Vehicle Technology.

Green Energy - Definition **-** Importance of Green (Renewable) energy sources – Advantages and disadvantages of green energy over conventional energy sources- **Solar Energy:** Advantages, Disadvantages and Applications of Solar energy – Types of Solar Energy Collectors - Working Principle of Solar water heater and Solar Still - **Wind Energy:** Definition, Advantages and disadvantages - Working principle of horizontal axis type and vertical axis type wind mills- Applications - Solar Photovoltaic cell - Principle of Photovoltaic cell – Types of PV technologies – **Fuel Cells:** Definition- Principle – Advantages, Disadvantages and Applications - Types of Fuel cells -Working of Bacon's High pressure fuel cell .

E-Vehicle Technology

Definition and Necessity of E-Vehicles - Types of Electric Vehicles – Definition of Battery Electric Vehicle (BEV) – Differences between BEV and Conventional Vehicle - Advantages of BEV – Functions of Parts or Configuration of a BEV with a Block diagram– Meaning of Hybrid electric Vehicle (HEV), Plug-in Hybrid Electric Vehicle (PHEV)and Fuel Cell Electric Vehicle (FCEV).

REFERENCE BOOKS

1. P.K.Nag, Engineering Thermodynamics, 2017, McGraw Hill Education Publishers
2. C.P.Arora, Thermodynamics, 2004, McGraw Hill Education Publishers
3. Thermal Engineering- J.K.Guptha and R.S.Khurmi, 2015, S.Chand & Company
4. R.S.Khurmi & J K Guptha, Thermal Engineering, 2006, SCHAND publishers
5. Mathur & Mehtha, Thermal Engineering, 2009, JainBrothers
6. P.L.Ballaney, Thermal Engineering, 1966, Khanna Publishers
7. Arora & S.Domkundwar, A course in Thermal Engineering, 2016, Dhanpat Rai
8. A.S.Sarao, Thermal Engineering, 2016, Satya Publications.
9. Non conventional Energy source by G.D Rai..... Khanna Publishers
10. Modern Electric, Hybrid Electric and Fuel Cell Vehicles, Mehrdad Ehsani, Yimin Gao, Sebastien E.Gay, Ali Emadi, CR Press, London, New York.

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II
M-503 :: GREEN ENERGY AND THERMAL SYSTEMS.

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.12
Unit Test – II	From 4.1 to 5.16

C 23 :: M-504 :: Industrial Automation and 3D Printing.

CourseTitle	CourseCode	Periodsperweek	Periodpersemester
Industrial Automation and 3D Printing.	**M-504**	**04**	**60**

TIME SCHEDULE

S. No.	Major Topics	Periods	Weightage of Marks	Short Answer Questions (3 M)	Essay Type Questions (10 M)	CO MAPPING
1	Industrial Automation	10	21	2	1.5	CO1
2	Computer Integrated Manufacturing Systems	12	21	2	1.5	CO2
3	CNC Programming	12	21	2	1.5	CO3
4	Industrial Robotics	12	21	2	1.5	CO4
5	3D Printing	14	26	2	2	CO5
	Total	60	**110**	**10**	**8**	

Course Outcomes and Course Objectives

Course Objectives			Upon completion of the course the student shall be able to
COURSE OBJECTIVES	01		Describe History of Industrial Revolution, Computer Integrated Manufacturing systems, Material handling systems.
	02		Explain the importance of industrial Robots and Development of 3D Printing.
COURSE OUTCOMES	CO1	M-505.1	Explain the Evolution of Industrial Automation and Need of Industry 4.0.
	C02	M-505.2	Describe Computer aided manufacturing, integrated CAD/CAM system.
	C03	M-505.3	Write CNC part programming by using G codes and M codes and APT language.
	C04	M-505.4	Explain the importance of Industrial Robots and their features.
	C05	M-505.5	Explain the Methods of 3D Printing or Additive Manufacturing.

C0-PO Mapping:

Course Code: M-504	**Course Title: INDUSTRIAL AUTOMATION AND 3D PRINTING Number ofCOs:5**				**No.ofperiods:60**
POs	**Mapped with CONo**	**CO PeriodsAddressingPOin Col1**		**Level(1,2,3)**	**Remarks**
		No	%		
PO1	CO1,	6	10	1	**>40% Level 3 (HighlyAddressed) 25%to 40% Level 2(Moderately Addressed)5% to25%Level1 (LowAddressed) <5%NotAddressed**
PO2	CO2	10	16.7	1	
PO3	CO3	6	10	1	
PO4	CO4,CO5	25	41.6	3	
PO5					
PO6	CO5	8	13.3	1	
PO7	CO3	5	8.3	1	

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

3- HIGH 2- MODERATE 1- LOW

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

1.0 INDUSTIAL AUTOMATION

1.1 Define Industrial Automation.
1.2 State the reasons for implementation of Automated Systems in Manufacturing Industries
1.3 Explain Briefly the Features of Industrial Revolutions from First Industrial Revolution to Fourth Industrial Revolution (Industry1.0 to Industry 4.0.)
1.4 Understand the concept of Industry 4.0 or Smart Manufacturing
1.5 List the Systems integrated in Industry 4.0.
1.6 Evaluation of Industry 4.0 in India
1.7 List the Advantages, Disadvantages and Benefits of Industry 4.0.
1.8 Define **Internet of Things (IoT)**
1.9 **Explain the f**unctions of Key Components of IoT
1.10 List Advantages, Disadvantages and Applications of IoT.
1.11 Define **Industry Internet on Things (IIoT**)
1.12 State the Difference between IoT and IIoT
1.13 Explain IIoT Key Technologies
1.14 Features and Applications of IIoT .

2.0 COMPUTER INTEGRATED MANUFACTURING SYSTEMS

2.1 Define Computer Aided Design and Computer Aided Manufacturing:
2.2 List Benefits of CAD and CAM.
2.3 Describe the layout and Functions of Principal components of Flexible Manufacturing Sysem.
2.4 Write Advantages and Applications of Flexible Manufacturing System.
2.5 Define Computer Integrated Manufacturing and explain the components of CIM Wheel.
2.6 Define CNC Machine and explain the functions of components of CNC Machine.
2.7 Write the Advantages, disadvantages and applications of CNC machines.
2.8 Explain the construction and working principle of a turning Centre
2.9 Explain the construction and working principle of a machining Centre.
2.10 Write the differences between NC and CNC Machines.
2.11 List functions of Material Handling Systems in CIM.
2.12 Explain Working principle and Applications of AGV and AS/RS.

3.0 CNC PROGRAMMING

3.1 List types of CNC Part Programming.

3.2 Explain the features of Manual Part Programming
3.3 What is meant by linear interpolation and Circular interpolation?
3.4 Write different preparatory functions (G-codes) and miscellaneous functions (M-Codes) in Part Programming.
3.5 Write steps in Manual Part Programming.
3.6 Write CNC turning program using linear interpolation and circular interpolation.
3.7 Write CNC turning program for the given simple problems.
3.8 Understand the concept of Computer Aided Part Programming (CAPP)
3.9 List the steps involved in CAPP .
3.10 List advantages of CAPP
3.11 Write NC Part Programming Languages.
3.12 Concept of APT language and commercially available GUI based CAPP Programming languages.

4.0 INDUSTRIAL ROBOTICS

4.1 Definition of Robotics and Robot.
4.2 Explain the Necessity of Robots in Industries .
4.3 Explain the classification of Robots
4.4 Explain briefly the functions of Robot Components
4.5 Explain degrees of freedom of a robot.
4.6 State Robot programming methods and Languages
4.7 Write Advantages, Disadvantages and Industrial applications of Robots.

5.0 3D PRINTING (or) ADDITIVE MANUFACTURING

5.1 Define Rapid Prototyping and 3D Printing.
5.2 Explain the need of Additive Manufacturing
5.3 Compare Additive manufacturing with CNC Machining.
5.4 What is Principle of Additive Manufacturing Process?
5.5 Explanation of Steps in the 3D Printing Process with a Flow chart.
5.6 List seven types of 3D Printing Technologies or Processes with examples.
5.7 Write Advantages, Limitations and Applications of 3D Printing.
5.8 List important **3D Printing Methods**
5.9 Explain SLA 3D Printing Process.
5.10 Explain FDM 3D Printing Process .
5.11 Explain Selective Laser Sintering (SLS) Process.
5.12 List the Advantages, Disadvantages and Applications of the above.

COURSE CONTENT

1.0 INDUSTIAL AUTOMATION

Industry – Automation – Reasons for implementation of Automated Systems in Manufacturing Industries – Types of Automation – Features of Industrial Revolutions from First Industrial Revolution to Fourth Industrial Revolution (Industry 1.0 to Industry 4.0.)

Concept of Industry 4.0 or Smart Manufacturing – Systems integrated in Industry 4.0 – Certification – Effect of Industry 4.0 on Society – Industry 4.0 in India – Advantages and Disadvantages of Industry 4.0 – Benefits of Industry 4.0.

Internet of Things (IoT) : Definition – History - Examples IoT devices – Features of IoT – Functions of Key Components of IoT - Advantages and Disadvantages of IoT – Applications of IoT.

Industry Internet of Things (IIoT) : Concept of IoT in Manufacturing Industries - Definition of IIoT– Difference between IoT and IIoT – IIoT Key Technologies - Features and Benefits of IIoT – Working of IIoT – Industries using IIoT .

2.0 COMPUTER INTEGRATED MANUFACTURING SYSTEMS

Computer Aided Design: Definition of CAD – CAD Activities –CAD Software Packages.

Computer Aided Manufacturing: Definition of CAM - Functions of CAM – Group Technology- Functions of Principal components of Flexible Manufacturing System – Advantages and Applications of Flexible Manufacturing System.

Computer Integrated Manufacturing: Integration of CAD and CAM - Definition of CIM – CIM Hardware and Software – Functions of CIM - CIM Wheel – Benefits of CIM.

Computer Numerical Control Machines: Definition of Numerical Control – Classification of NC Machines - Working Principle of a CNC machine - Specification of CNC Machines– Advantages, disadvantages and applications of CNC machines – Construction and working principle of turning centre – Construction and working principle of machining centre.

Components of CNC machine: Main components- Functions of Slide ways, recirculation ball screw Automatic Tool Changer and Tool Magazine, linear and rotary transducers – encoders - Comparison between NC and CNC Machines.

Material Handling Systems in CIM: Functions –Automated Guided Vehicle (AGV): Working Principle AGV types – Applications; Automated Storage and Retrieval System AS/RS – Working principle –Types – Applications.

3.0 CNC PART PROGRAMMING

CNC Part Programming – Meaning - Types of Part Programming.

Manual Part Programming: Introduction – NC dimensioning - Datum points, Machine zero, Work zero, and Tool zero - Reference points - Absolute and Incremental positioning – List of preparatory functions (G-codes) – List of miscellaneous functions (M-Codes) – Word address Programme format (as per ISO) – Meaning of each word – Basic Steps in CNC Manual Part Programming- CNC turning program using linear interpolation and circular interpolation - Practice Problems .

Computer Aided Part Programming (CAPP): Concept- Steps involved in CAPP- Advantages of CAPP – NC Part Programming Languages- Concept of APT language- Commercially available GUI based CAPP programming languages.

4.0 INDUSTRIAL ROBOTICS

Industrial Robotics: Definition of Robotics and Robot – Necessity of Robots in Industries- Characteristics - Classification of Robots: Based on Physical configuration, Type of Power Source, Control Systems and Type of Application - Work envelope, Work Volume and Pay Load Capacity – Brief Layout of an industrial robot - Description of Robot Components: Manipulator, End effector, Driving system, Controllers, Sensors and Grippers – Degrees of freedom: Pitch, Yaw, Roll – Robot programming methods and Languages- Advantages , Disadvantages and Industrial applications of Robots.

5.0 3D PRINTING (or) ADDITIVE MANUFACTURING

Rapid Prototyping : Definition - 3D Printing or Additive Manufacturing: Definition - Need of Additive Manufacturing - Additive manufacturing Vs CNC Machining – Principle of Additive Manufacturing Process – Flow chart showing Steps in the 3D Printing Process - Seven types of 3D Printing Technologies or Processes with examples – Materials used in 3D Printing - Advantages, Limitations and Applications of 3D Printing.

3D Printing Methods: Stereo Lithography (SLA), Selective Laser Sintering (SLS), Fused Deposition Modelling (FDM), Three Dimensional Printing (3DP) Laminated Object Manufacturing (LOM); SLA- Process description, Materials, Advantages and Applications ; FDM- Process description, Materials, Advantages and Applications- Selective Laser Sintering (SLS) Process description, Materials, Advantages and Applications.

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II
M-504 :: Industrial Automation & 3D Printing

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.12
Unit Test – II	From 4.1 to 5.12

M-505 REFRIGERATION & AIR CONDITIONING

Course Title	Course Code	Periods/Week	Periods per Semester
Refrigeration & Air Conditioning	M-505	04	60

TIME SCHEDULE

Sl. No.	Chapter/Unit Title	*No. of Periods*	*Weightage of Marks*	Short Answer Questions (3 M)	Essay Type Questions (10 M)	*CO's Mapped*
1.	**Fundamentals of Refrigeration**	10	21	2	1.5	CO1
2.	**Vapour compression & Vapour absorption Refrigeration Systems**	14	26	2	2	CO2
3.	**Refrigeration equipment & Applications of Refrigeration.**	12	21	2	1.5	CO3
4.	**Air Conditioning & Psychrometry**	12	21	2	1.5	CO4
5.	**Air Conditioning Equipment & Applications of Air Conditioning.**	12	21	2	1.5	CO5
Total		**60**	**110**	**10**	**8**	

Course Objectives and Course Outcomes

Course Objectives			*Upon completion of the course the student shall be able to:* Apply the principles and concepts of thermodynamics and Psychometric to design the Refrigeration and Air Conditioning Systems
Course Outcomes	CO1	M-505.1	Understand the principles of refrigeration
	CO2	M-505.2	Understand the principles of vapour compression and vapour absorption systems.
	CO3	M-505.3	Describe the Working of Refrigeration and Air Conditioning equipment.
	CO4	M-505.4	Explain the various psychometric properties and Processes
	CO5	M-505.5	Describe the working of air conditioning equipment and their applications.

PO-CO Mapping

Course Code: M-505		Course Title: Refrigeration and Air Conditioning No of Cos: 04			No. of Periods: 60
PO No	**Mapped with CO number**	**CO Periods addressing PO in Col 1**		**Level (1,2,3)**	**Remarks**
		No	**%ge**		
PO1	CO1 – CO5	35	53.33	3	**>40% Level 3 Highly addressed** **25% to 40% Level 2 Moderately Addressed** **5 to 25% Level 1 Low addressed** **<5% Not addressed**
PO2					
PO3	CO1, CO3	15	26.67	2	
PO4	CO3, CO5	5	10.67	1	
PO5	CO2	5	09.33	1	
PO6					
PO7					

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3		2					2	2	
CO2	3				1			2	2	
CO3	3		2	1				2	2	1
CO4	3							2	2	
CO5	3			1				2	2	1

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.

Suggestive activities for further strengthening of CO-PO mapping:

1. Seminar with an industrial expert may be arranged on emerging refrigerants, ozone depletion potential and global warming potential of refrigerants.

Learning Outcomes:

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

1.0 Fundamentals of Refrigeration

1.1 Define the term 'Refrigeration'.
1.2 List different methods of refrigeration with applications.
1.3 Define the term 'Ton of Refrigeration'. Give the value in S.I units.
1.4 Define the term 'Coefficient of Performance'.
1.5 Estimate the power required per ton of refrigeration.
1.6 Explain Carnot refrigeration cycle by plotting it on p-V and T-s diagrams.
1.7 Calculate the COP of Carnot refrigeration cycle.
1.8 Explain thermodynamic processes involved in air refrigeration cycle.
1.9 Explain the working principle of Open-air refrigeration system.
1.10 Explain the working principle of closed air refrigeration system.

2.0 Vapour Compression and Vapour Absorption Refrigeration Systems.

2.1 Describe main components and Principle of working of a vapour compression refrigeration system with flash chamber and accumulator.
2.2 Explain theoretical vapour compression refrigeration system with the help of p-V, T-s and p-H diagrams.
2.3 Calculate COP of ideal vapour compression refrigeration Cycle when the vapour is dry and saturated at the beginning and end of compression without undercooling - Simple problems.
2.4 Distinguish between wet and dry compression.
2.5 List the effects of under cooling and super heating on COP of vapour compression refrigeration system.
2.6 Define Refrigerant and Classify refrigerants with examples.
2.7 Explain properties and applications various refrigerants
2.8 Describe main components and Principle of working of Ammonia vapour absorption refrigeration system.
2.9 Calculate "COP" of the ideal vapour absorption refrigeration system.
2.10 Describe the working of Electrolux refrigerator with the help of a legible sketch.
2.11 Describe the working of a solar powered vapour absorption refrigeration system with the help of a legible sketch.
2.12 Difference between vapour compression refrigeration and vapour absorption refrigeration systems.

3.0 Refrigeration Equipment & Applications of Refrigeration.

3.1 State the functions Refrigeration equipment.
3.2 Explain principle of working of reciprocating and rotary compressors.
3.3 Describe shell and coil and evaporative condensers with the help of legible sketches.

3.4 Explain the working of shell and coil, flooded type evaporators with the help of legible sketches.

3.5 Explain the working of expansion devices such as capillary tube, thermostatic expansion valve, automatic expansion valve and solenoid valves with the help of legible sketches.

3.6 Describe the working of a domestic refrigerator with the help of a legible sketch.

3.7 Describe the working of an ice plant with the help of a legible sketch.

3.8 Describe the working of a water cooler with the help of a legible sketch.

3.9 Describe the working of a cold storage plant with the help of a legible sketch.

4.0 Air Conditioning & Psychrometry

4.1 Define air conditioning.

4.2 List modern applications of air conditioning.

4.3 Explain Air conditioning as applied to human comfort.

4.4 Define Psychrometry- Define the terms :humidity, Relative humidity, dew point, DBT & WBT, Absolute humidity, humidity ratio.

4.5 Explain the features of Psychrometric chart.

4.6 List and explain various Psychrometric processes with the help of Psychrometric chart.

4.7 Simple problems by using Psychrometric chart.

5.0 Air Conditioning Equipment & Applications of Air Conditioning

5.1 State the functions of air conditioning equipment viz,. fans, ducts, filters, dust collectors, heating and cooling coils.

5.2 Explain the working of various cooling towers.

5.3 Explain various air distribution systems.

5.4 Describe the working of a window air – conditioner with a neat sketch.

5.5 Illustrate the working of summer air conditioning system.

5.6 Illustrate the working of winter air conditioning system.

5.7 Working of Split type, Central, Unitary and Cascade Air Conditioning systems (Description only)

5.8 Service and Maintenance of Refrigeration and Air conditioning systems.

COURSE CONTENT

1.0 Fundamentals of Refrigeration

Introduction – Definition and meaning of refrigeration-Methods of refrigeration – unit of refrigeration – Refrigeration effect – Coefficient of Performance – Power required Capacity of the refrigerating system – Simple problems.

Working of Carnot refrigeration System - Thermodynamic analysis of Carnot refrigeration cycle on p-V and T-s diagrams– Simple Numerical Problems on determining the COP of Carnot refrigeration cycle.
Air Refrigeration System: Advantages and disadvantages – Explanation of Thermodynamic Processes of Bell-Coleman Cycle with p-V and T- s diagrams- Working of Open air and closed air refrigeration systems- Applications.

2.0 Vapour Compression & Vapour Absorption Refrigeration Systems.

Vapour Compression Refrigeration System: Functions of components and working principal of simple vapour compression refrigeration system with flash chamber and accumulator – Explanation of thermodynamic processes and Write expression for COP of vapour compression refrigeration cycle with the help of T-s & p-H diagrams – COP of theoretical vapour compression refrigeration system – Simple problems.
Wet and dry compression –Effect of under cooling and super heating on COP.

Refrigerants : Refrigerants – Classification - Primary and secondary refrigerants with examples – Selection of refrigerants – Thermal, Physical, Chemical, Safety and Environmental properties of ideal refrigerant - Properties and applications refrigerants viz., Ammonia, Carbon di-oxide, Freon-12, Freon-22, Brine solutions, R-32, R-410a, R-134a and HFOs.

Vapour Absorption Refrigeration System: Functions of components and working principal of vapour absorption refrigeration system – Theoretical C.O.P of vapour absorption cycle - Simple Problems.
Working of Electrolux refrigerator and Solar powered vapour absorption refrigeration systems – Comparison of vapour absorption and vapour compression systems.

3.0 Refrigeration Equipment and Applications.

Refrigeration Equipment
Equipment used in Refrigeration systems;
Compressors – types of compressors – Working of Hermetically sealed compressor – Working of vane type rotary compressor.
Condensers – types of condensers – Working of Air cooled, Water cooled and Evaporative type condensers.
Evaporators – types of evaporators – Working principle of flooded type evaporators.
Expansion devices – types of expansion devices – Working principle of capillary tube, thermostatic expansion device, automatic expansion valve, solenoid valve with neat sketches.

Applications of Refrigeration:
Working of Domestic refrigerator, Ice plant and Water cooler and cold storage plant with neat sketches.

4.0 Air Conditioning &Psychrometry

Air conditioning: Definition – Applications- Classification - Human comfort – Factors effecting human comfort - effective temperature – Factors governing effective temperature conditions that affect body heat – comfort chart.

Psychrometry – Definitions of Psychrometric terms– dry air, wet air, moist air, saturate air, Partial pressure, humidity, Relative humidity, dew point, DBT & WBT, Absolute humidity, humidity ratio, Degree of saturation, sensible heat, latent heat and total heat of moist air - Solving simple problems using psychrometric chart and mathematical formulas.

Psychrometric chart - List and explanation of various psychrometric processes with the help of Psychrometric chart.
Cooling load: definition – List the components involved in computation of cooling load.
Heating load: definition – List the components involved in computation of heating load.

5.0 Air Conditioning Equipment& Applications.

Air Conditioning Equipment:
Functions of Air Conditioning equipment such as fans, supply ducts, outlets, return outlets and ducts- Grills –dampers – registers -humidifiers – dehumidifiers- Heating and cooling coils- Filters and
Wet, Dry and Cyclone dust collectors.
Working of Air distribution Systems: Radial perimeter, loop perimeter and extended plenum systems.
Working of cooling towers: Natural, induced draft and forced draft.

Applications of Air conditioning:
Describe the working of Window air conditioner – Describe the working of Summer and Winter air conditioning systems – Working Principle of Split type, Central, Unitary and Cascade Air Conditioning systems - Trouble shooting of R & AC systems.

REFERENCE BOOKS

1. Arora C P, Refrigeration and Air Conditioning, 2009, MGH Publishers
2. P N Ananthanarayana, Basic Refrigeration and Air conditioning, 2013, MGH Publishers
3. John Tomczyk, Troubleshooting and Servicing Modern Air Conditioning and Refrigeration Systems, 1995, Esco Press

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II
M-505 :: REFRIGERATION AND AIRCONDITIONING

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.5
Unit Test – II	From 3.6 to 5.8

M-506 CAD LAB PRACTICE

Course Title	Course Code	Periods/Week	Periods per Semester
CADLABPRACTICE	M-506	03	45

TIMESCHEDULE

PART-A-CADLab		
SlNo.	**Chapter/UnitTitles**	**No.ofperiods**
1.	Introductionto CAD	03
2.	Selectingcommands&Workingwithdrawing	03
3.	Viewingdrawing	03
4.	Workingwithcoordinates	03
5.	Creatingsimpleandcomplexentities	03
6.	GettingDrawinginformation	03
7.	Modifyingentities	03
8.	Workingwithtext	03
9.	Dimensioningdrawing	03
10.	2DDrawing	09
11.	Layers	03
12.	3DDrawings	06
TOTAL		**45**

CourseObjectivesandCourseOutcomes

Uponcompletionofthecourse thestudentshallbe ableto		
COURSEOBJECTIVES	01	KnowCADscreen andvarioustool bars andmenus
	02	Applydimensioningandhatchingonthe auto CAD drawings
	03	Draw2D –drawings
	04	Draw3D–drawings
COURSEOUTCOMES	CO1	DemonstratebasicconceptsoftheCAD software
	C02	Applyappropriatecommandtodevelopbasicdrawings
	C03	Useeditandplottingtechniquestomanipulatedrawingsthrough editingandplottingtechnique
	CO4	Draw2Ddrawingsforgivenspecifications
	CO5	Draw3Ddrawingsforgivenspecifications

PO-COMapping

Course Code: M-506	**Course Title: CAD Lab PracticeNoofCos:7**				**No.Ofperiods:45**
POs	**Mapping withCONo**	**CO PeriodsAddressing PO inCol1**		**Level (1,2,3)**	**Remarks**
		No	**%**		
PO1	CO1,CO2,CO3	6	13	1	>40%Level3(HighlyAddressed) 25%to 40% Level 2 (ModeratelyAddressed) 5% to 25% Level 1(LowAddressed) <5%NotAddressed
PO2	CO2,CO3	15	33	2	
PO3	CO4,CO5	21	47	3	
PO4					
PO5	CO4,C05	3	7	1	
PO6					
PO7					

	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PSO 1	PSO2	PSO 3
CO1	1							3	2	1
CO2	1							3	2	1
CO3		2						3	2	1
CO4		2	3		1			3	2	1
CO5	1		3		1			3	2	1

3: High, 2:Moderte, 3:Low

Note:

ThegapsinCOandPOmappingwillbeachievedbyoneormoreappropriateactivitiesfromthefollowing:

(i)Assignments(ii)Tutorials(iii)Seminars (iv)Guest Lectures (v)GroupDiscussions (vi)Quiz **(vii)IndustryVisits (viii)TechFest(ix)MiniProjects(x)LibraryVisits.**

LearningOutcomes

1.0 UnderstandabouttheComputerAidedDraftinganditssoftware

- **1.1** DefineComputerAidedDrafting
- **1.2** Listthe AdvantagesofCAD
- **1.3** Explainthe importanceofCAD software
- **1.4** Explain the evolution of CAD software up to parametric modelling and directmodelling
- **1.5** Explainthe featuresofGraphicWork station
- **1.6** UseCADEnvironment:Screen,Varioustoolbarsandmenus.

2.0 Useappropriateselectioncommands

- **2.1** Practicecommandsusingtoolbars,menus,commandbar
- **2.2** Practice repeatingacommand,Nestingacommandandmodifyingacommand
- **2.3** Use prompthistorywindowandscripts
- **2.4** Practicemouse shortcuts
- **2.5** Practice the Creating the drawing, Opening existing and damaged Files, saving thedrawing
- **2.6** Practicethe settingupadrawing
- **2.7** Practice the settingandchangingthe gridandsnappingalignment
- **2.8** PracticetheEntitysnaps

3.0 UseviewingtoolsofCAD

- **3.1** Practice the use of Scroll bar, pan command, and rotating view to move aroundwithindrawing
- **3.2** Practicethechangingofmagnificationof drawing
- **3.3** Practice thedisplayingofmultipleviews
- **3.4** Practice the useofcontrollingvisual elementslike Fill,Text,Blips andLine weight

4.0 Usecoordinatesystemsofthedrawing

- **4.1** Practicehowthecoordinate systemwork
- **4.2** Practicehowthecoordinatesystemdisplayed
- **4.3** Practice the Findtooltodetermine thecoordinatesofa point
- **4.4** Practice the Two dimensional coordinates such as Absolute Cartesian, RelativeCartesianandPolarcoordinates
- **4.5** Practice theuseofright-handrule
- **4.6** Practice thehow toenterintox,y,z - coordinates
- **4.7** Practice the Three dimensional coordinates such as Spherical and Cylindricalcoordinates
- **4.8** Practicethe useoffiltersintwo andthreedimensions
- **4.9** Practicedefiningusercoordinatesystem
- **4.10** Practicethe useofpresentusercoordinate system

5.0 Createthesimpleandcomplexentities

- **5.1** Drawthelines,circles,arcs,ellipses,ellipticalarcs,raysandinfinite lines
- **5.2** Practicethe Creationofpointentities
- **5.3** Practice the Editingofpointentities
- **5.4** Draw the complex shapes like Rectangles, Polygons, Polylines,Splines,Donuts,andPlanes
- **5.5** Practicethe addingofhatchpattern

6.0 **Usethe drawinginformationretrievingtoolsMeasure,Divide,Calculate,Display,and Track**

- 6.1 Measuretheintervalson entities
- 6.2 Dividetheentitiesintosegments
- 6.3 Calculatetheareas definedbypoints,ofclosedentities, andCombinedentities
- 6.4 Calculatethedistance betweentheentities
- 6.5 Calculatetheanglebetweenthe entities
- 6.6 Displaythe informationabout theentities anddrawingstatus
- 6.7 Tracktime spentworkingonadrawing

7.0 **Usethe modifyingtoolstomodifythepropertiesofentities**

- 7.1 Practicetheentityselectionanddeselectionmethods
- 7.2 PracticetheDeletionofentities
- 7.3 Practicethe Copyingofentitieswithinadrawing,betweendrawings
- 7.4 Practice themakingofparallelcopies,Mirroringentities andarrayingentities
- 7.5 Practice the Rearrangingofentities byMoving,RotatingandReordering
- 7.6 PracticetheResizingofentitiesbyStretching,Scaling,Extending,Trimming,and
- 7.7 Editingthelength Practice the Brakingandjoiningofentities
- 7.8 Practicethecreating,modifyingthegroupsandungroupingofEntities
- 7.9 PracticetheEditingofpolylines:Opening,Closing,Curving,Decurving,Joining,
- 7.10 Changing width and editing verticesPractice the Explodingofentities
- 7.11 Practicethe ChamferingandFilletingofentities

8.0 **Usethe Texttooltocreateandformattingthevarioustypesoftextfontsanditsstyles**

- 8.1 Practicethe creating,namingandmodifyingthetextfonts
- 8.2 Practicethe Creationofline text,paragraphtext
- 8.3 Practice the Settingoflinetextstyle andits alignment
- 8.4 Practice the SettingofParagraphtextstyleanditsalignment
- 8.5 Practice theChangingofline text andParagraphtext
- 8.6 Practice the useofalternatetexteditor

9.0 Use Dimensioning concepts to create dimensions, Edit dimensions, Control dimensionstyles&variables andAddinggeometrictolerances

- **9.1** Practicethe creatingoflinear,Angular,Diametral,Radial,Ordinatedimensions

9.2 Practice the creatingleadersandannotations
9.3 Practicemakingdimensionsoblique
9.4 Editthedimensiontext
9.5 Practice theControllingofdimensionarrowsandformat
9.6 Practicethe Controllingofline settingsanddimensiontext
9.7 Practicethe Controllingofdimensionunits,anddimensiontolerance

10.0 Create2DDrawing
10.1 Create2D drawingsofKnuckle Joint
10.2 Create2DdrawingsofflangeCoupling
10.3 Create2DdrawingsofFootstepBearing
10.4 LatheToolPost
10.5 Eccentric

11.0 Organizetheinformationonlayers
11.1 Practicethe settingacurrentlayer,layerscolor,linetype, lineweight,printstyle
11.2 Practice thelockingandunlockingof layers
11.3 Practice the layervisibilityandlayer printing
11.4 Practice the settingofcurrent linetype
11.5 Practice the loadingofadditionallinetypes
11.6 Practice thecreatingandnamingofline type
11.7 Practicetheeditingof linetype

12.0 3DDrawings
12.1 Explaintheconceptof3D
12.2 Create3Dsolidsusingsolidtoolbaroptions
12.3 Create3DDrawingsofStandardMechanicalComponents(BoltandNut,Screwjack)
12.4 Practiceof Rendering

COURSECONTENT

1.0 **TheComputerAidedDraftinganditssoftware**
DefinitionofComputerAidedDrafting,the Advantagesandimportance of CADsoftwar

2.0 Selectionofcommands
Commandsusingtoolbars,menus,commandbar.Repeatingacommand,Nestingacommand and modifying a command. Use of prompt history window and scripts, mouseshortcuts.Creatingthedrawing.Openingexistinganddamagedfiles, savingofdrawing,setting up a drawing. Setting and changing the grid and snapping alignment, and the Entitysnaps.

3.0 Useofviewingtools ofCAD
Use of Scroll bar, pan command, and rotating view to move around within drawing,

changingofmagnificationofdrawing.Displayingofmultipleviews,theuse ofcontrollingvisualelementslike Fill,Text, Blips andLineweight.

4.0 Useofcoordinatesystemsofthedrawing

TwodimensionalcoordinatessuchasAbsolute,Cartesian,RelativeCartesia nandPolarcoordinates. The use of right-hand rule. Three dimensional coordinates such as Spherical andCylindricalCoordinates,theuseoffiltersintwoandthreedimensions,de fininguserCoordinate system.

5.0 Creatingsimpleandcomplexentities

Drawing of lines, circles, arcs, ellipses, elliptical arcs, rays and infinite lines. Creating andediting of point entities. Drawing of complex shapes like rectangles, polygons, polylines,Splines, donuts,planes,andaddingof hatch pattern

6.0Use the drawing information retrieving tools Measure, Divide, Calculate, Display, andTrack

Measuring the intervals on entities, dividing the entities into segments. Calculation of areasdefined by points, closed entities, and combined entities, calculate the distance and anglebetween theentities. Displaying the information about the entities and drawing status. Tracking time spent working on a drawing.

7.0 UsetheModifyingtoolstomodifytheproperties ofentities

Entity selection and de selection methods, the Deletion of entities. Copying of entities withina drawing, between drawings, parallel copies, Mirroring entities andArraying entities. TheRearrangingof entitiesbyMoving, Rotatingand Reordering.The Resizingof entities byStretching, Scaling, Extending, Trimming, and Editing the length. The Braking and joining ofentities.The creating, modifying the groups and Ungrouping of Entities. Editing of polylines:Opening,Closing,Curving,Decurving,Joining,Changingwidth andeditingvertices,TheExplodingofentities,the ChamferingandFilletingofentities

8.0 UsetheTexttooltocreateandformattingthevarioustypesoftext Fontsanditsstyles

The creating, naming and modifying the text fonts, the Creation of line text, paragraph text,settingoflinetextstyleanditsalignment.TheSettingofParagraphtextst yleanditsalignment,the Changingofline.Text andParagraphtext,theuseof alternate texteditor.

9.0UseDimensioning concepts to create dimensions, Edit dimensions, Control dimensionstyles&variables andAddinggeometrictolerances

The creating of linear, Angular, Diametral, Radial, Ordinate dimensions. The creating leadersandannotations,makingdimensionsoblique,Editingthedimension text,controllingofdimensionarrowsandformat.TheControllingoflinesetti ngsanddimensiontext,theControllingof dimensionunits, anddimensiontolerance.

10.02DDrawings

Usingappropriatecommandscreationof2D drawingsofstandardmechanicalcomponents.

11.0Organizetheinformationonlayers

Setting a current layer, layers color, line type, line Weight, print style Locking and unlockingof layers, the layer visibility and layer printing. Setting of current line type.The loading ofadditionallinetypes, creatingandnamingoflinetype,editingofline type.

12.03DDrawings

3Ddrawingsofstandardcomponents.Renderingof3Dimages

REFERENCEBOOKS

4MCAD User Guide- IntelliCAD Technology Consortium (WWW.intellicad.org)4MCAD Software:

1. 4MCADViewer,
2. 4MCADClassic,
3. 4MCADStandard,
4. 4MCADProfessional.

M-507 CAMLABPRACTICE

Course Title	Course Code	Periods/Week	Periods per Semester
CAMLABPRACTICE	M-507	03	45

TIMESCHEDULE

M-507–CAM LAB PRACTICE		
S.No	**Chapter/UnitTitles**	**Periods**
1	CNCIntroduction	3
2	Studyofturning	3
3	G–codes andM-codes	3
4	Simulationsoftwarepractice	6
5	Structureofprogram	6
6	Turningexercise–stepturningusingcannedcycle	6
7	Turningexercise–CircularinterpolationCW,CCW	6
8	TurningExercise-TaperturningandPeckdrilling	6
9	Turningexercise–Threadcuttingandgrooving	6
Total		**45**

CourseObjectivesandCourseOutcomes

		Uponcompletionofthecourse thestudentshallbe able to
COURSE OBJECTIVES	01	Familiarisewithparts andfunctionsof CNC lathe
	02	Familiarisein writingthe partprogrammingusingM-CodesandG-CodesandexecuteonCNCLathe
COURSE OUTCOMES	CO1	Demonstratetheparts andfunctionsof aCNClathe
	C02	Practiceincrementalsystemandabsolutesystemofdimensioning
	C03	WritesimplepartprogramusingG-CodesandM-Codes.
	C04	Editandexecuteapart program usingCNClathemachine simulationpackage.
	C05	Producepartasperthedrawingusing CNC lathemachine.

PO-COMapping

Course Code:M-507B	Course Title: COMPUTER AIDED MANUFACTURING SYSTEMS LAB NoofCos:5				No. Ofperiods:45
POs	Mappedwith CONo	COPeriodsAddressing PO inCol1		Level (1,2,3)	Remarks
		No	%		
PO1	CO1andC02	07	15.55	1	>40% Level 3 (HighlyAddressed) 25%to 40% Level 2(ModeratelyAddressed) 5% to 25% Level 1(LowAddressed) <5%NotAddressed
PO2	CO3,CO4andCO5	05	11.11	1	
PO3	CO3,CO4andCO5	25	55.55	3	
PO4	CO3,CO4andCO5	08	17.78	1	
PO5					
PO6					
PO7					

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

3:High,2:Moderate,1:Low

Note:

ThegapsinCOandPOmappingwillbeachievedbyoneormoreappropriateactivitiesfromthefollowing:

(i)Assignments(ii)Tutorials(iii)Seminars (iv)GuestLectures (v)GroupDiscussions (vi)Quiz **(vii) IndustryVisits (viii)TechFest(ix)MiniProjects(x)LibraryVisits.**

LearningOutComes:

Uponcompletionofthecourse thestudentshallbe ableto

1. DemonstratethepartsandfunctionsofCNClathe

2. Explainincrementalsystemandabsolutesystemofdimensioning.
3. WritesimplepartprogramusingG-CodesandM-Codes.
4. Editand executeapartprogramusingCNClathe machinesimulationpackage.
5. Preparepartprogramasperthedrawing.
6. .Producepartasperthedrawingusing CNClathemachine.

COURSECONTENT

1. CNCIntroduction
2. Studyofturning.
3. G–codesandM-codes
4. Simulationsoftwarepractice.
5. Structureofprogram.
6. Turningexercise–stepturningusingcannedcycle.
7. Turningexercise–CircularinterpolationCW,CCW.
8. Turningexercise-TaperturningandPeckdrilling.
9. Turningexercise–Threadcuttingandgrooving

M508: Life Skills

Course Title : Life Skills	**Course code : C23- Common-508 (Common to all Branches)**
Year/ Semester : V/ VI Semester	**Total periods : 45**
Type of Course : Lab Practice	**Max Marks : 100 (Sessional 40 + External 60)**

Course Objectives:	understand the relevance of life skills in both personal and professional lives
	practise life skills complementarily in life-management to lead a happy and successful life

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

Course Delivery:

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

Sl no	Unit	Teaching Hours
1	**Attitude**	4
2	**Adaptability**	4
3	**Goal Setting**	4
4	**Motivation**	4
5	**Time Management**	4
6	**Critical Thinking**	4
7	**Creativity**	4
8	**Problem Solving**	5
9	**Team work**	4
10	**Leadership**	4
11	**Stress Management**	4
	Total	45

Course Content:

UNIT I:Attitude ***matters!***

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

UNIT 2: **Adaptability…** ***makes life easy!***

Pair work-Study the given pictures and understand adaptability -read the anecdote and discuss, read the story and answer the questions, role play

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

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

UNIT 5: Time Management … *the need of the hour!*
Effective Time Management- Time quadrant - Group task on management of time- Time wasters-fill in the grid, read the story and answer the questions- prioritising tasks.
UNIT 6: Critical Thinking… *Logic is the key!*

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

UNIT 7: Creativity…. The essential YOU!!
Definition- Pre-activity-read the anecdote and answer the questions- matching celebrities with their fields of specialisation- think of creative uses of objects- think creatively in the given situations.

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

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

UNIT 9: Team Work… *Together we are better!*

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

UNIT 10 : Leadership… the *making of a leader!*

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

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

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

Mapping COs with POs

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

Unit wise Mapping of COs- POs

CO	Course Outcome	CO Unit Mapped	PO mapped	Cognitive levels as per Bloom's Taxonomy R/U/Ap/An/Ev/Cr (Remembering / Understanding/ Applying/Analysing/ Evaluating/ Creating)
CO 1	To exhibit right attitude and be adaptable to adverse and diverse situations	All Units (1 to 11)	6,7	U/Ap/ An
CO2	To set appropriate goals and achieve them through proper planning, time management and self-motivation	Units 3,4,5	6,7	U/Ap/An
CO3	To solve diverse real-life and professional problems with critical thinking and creativity for a stress-free life	Units 6,7,8,11	6,7	U/Ap/An/ Ev/ Cr.
CO4	To be an ideal team player and manifest as a leader	Units 9,10	6,7	U/Ap/An/ Ev

M509 REFRIGERATION AND AIR CONDITIONING LAB

Course Title	Course Code	Periods per Week	Periods per Semester
Refrigeration and Air Conditioning Lab	M – 509	03	45

TIME SCHEDULE

S.No	Chapter/Unit Title	Periods
1	Perform basic fabrication operations viz., flaring, swaging, bending and brazing on soft copper tubes	9
2	Evaluate the C.O.P of a given Vapour Compression cycle test rig	3
3	Evaluate the C.O.P of a Domestic Refrigerator	3
4	Evaluate the C.O.P of a water cooler	3
5	Evaluate the C.O.P of Ice Plant	3
6	Perform various types of leak detection methods of a refrigeration system	9
7	Evaluate the C.O.P. of given air-conditioning system	3
8	Apply the method of vacuumization and refrigerant charging for a given vapour compression system.	6
9	Servicing and maintenance of Window/split Air Conditioning System	6
Total		**45**

Course Objectives and Course Outcomes

Upon completion of the course the student shall be able to			
COURSE OBJECTIVES	01		Familiarisation with R & AC tools and perform the basic operations on soft copper tube
	02		Conduct performance test on Vapour Compression Refrigeration test rig, Domestic Refrigerator, Water Cooler, Ice Plant and Air condition Test Rig
	03		Detect the Leakage of Refrigerant and vacuumization and refrigerant charging for a given vapour compression system.
COURSE OUT COMES	CO1	M-509.1	Explain various tools used in Refrigeration & Air Conditioning
	C02	M-509.2	Conduct the performance test and evaluate the COP of Vapour Compression Refrigeration test rig, Domestic Refrigerator, Water Cooler, Ice Plant.
	C03	M-509.3	Calculate the COP of a given Air condition Test Rig.
	C04	M-509.4	Conduct the vacuumization and refrigerant charging for a given vapour compression system.
	C05	M-509.5	Describe Window Air Conditioning System

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

1.0. Perform basic fabrication operations viz., flaring, swaging, bending and brazing on soft copper tubes

1.1. Identify various tools used in Refrigeration & Air Conditioning

1.2. Perform flaring, swaging, bending and brazing operations by using Refrigeration & Air conditioning tools.

2.0. Evaluate the C.O.P of a given Vapour Compression cycle test rig

2.1. Identify the components of vapour compression system

2.2. Record the values of pressure and temperature when the pressure gauges are stabilized

2.3. Record the energy meter reading

2.4. Read the values from Pressure Vs Enthalpy diagram of the given refrigerant

2.5. Evaluate actual, theoretical and relative C.O.P

3.0. Evaluate the C.O.P of a Domestic Refrigerator

3.1 Identify the components

3.2 Record the values of pressure and temperature when the Pressure gauges are stabilized

3.3 Record the energy meter reading

3.4 Read the enthalpy values from Pressure Vs Enthalpy diagram of the given refrigerant

3.5 Evaluate actual, theoretical and relative C.O.P

4.0. Evaluate the C.O.P of a water cooler

4.1 Identify the components

4.2 Record the values of pressure and temperature when the Pressure gauges are stabilized

4.3 Record the energy meter reading

4.4 Read the enthalpy values from Pressure Vs Enthalpy diagram of the given refrigerant

4.5 Evaluate actual, theoretical and relative C.O.P

5.0. Evaluate the C.O.P of Ice Plant

5.1 Identify the components

5.2 Record the values of pressure and temperature when the Pressure gauges are stabilized

5.3 Record the energy meter reading

5.4 Read the enthalpy values from Pressure Vs Enthalpy diagram of the given refrigerant

5.5 Evaluate actual, theoretical and relative C.O.P

6.0. Identify various types leak detection methods of a refrigeration system

6.1 Detect the leakages of given vapour compression refrigeration system by using soap solution method.

6.2 Apply the methods of arresting leakages

6.3 Arrest the leakages if any by soldering

7.0. Evaluate the C.O.P. of given air-conditioning system

7.1 Identify the components of given vapour compression air-conditioning test rig.

7.2 Insert thermometers in suction line and discharge line

7.3 Run the given V.C. A.C. system for some time

7.4 Record the pressure and temperature readings when the pressure gauges are stabilized.

7.5 Record the energy meter reading

7.6 Read the enthalpy values from Pressure Vs Enthalpy diagram of the given refrigerant

7.7 Evaluate C.O.P

8.0. Apply the method of vaccumization and refrigerant charging for a given vapour compression system.

8.1 Evacuate the given V.C.R. system using a vacuum pump

8.2 Charge the given V.C.R. system by using suitable refrigerant gas

8.3 Run the system for at least 15 min. and check for the build-up of pressure in the pressure gauge.

9.0. Study of Window Air Conditioning System

9.1 Identify the components of given window A/C

9.2 Understand the functions of the components

9.3 Understand the maintenance procedure and remedies to the common problems encountered.

Course Content:

1. Perform Basic operations like flaring, swaging, bending and brazing on soft copper tubes
2. Determination of C.O.P of a given Vapour Compression cycle test rig
3. Determination of the C.O.P of a Domestic Refrigerator
4. Determination of C.O.P of a water cooler
5. Determination of C.O.P of Ice Plant
6. Perform various types of leak detection methods of a refrigeration system
7. Determination of C.O.P. of given air-conditioning system
8. Vacuumization and charging,pressure testing of given refrigeration system.
9. Servicing of Window/ split Air Conditioning System

M-510 Training cum Production Workshop

Course Title	CourseCode	Periods/Week	PeriodsperSemester
Training cum Production Workshop	M-510	03	45

CourseObjectives	Uponthecompletionofthecoursethe student shallable • To study the drawings to prepare the articles. • To prepare the correct sized components as per the drawings. • Tofabricate utility articles.		
CourseOutcomes	CO1	M-510.1	Making Wooden articles.
	CO2	M-510.2	Fabricate the useful articles by welding
	CO3	M-510.3	Assembling of parts to make the final articles.
	CO4	M-510.4	Assembling the fabricated articles.

TIMESCHEDULE

S.NO	EXERCISETITLE	NO.OF PERIODS
1	FabricationofWindowGrill/Shoe racks /steel almraih /any utility article for institution	9
2	FabricationofDrawing tables.	9
3	FabricationofDrawing stools	9
4	FabricationofDuel Desks	9
5	Painting/finishing	9
TOTAL		45

Learning Outcomes:

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

Fabrication of utility articles by arc welding method

- Plan and select the type &size of electrode, welding current.
- Prepare edge as per requirement
- Prepare, set arc welding machine as per sketch.
- Deposit the weld maintaining appropriate arc length, electrode angle, welding speed, welding technique and safety aspects.
- Clean the welded joint thoroughly.
- Cutout the required wooden/metal work piece as per specification
- Assemble the parts as per drawing
- Carry out visual inspection for assembled components
- Complete painting

REFERENCEBOOKS

1. AtextbookofweldingTechnology– KhannaO.P.DhanpathRaiPublications
2. Workshoppractice–SwarnaSingh
3. ElementsOfWorkshopTechnology-VolumeII-MachineTools,MediaPromotersPvt,Ltd

M-511 PROJECT WORK

Course Title	CourseCode	Periods/Week	PeriodsperSemester
PROJECT WORK	**M – 511**	03	45

Upon completion of the course the student shall be able to		
Course Objectives		• Enhance the knowledge by field visits • Provide with the opportunity to synthesize knowledge from various areas of learning • Critically and creatively apply it to real life situations
COURSE OUT COMES	CO1	To build the strength, teamwork spirit and self-confidence
	CO2	To Improve independent learning
	CO3	To Apply theory to practical work situations
	CO4	To gain knowledge in writing report in technical projects

PO-CO Mapping

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

3: High, 2: Moderate,1: Low

Learning Outcomes

Upon completion of the course the student shall be able to

1.0 Problem solving and Critical Thinking

1.1. Generate Ideas from mechanical courses.

1.2. Develop these Ideas.

1.3. Gather relevant Information.

1.4. Evaluate Ideas.

1.5. Apply these ideas to a specific task.

1.6. Execute appropriate Laboratory skills

1.7. Draw Appropriate Conclusions

2.0 Communication

.2.1 Communicate effectively.

2.2 Present Ideas Clearly.

2.3 Present Ideas Coherently.

2.4 Report writing

3.0 Collaboration

3.1. Discuss the ideas.

3.2 Coordinate with team members

3.3. Team work in accomplishing the task.

4.0 Independent Learning

4.1. Involves in the group task.

4.3. Analyze the appropriate actions.

4.4. Compares merits and demerits

4.5. Analyze the activities for sustainability.

4.6 Analyze the activities to ensure ethics

5.0 Ethics

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

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

5.3 Recognize the constraints of limited resources

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

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

COURSE CONTENT

1.0 Design/Fabrication/Analysis/ Case Study Projects in the areas of Mechanical Engineering and other related areas

Weightage of marks for Assessment of Learning Outcomes of Project work

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

End Examination assessment shall be done by both internal, external examiners and faculty members who guided the students during project work.

VI SEMESTER

C-23 :: DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
VI Semester

INDUSTRIAL TRAINING

Sl.No.	*Course*	*Duration*	*Scheme of Evaluation*		
			Assessment	*Nature*	*Max. Marks*
1	*Industrial Training*	*6 months*	*1.First Assessment at Industry (After 12 Weeks)*	*Assessment of Learning outcomes by both the faculty and training Mentor of the industry*	*120*
			2.Second Assessment at the Industry (After 22 weeks)	*Assessment of Learning outcomes by both the faculty and training Mentor of the industry*	*120*
			Final Summative assessment at institution level	*Training Report*	*20*
				Demonstration of any one of the skills listed in learning outcomes	*30*
				Viva Voce	*10*
				TOTAL MARKS	*300*

- The Industrial Training shall carry 300 marks and pass mark is 50% in assessment at industry (first and second assessment put together) and in final summative assessment at institution put together
- If the student fails to secure 50% marks in final summative assessment at institution level, the student shall reappear for final summative assessment, in the subsequent board examination.

- During Industrial Training the candidate shall put in a minimum of 90% attendance. If the student fails to secure 90% attendance during industrial training, the student should reappear for 6 months industrial training.

INDUSTRIAL TRAINING

Subject Title : Industrial Training
Subject Code : M-601
Duration : 6 months

Time schedule

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

Course Objectives and Course Outcomes

Upon completion of the course the student shall be able to		
Course Objectives		1.Expose to real time working environment 2. Enhance knowledge and skill already learnt in the institution. 3. Acquire the required skills of manufacturing processes, assembling, servicing, supervising in the engineering fields. 4. Instill the good qualities of integrity, responsibility and self confidence.
COURSE OUT COMES	CO1	Apply theory to practical work situations
	CO2	Cultivate sense of responsibility and good work habits
	CO3	Exhibit the strength, teamwork spirit and self-confidence
	CO4	Write report in technical projects

PO ₵O Mapping

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

3: High, 2: Moderate,1: Low

Learning Outcomes

The student shall be able to display the following skill sets

1) Demonstration Skills
2) Reading drawings and analysing Specifications
3) Recognize and Practice safety Measures
4) Handling Tools/Instruments/Materials/Machines
5) Assess and Control of quality parameters

6) Planning, Organizing and recording Skills
7)

Scheme of evaluation

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

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

Sl.No	*Learning Outcome*	*Max Marks Allotted For each parameter*	*Marks secured for each parameter*
1	*Demonstration Skills*	*25*	
2	*Reading drawings and analysing Specifications*	*20*	
3	*Recognize and Practice safety Measures*	*15*	
4	*Handling Tools/Instruments/Materials/machines*	*25*	
5	*Quality Assessment and Control*	*15*	
6	*Planning, Organizing and recording Skills*	*20*	
	Total	*120*	

GUIDELINES FOR INDUSTRIAL TRAINING OF DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME

- Duration of the training: 6 months.
- Eligibility: The As per SBTET norms
- Training Area: Students can be trained in Fabrication/Foundry/Manufacturing/Service/Drafting/Maintenance etc. fields

- The Industrial Training shall carry 300 marks and pass marks is 50% in assessment at industry (first and second assessment put together) and also 50% in final summative assessment at institution level.

- Formative assessment at industry level shall be carried out by the representative of the industry, where the student is undergoing training and the faculty from the concerned section in the institution.

- If the student fails to secure 50% marks in industrial assessments put together, the student should reappear for 6 months industrial training at his own expenses.

- If the student fails to secure 50% marks in final summative assessment at institution level, the student should reappear for final summative assessment in the subsequent board examination.

- Final Summative assessment at institution level is done by both internal, external examiners and faculty members who assessed the students during Industrial Training.

- During Industrial Training the candidate shall put a minimum of 90% attendance.

- If the student fails to secure 90% attendance during industrial training, the student should reappear for 6 months industrial training at his own expenses.

DEPARTMENT OF TECHNICAL EDUCATION
GOVERNMENT POLYTECHNIC:
INDUSTRIAL TRAINING ASSESSMENT

PIN:

NAME OF THE STUDENT:

Sl.No	*Learning Outcome*	*Max Marks Allotted For each parameter*	*Marks secured for each parameter*
1	*Demonstration Skills*	*25*	
2	*Reading drawings and analysing Specifications*	*20*	
3	*Recognize and Practice safety Measures*	*15*	
4	*Handling of Tools / Instruments / Materials/machines*	*25*	
5	*Quality Assessment and Control*	*15*	
6	*Planning, Organizing and recording Skills*	*20*	
	Total	*120*	

(Marks in words:)

Signature of the Training Incharge
Name:
Designation:

Signature of the visiting staff
Name:
Designation: