CURRICULUM-2020

(C-20)

DIPLOMA IN
AUTOMOBILE ENGINEERING

STATE BOARD OF TECHNICAL EDUCATION & TRAINING

ANDHRA PRADESH:: VIJAYAWADA

AUTOMOBILE ENGINEERING
CURRICULUM- 2020 (C-20)

INDEX

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PREAMBLE

The proposed programme intends to develop a skilled technician to support the industries both nationally or globally. It also helps to kindle the spirit of entrepreneurship with necessary skills and theoretical inputs aligning with the National policy of 'Make in India'. The programme also provides for accomplishing higher education goals for those who wish to enrich their theoretical concepts further.

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. 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. Accordingly the SBTET, AP under the aegis of the Department of Technical Education, Andhra Pradesh in it's 57th Board Meeting held on 05-02-2019 (vide item no: 18) resolved to update the Polytechnic Curriculum C-16 with the guidance of National Institute of Technical Teachers Training & Research (NITTTR), Extension Centre, Vijayawada (ECV), to be implemented with effect from the academic year '20-21.

Analysis of Curriculum C-16 (SWOT analysis) started in the month of June-2019. Feedback was collected from all stake holders: Students, Lecturers, Senior Lecturers, Head of Sections and Principals for all programmes for this purpose. A series of workshops with subject experts followed in the subsequent weeks and the draft curricula were prepared for every programme. Finally, an interactive session with representatives from industries, academia and subject experts was held on 04.01.2020 for thorough perusal and critique of draft curricula; and the suggestions received thus received from Industrialists and academia have been recorded , validated by another set of experienced subject teachers from the Department of Technical education for incorporation into the Curriculum C-20.

The design of new Curricula for the 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 technicians 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 is designed to meet the requirements of NBA Accreditation, too.

The revised New Curriculum i.e., Curriculum–2020 (C-20) is approved by BoG of SBTET for its implementation with effect from 2020-21.

Highlights of Curriculum C-20:

1. Duration of course for regular Diploma and for sandwich Diploma is 3 years and 3½ years respectively.
2. The Curriculum is prepared in Semester Pattern. However, First Year is maintained as Year-wise pattern.
3. 6 Months Industrial training has been introduced for 3 years Diploma Courses and 1 year Industrial Training is introduced for 3 ½ years Sandwich Diploma courses.
4. Updated subjects relevant to the industry are introduced in all the Diploma courses.
5. CISCO course content has been incorporated into the ECE and CME programmes for certification from CISCO in lieu of industrial training when students are unable to get Industrial Training placement in any industry.
6. The policy decisions taken at the State and Central level with regard to environmental science are implemented by including relevant topics in Chemistry. This is also in accordance with the Supreme Court guidelines issued in Sri Mehta's case.
7. Keeping in view of the increased need of communication skills which is playing a major role in the success of Diploma Level students in the Industries, emphasis is given for learning and acquiring listening, speaking, reading and writing skills in English. Further as emphasized in the meetings, Communication Skills lab and Life Skills lab are continuing for all the branches.
8. CAD specific to the branch has been given emphasis in the curriculum. Preparing drawings using CAD software has been given more importance.
9. Upon reviewing the existing C-16 curriculum, it is found that the theory content is found to have more weightage than the Practical content. In C-20 curriculum, more emphasis is given to the practical content in Laboratories and Workshops, thus strengthening the practical skills.
10. With increased emphasis for the student to acquire Practical skills, the course content in all the subjects is thoroughly reviewed and structured as outcome based than the conventional procedure based.
11. Curricula of Laboratory and Workshops have been thoroughly revised based on the suggestions received from the industry and faculty, for better utilization of the equipment available in the Polytechnics. The experiments /exercises that are chosen for the practical sessions are identified to confirm to the field requirements of industry.
12. An exclusive section for assessing Higher order Thinking skills (HOTS) has been introduced in summative evaluation.

Acknowledgements:

It is pertinent to acknowledge the support of the following in the making of Curriculum C-20.

A series of workshops in three phases were conducted by NITTTR, AP Extension Centre, Vijayawada involving faculty from Polytechnics, Premier Engineering Colleges & Industries to analyze the Previous C-16 Curriculum and to design C-20 Curriculum under the guidance of **Dr C. R. Nagendra Rao, Professor & Head, NITTTR-ECV**. The efforts & support extended by NITTTR to bring out final Curriculum C-20 by incorporating needs, aspiration & expectations of all stake holders is highly appreciated and gratefully acknowledged.

The Secretary, SBTET AP extends its gratitude and congratulate all the staff members who are involved and the subject experts of various branches who have contributed their services in designing this C-20 curriculum book.

The Secretary, SBTET AP is very much thankful to **Dr. Pola Bhaskar I.A.S., Commissioner of Technical Education & Chairman,SBTET, AP** for his valuable guidance to bring out this curriculum book.

The Secretary, SBTET AP is grateful to **Sri M.M. Nayak, I.A.S.,** the then **Special Commissioner of Technical Education & Chairman,SBTET, AP**. for their guidance and valuable inputs during process of revising, modifying, updating and bring it for implementing the Curriculum C-20 from 2020-21 academic year.

The Secretary, SBTET AP acknowledge with thanks the guidance & inspiration provided by **Sri. V.S. Dutt,** the then **Secretary, SBTET, Andhra Pradesh,** and other officials of State Board of Technical Education, Andhra Pradesh, experts from industry, academia from the Universities and higher learning institutions and all teaching fraternity from the Polytechnics who are directly or indirectly involved in preparation of the curriculum.

K.VIJAYA BHASKAR
Secretary (FAC)
SBTET AP

RULES AND REGULATIONS OF C-20 CURRICULUM

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.

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).

b) The candidates seeking admission should have appeared for S.S.C examination, conducted by the Board of Secondary Education, Andhra Pradesh or equivalent examination thereto, at the time of 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.

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

d) For admission into the following Diploma Courses for which entry qualification is 10+2, candidates need not appear for POLYCET. A separate notification will be issued for admission into these courses.

i). D.HMCT ii).D. Pharmacy

3 MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

4 PERMANENT IDENTIFICATION NUMBER (PIN)

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

5 NUMBER OF WORKING DAYS PER SEMESTER / YEAR:

a) The Academic year for all the Courses shall be in accordance with the Academic Calendar.
b) The Working days in a week shall be from Monday to Saturday
c) There shall be 7 periods of 50 minutes duration 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.

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.
f) **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.

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.

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.

8 SCHEME OF Evaluation

a) First Year

THEORY Courses: Each Course carries Maximum marks of 80 with 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 Marks for internal assessment i.e. sessional marks for each practical Course with an end examination of 3 hours duration carrying 60 marks. However, there are no minimum marks prescribed for sessionals.

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

THEORY 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 3hours duration 40/20 sessional marks.

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.**

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

The average of marks of all the test, reduced to 20 shall be taken as final sessional in any case.

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.

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

(ii) Laboratory Courses:

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

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) HoDs from Govt.Polytechnic, Sr. Lecturers, Lecturers

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 and 2. Training 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 weeks	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**

10 MINIMUM PASS MARKS

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.

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.

INDUSTRIAL ASSESSMENT:

Pass marks is 50% in assessment at Industry (I and II assessments put together) and also 50% in final summative assessment at institution level

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.

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

A) For Diploma Courses of 3 Years duration

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

ii. A candidate shall be promoted to 3rd semester if he/she puts the required percentage of attendance in the first year and pays the examination fee. A candidate who could not pay the first year examination fee has to pay the promotion fee as prescribed by State Board of Technical Education and Training, AP 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 AP 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 the required percentage of attendance in the 4th semester
b) Should not have failed in more than four Courses in 1st year

For IVC & ITI Lateral Entry Students:

a) A candidate is eligible to appear for the 4th semester examination if he/she puts the required percentage of attendance in the 4th semester
b) A candidate is eligible to appear for the 4th semester examination if he/she clears at least two Courses in third semester.

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

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

a) Puts the required percentage of attendance in the 5th semester
b) Should get eligibility to appear for 4th Semester examination.

The first backlog exam in 5th semester will be conducted only in instant/supplementary diploma examination.

For IVC& ITI Lateral Entry students:

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

v) A candidate shall be sent to Industrial training provided he/she puts in the required percentage of attendance in the 4th 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)

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

For IVC & ITI Lateral Entry students:

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

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

a). Puts the required percentage of attendance in the 4th semester
b). Should not have failed in more than Four backlog Courses of 1st year.

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
b) Should get eligibility to appear for 4th semester Examination.

For IVC & ITI Lateral Entry students:

a) Puts in the required percentage of attendance in the 7th semester
b) Should not have failed more than four backlog Courses of 3rd 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
b) Should not have failed in more than Four backlog Courses of 1st year

For IVC & ITI Lateral Entry Students:

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

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

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

a) Puts in the required percentage of attendance in the 5 th semester.
b) Should get eligibility to appear for 4th Semester examination.

For IVC & ITI Lateral Entry students:

a) Puts in the required percentage of attendance in the 5th semester.
b) Should not have failed in more than Four backlog Courses of 3rd Semester.

v. A candidate shall be promoted to 6th semester provided he/she puts in the required percentage of attendance in the 5th semester and 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 and
b) should get eligibility to appear for 4th Semester Examination.

For IVC & ITI Lateral Entry students:

a) Puts in the required percentage of attendance in 6th semester.
b) Should get eligibility to appear for 5th Semester Examination.

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

For IVC & ITI Lateral Entry students:

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

Important Note:

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

OTHER DETAILS

a) In case a candidate does not successfully complete the Industrial training, he / she will have to repeat the training at his / her own cost.
b) The First spell of Industrial training shall commence 10 days after the completion of the last theory examination of 4th Semester.
c) The Second spell of Industrial training shall commence within 10 days after the completion of first spell of Industrial training.

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.

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.

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 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 marks 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', 'B' and 'C'**.

Section 'A' with Max marks of 30, contains 10 short answer questions. All questions are to be answered and each carries 3 marks, i.e., 10 x 3 = 30.

Section 'B' with Max marks of 40 contains 5 essay type questions including Numerical questions (without any divisions in the question), with internal choice(Either/or type), each carrying 8 marks, i.e., Max. Marks: 5 x 8 = 40.

Section 'C' with Max marks of 10 contains single essay type, Higher order Thinking skills question (HoTs)including Numerical questions, without choice (without any divisions in the question),

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, ie. 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.

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.

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.

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.

<u>For IVC & ITI Lateral Entry students</u>:

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

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

A) FOR ISSUE OF PHOTO COPIES OF VALUED ANSWER SCRIPTS

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.

20. MAL PRACTICE CASES:

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

21. DISCREPANCIES/ PLEAS:

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

22. ISSUE OF DUPLICATE DIPLOMA

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

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

23. ISSUE OF MIGRATION CERTIFICATE AND TRANSCRIPTS:

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

24. SPECIFIC CHANGES INCORPORATED IN PRESENT CURRICULUM C-20 BRANCH: AUTOMOBILE ENGINEERING

All the subjects in earlier curricula are reviewed and the following specific changes are discussed and incorporated.

1. In Engineering Mechanics (C-20 A-105) the topics of friction in screw jack and journal bearings are added in friction and chapter of dynamics is removed as those topics are being covered in Engineering Physics.
2. Generating system is included in Automobile Electrical and Electronic System (A-306)
3. Exclusive lab for Automobile Electrical and Electronic systems is introduced in III semester (A-310)
4. A chapter on Automobile air conditioning system is included in Automobile chassis and body engineering (A-403).
5. Drawing of Cam profiles is included in Automobile Engineering drawing (A-407) by deleting from Design of machine elements as it is treated to be more appropriate in (A-407).
6. Experiments on starting, generating and ignition systems from A-409 (C-16) are excluded and included in A-310 of C20
7. A lab on Hydraulics and pneumatic control is introduced in IV semester (A-410).
8. Industrial Management and smart technologies is renamed as Industrial Management (C-20 A-501)
9. Design of engine cylinder, cylinder head, crank shaft, brakes and clutch are introduced in Design of machine elements (A-502).
10. A new chapter Automobile assembly line and Testing which includes 1. Chassis dynamometer 2.Crash test 3. Rollover test is introduced in Modern Trends in Automobile Engineering (C-20 A-504) to suit the requirements of automobile engineers.
11. A new subject on Electrical and Electric Hybrid Vehicles (C-20 A-505) is introduced in V semester to sail the Automobile Students Community in the new era of Advanced Automobile Technologies.

25. 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 Vijayawada.

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

DIPLOMA IN AUTOMOBILE ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
I YEAR

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

DIPLOMA IN AUTOMOBILE ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
III Semester

Subject Code	Name of the Subject	Instruction period / week		Total Periods	Scheme of Examination			
		Theory	Practical/Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
A-301	Engineering Mathematics – II	4	-	60	3	20	80	100
A-302	Automobile Power Plants	4	-	60	3	20	80	100
A-303	Automobile Transmission System	4	-	60	3	20	80	100
A-304	Engineering Materials and Manufacturing Processes	4	-	60	3	20	80	100
A-305	Thermal Engineering	4	-	60	3	20	80	100
A-306	Automobile Electrical and Electronics Systems	4	-	60	3	20	80	100
PRACTICAL								
A-307	Machine Drawing	-	6	90	3	40	60	100
A-308	Automobile Laboratory	-	3	45	3	40	60	100
A-309	Workshop Practice – II	-	6	90	3	40	60	100
A-310	Automobile Electrical & Electronics Laboratory	-	3	45	3	40	60	100
TOTAL		24	18	360+270	-	280	720	1000

DIPLOMA IN AUTOMOBILE ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
IV Semester

Subject Code	Name of the Subject	Instruction period / week		Total Periods	Scheme of Examination			
		Theory	Practical/Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY (for a duration of 9 weeks):								
A-401	Engineering Mathematics - III	3		45		20	80	100
A-402	Strength of Materials and Fluid Mechanics	5		75		20	80	100
A-403	Automobile Chassis and Body Engineering	4		60		20	80	100
A-404	Automobile Servicing and Maintenance	4		60		20	80	100
A-405	Special Purpose Vehicles	4		60		20	80	100
A-406	Motor Transport Organisation	4		60		20	80	100
PRACTICAL								
A-407	Automobile Engineering Drawing	-	6	90	3	40	60	100
A-408	Communication Skills	-	3	45	3	40	60	100
A-409	Automobile Servicing and Maintenance Laboratory	-	6	90	3	40	60	100
A-410	Hydraulic and Pneumatic Controls Laboratory	-	3	45	3	40	60	100
TOTAL		24	18	360+270	-	280	720	1000

DIPLOMA IN AUTOMOBILE ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
V Semester

Subject Code	Name of the Subject	Instruction period / week		Total Periods	Scheme of Examination			
		Theory	Practical/Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY (for a duration of 9 weeks):								
A-501	Industrial Management	5	-	75	3	20	80	100
A-502	Design of Machine Elements	5	-	75	3	20	80	100
A-503	Production Technology	5	-	75	3	20	80	100
A-504	Modern Trends in Automobile Engineering	5	-	75	3	20	80	100
A-505	Electric Vehicles	4	-	60	3	20	80	100
PRACTICAL								
A-506	CAD Practice	-	6	90	3	40	60	100
A-507	IC Engine Testing and Vehicle Diagnosing Lab	-	6	90	3	40	60	100
A-508	Life Skills	-	3	45	3	40	60	100
A-509	Project Work	-	3	45	3	40	60	100
TOTAL		**24**	**18**	**360+ 270**	**-**	**260**	**640**	**900**

INDUSTRIAL TRAINING

Subject Title	Subject Code	Duration
Industrial Training	A-601	6 Months

Time schedule

S.NO	Code	TOPICS	Duration
1	A-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 Equipment's) List of Processes: Skills Acquired, Conclusions and References	Six Months

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 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**

FIRST YEAR

DIPLOMA IN AUTOMOBILE ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS

Subject Code	Name of the Subject	Instruction period / week		Total Period / year	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
A-101	English	3	-	90	3	20	80	100
A-102	Engineering Mathematics-I	5	-	150	3	20	80	100
A-103	Engineering Physics	4	-	120	3	20	80	100
A-104	Engineering Chemistry & Environmental Studies	4	-	120	3	20	80	100
A-105	Engineering Mechanics	4	-	120	3	20	80	100
A-106	Workshop Technology	4	-	120	3	20	80	100
PRACTICAL:								
A-107	Engineering Drawing	-	6	180	3	40	60	100
A-108	Basic Workshop Practice	-	6	180	3	40	60	100
A-109	Physics Lab	-	1.5	90	3	20	30	50
A-110	Chemistry Lab	-	1.5	90	3	20	30	50
A-111	Computer Fundamentals Lab	-	3	90	3	40	60	100
TOTAL		**24**	**18**	**1260**		**280**	**720**	**1000**

ENGLISH

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

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

Course Objectives	To improve the skills of English Language use by enriching vocabulary and learning accurate structures for effective communication.
	To comprehend themes for value based living in professional and personal settings.

CO No.	Course Outcomes
CO1	Applies perceptions of themes related to societal responsibility of adolescents towards their surroundings.
CO2	Demonstrates knowledge of form and function of ‘grammar items’ and use them in both academic and everyday situations.
CO3	Demonstrates effective English communication skills with competence in listening, speaking, reading and writing in academic, professional and everyday contexts.
CO4	Displays positivity and values of harmonious living in personal and professional spheres as reflected through communication.

Blue Print of Question Paper

S. No.	Name of the Unit	Periods Allocated	Weightage Allocated	Marks Wise Distribution of Weightage				Question Wise Distribution of Weightage				CO's Mapped
				R	U	Ap	An	R	U	Ap	An	
1	English for Employability	8	17	3	8*			1	1*	1*		CO1, CO2, CO3, CO4
2	Living in Harmony	8		3				1				CO1, CO2, CO3, CO4
3	Connect with Care	8				3						CO1, CO2, CO3, CO4
4	Humour for Happiness	8	14		3	8*			1	1*		CO1, CO2, CO3, CO4
5	Never Ever Give Up!	8			3				1			CO1, CO2, CO3, CO4
6	Preserve or Perish	9	14		8*	3			1*	1		CO1, CO2, CO3, CO4
7	The Rainbow of Diversity	8				3				1		CO1, CO2, CO3, CO4
8	New Challenges - Newer Ideas	8	35		8*	8*+3+3+3	10*		1*	4	1*	CO1, CO2, CO3, CO4
9	The End Point First!	8										CO1, CO2, CO3, CO4
10	The Equal Halves	8										CO1, CO2, CO3, CO4
11	Dealing with Disasters	9										CO1, CO2, CO3, CO4
TOTAL		**90**	**80**	**6**	**30**	**34**	**10**	**2**	**5**	**8**	**1**	

PART-A: 10 Questions 3 marks each Marks	= 30	All Questions are compulsory 60 minutes	:
PART-B: 5 Questions 8 marks each Marks	= 40	Internal choice 90 minutes	:
Part-C: 1 Question 10 marks Marks (Higher Order Question)	= 10	No choice, one compulsory question minutes	: 30

NOTE: * indicates questions can be given from any of the corresponding lessons in the blue print.

Question Paper Pattern for Unit Tests

Part A: 16 marks: 4 questions with 1 mark each (FIB, True/false, one word/phrase, etc.)

4 questions with 3 marks each (short answer/ descriptive/ applicative questions)

Part B: 24 marks: 3 questions 8 marks each with internal choice

LEARNING OUTCOMES

1. English for Employability

1.1. Explain 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 for everyday situations

4. Humour for Happiness

4.1. Explain the importance of humour for a healthy living

4.2. Improve vocabulary related to the theme

4.3. Display reading and speaking skills

4.4. Frame sentences with proper Subject – Verb agreement

4.5. Explain 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. Practice 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. Describe the ecological challenges that we face today and act to save the environment.

6.2. Narrate / Report past events.

6.3. Develop vocabulary related to environment.

6.4. Write e-mails.

7. The Rainbow of Diversity

7.1. Illustrate and value other cultures for a happy living in multi-cultural workspace

7.2. use 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. Explain the functional difference between Active Voice and Passive Voice

8.2. Use Passive Voice to speak and write in various contexts

8.3. List the major parts and salient features of an essay

8.4. Explain latest innovations and get motivated

9. The End Point First!

9.1. Illustrate the importance of setting a goal 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. Speak and write about 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. write different kinds of reports

Textbook: INTERACT (A Textbook for I Year English) - Published 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

ENGINEERING MATHEMATICS-I

Course Code	Course Title	No. of Periods/week	Total No. of periods	Marks for FA	Marks for SA
A-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	33	CO4
5	Applications of Differentiation	19	CO4, 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 various functions, resolve partial fractions and solve problems on matrices.
	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	Evaluate solutions for engineering problems using differentiation.

ENGINEERING MATHEMATICS – I
COMMON TO ALL BRANCHES
Learning Outcomes
UNIT - I

C.O. 1 Identify various functions, resolve partial fractions and solve problems on matrices.

L.O. 1.1 Define Set, ordered pairs and Cartesian product - examples.

1.2 Explain Relations and functions – examples

1.3 Find Domain & Range of functions – simple examples.

1.4 Classify types of functions (into, many-to-one, one-one, onto and bijective).

1.5 Define inverse functions - examples.

1.6 Define rational, proper and improper fractions of polynomials.

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

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

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

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

1.11 Define the transpose of a matrix and write its properties;

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

2.2 List the values of trigonometric ratios at specified values.

2.3 Draw graphs of trigonometric functions.

2.4 Explain periodicity of trigonometric functions.

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

2.6 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.

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

2.8 Solve simple problems on compound angles.

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

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

2.11 Solve simple problems using the above formulae

Syllabus for Unit test-I completed

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

2.13 Solve problems by applying these formulae to sum or difference or product of three or more terms.

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

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

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

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

2.18 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.

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

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

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

2.22 Explain the formulae for $\sin A/2$, $\cos A/2$, $\tan A/2$ and $\cot A/2$ in terms of semi-perimeter s and sides a,b,c and solve problems.

2.23 List various formulae for the area of a triangle.

2.24 Solve problems using the above formulae.

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

2.26 Represent inverse hyperbolic functions in terms of logarithms.

2.27 Define complex number, its modulus , conjugate and list their properties.
2.28 Define the operations on complex numbers with examples.
2.29 Define amplitude of a complex number.
2.30 Represent the complex number in various forms like modulus-amplitude (polar) form, Exponential (Euler) form with examples.
2.31 Write DeMoivre's theorem (without proof) and illustrate with simple 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 the 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 Solve simple problems on the above forms.

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

3.4 Define locus of a point and define a circle.

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

3.6 Find the equation of a circle given (i) centre and radius, (ii) two ends of a diameter (iii) Centre and a point on the circumference (iv) three non collinear points.

3.7. Define a conic section.

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

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

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

Syllabus for Unit test-II completed

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 $\lim_{x\to l}\frac{f(x)}{g(x)}$ and $\lim_{x\to\infty}\frac{f(x)}{g(x)}$

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

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

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 State the significance of derivative in scientific and engineering applications.

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

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

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

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

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

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

4.13 Find the derivatives of hyperbolic functions.

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

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

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

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

4.18 Explain the definition of Homogenous function of degree n.

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

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

L.O. 5.1 State the geometrical meaning of the derivative as the slope of the tangent to the curve y=f(x) at any point on the curve.

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

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

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

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

5.6 Define the concept of increasing and decreasing functions.

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

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

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

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

Syllabus for Unit test-III completed

COMMON TO ALL BRANCHES

COURSE CONTENT

Unit-I

Algebra

1. **Relations and Functions**:
   Define Set, Ordered pairs, Cartesian product, Relations, functions, domain & range of functions. Describe types of functions (in-to, many-to-one, one-one, onto and bijective) and inverse functions – examples.

2. **Partial Fractions:**
   Define rational, proper and improper fractions of polynomials. Resolve rational fractions in to their partial fractions covering the types mentioned below.

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

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

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

Unit-II

Trigonometry

4. **Trigonometric ratios:**
   Definition of trigonometric ratios of any angle, values of trigonometric ratios at specified values, draw graphs of trigonometric functions, periodicity of trigonometric functions.
5. **Compound angles:**
   Formulas of sin(A±B), cos(A±B), tan(A±B),cot(A±B),and related identities with problems.
6. **Multiple and sub multiple angles:**
   Formulae for trigonometric ratios of multiple angles 2A, 3A and sub multipleangles A/2
   with problems.

7. Transformations of products into sums or differences and vice versa simple problems
8. **Inverse trigonometric functions:**
   Definition, domains and ranges-basic properties- problems.
9. **Trigonometric equations:**
   Concept of a solution, principal value and general solution of trigonometric equations:
   sinx =k , cosx= k, tanx =k, where k is a constant. Solutions of simple quadratic equations, equations involving usage of transformations- problems.
10. **Properties of triangles:**
    Relation between sides and angles of a triangle- sine rule, cosine rule, tangent rule and projection rule-area of a triangle- problems.
11. **Hyperbolic functions:**
    Definitions of hyperbolic functions, identities of hyperbolic functions, inverse hyperbolic
    functions and expression of inverse hyperbolic functions in terms of logarithms.
12. **Complex Numbers:**
    Definition of a complex number, Modulus and conjugate of a complex number, Arithmetic operations on complex numbers, Modulus- Amplitue (polar) form , Exponential form (Euler form) of a complex number- Problems. DeMoivre's theorem.

UNIT-III
Coordinate geometry

13. **Straight lines:** various forms of straight lines, angle between lines, perpendicular distance from a point, distance between parallel lines-examples.
14. **Circle:** locus of a point, Circle, definition-Circle equation given (i) centre and radius, (ii)
    two ends of a diameter (iii) centre and a point on the circumference (iv) three non collinear points - general equation of a circle – finding centre, radius.
15. 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:

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

UNIT-V

Applications of Derivatives:

18. Geometrical meaning of the derivative, equations of Tangent and normal to a curve at any point. Lengths of tangent, normal, sub tangent and subnormal to the curve at any point - problems.

19. Physical applications of the derivative – velocity, acceleration, derivative as a rate measure –Problems.

20. Applications of the derivative to find the extreme values – Increasing and decreasing functions, finding the maxima and minima of simple functions - problems leading to applications of maxima and minima.

21. Using the concept of derivative of a function of single variable, find the absolute error, relative and percentage errors and approximate values due to errors in measuring.

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. M.Vygodsky, Mathematical Handbook, Mir Publishers, Moscow.
4. Frank Ayers & Elliott Mendelson, Schaum's Outline of Calculus, Schaum's Series

Engineering Mathematics – I
Blue print

S.No	Chapter/ Unit title	No of Periods		Weightage Allotted	Marks wise distribution of weightage				Question wise distribution of weightage				COs mapped
	Unit - I : Algebra	**Theory**	**Practice**		**R**	**U**	**Ap**	**An**	**R**	**U**	**Ap**	**An**	
1	Relations and Functions	4	2	3	0	3	0	0	0	1	0	0	**CO 1**
2	Partial Fractions	3	2	3	0	3	0	0	0	1	0	0	**CO 1**
3	Matrices and Determinants	10	10	11	3	0	8	0	1	0	1	0	**CO 1**
	Unit - II : Trigonometry												
4	Trigonometric Ratios	1	1	0	0	0	0	0	0	0	0	0	**CO2**
5	Compound Angles	3	2	3	3	0	0	0	1	0	0	0	**CO2**
6	Multiple and Submultiple angles	4	4	3	0	3	0	0	0	1	0	0	**CO2**
7	Transformations	3	3	8	0	8	0	0	0	1	0	0	**CO2**
8	Inverse Trigonometric Functions	3	2										
9	Trigonometric Equations	3	2	8	0	0	8	0	0	0	1	0	**CO2**
10	Properties of triangles	3	2										
11	Hyperbolic Functions	1	1	0	0	0	0	0	0	0	0	0	**CO2**
12	Complex Numbers	4	2	3	3	0	0	0	1	0	0	0	**CO2**
	Unit III : Co-ordinate Geometry												
13	Straight Lines	4	2	3	3	0	0	0	1	0	0	0	**CO3**
14	Circle	3	2	8	0	8	0	0	0	1	0	0	**CO3**
1	Conic	8	4										

5	Sections												
	Unit – IV : Differential Calculus												
16	Limits and Continuity	4	2	3	0	3	0	0	0	1	0	0	**CO4**
17	Differentiation	17	10	14	3	11	0	0	1	2	0	0	**CO4**
	Unit - V : Applications of Differentiation												
18	Geometrical Applications	3	2	10	0	0	0	10	0	0	0	1	**CO5**
19	Physical Applications	2	2										
20	Maxima and Minima	3	4										
21	Errors and Approximations	2	1										
Total		**89**	**61**	**80**	**15**	**39**	**16**	**10**	**5**	**8**	**2**	**1**	

R: Remembering Type : 15 Marks
U: understanding Type : 39 Marks
Ap: Application Type : 16 Marks
An: Analysing Type : 10 Marks

Engineering Mathematics – I
Unit Test Syllabus

Unit Test	Syllabus
Unit Test-I	From L.O. 1.1 to L.O. 2.11
Unit Test-II	From L.O. 2.12 to L.O. 3.10
Unit Test-III	From L.O.4.1 to L.O. 5.10

ENGINEERING PHYSICS

Course code	Course Title	No. of Periods per week	Total No. of Periods	Marks for FA	Marks for SA
A-103	Engineering Physics	4	120	20	80

S. No	Unit Title/Chapter	No of Periods	COs Mapped
1	Units and Dimensions	08	CO1
2	Elements of Vectors	12	CO1
3	Dynamics	12	CO2
4	Friction	10	CO2
5	Work, Power and Energy	12	CO3
6	Simple harmonic motion	12	CO3
7	Heat and Thermodynamics	12	CO4
8	Sound	10	CO4
9	Properties of matter	10	CO5
10	Electricity and Magnetism	12	CO5
11	Modern physics	10	CO5
Total		**120**	

Course Title: Engineering Physics	
Course Objectives	1. To familiarize with the concepts of Physics involved in the process of various Engineering, Industrial and Daily life Applications. 2. To understand and apply the basic principles of physics in the field of engineering and technology to familiarize certain natural phenomenon occurring in the day to day life 3. To reinforce theoretical concepts by conducting relevant experiments/exercises

Course Outcomes	CO1	Explain S.I units and dimensions of different physical quantities, basic operations among vector quantities.
	CO2	Explain the motion of objects moving in one dimension and two dimensions, the causes of motion and hindrance to the motion of the objects especially with respect to friction.
	CO3	Explain the mechanical energy of bodies like PE, KE and conservation law of energy, the properties of simple harmonic motion.
	CO4	Explain gas laws, ideal gas equation, Isothermal and adiabatic processes, Specific heats, to study the laws of thermodynamics. Causes, consequences and methods to minimise noise pollution, explain beats, Doppler effect, Reverberation, echoes.
	CO5	Explain certain properties of solids, liquids like elastic properties, viscosity and surface tension. Explain Ohm's law, to study Kirchoff's laws, to study the principle of Wheatstone's bridge and its application to meter bridge. To study the magnetic force and understand magnetic field. To compute magnetic field strength on axial and equatorial lines of a bar magnet. To familiarise with modern topics like photoelectric effect, optical fibres, superconductivity and nanotechnology.

LEARNING OUTCOMES

1.0 Concept of Units and dimensions

1.1 Explain the concept of Units, Physical quantity, Fundamental physical quantities and Derived physical quantities

1.2 Define unit, fundamental units and derived units, State SI units with symbols

1.3 State Multiples and submultiples in SI system, State Rules of writing S.I. units, State advantages of SI units

1.4 Define Dimensions, Write Dimensional formulae of physical quantities

1.5 List dimensional constants and dimensionless quantities

1.6 State the principle of homogeneity of dimensions

1.7 State the applications and limitations of dimensional analysis

1.8 Errors in measurement, Absolute error, relative error, percentage error, significant figures

1.9 Solve problems

2.0 Concept of Elements of Vectors

2.1 Explain the concept of scalars, Vectors and give examples

2.2 Represent vectors graphically, Classify the Vectors, Resolve the vectors

2.3 Determine the resultant of a vector by component method, represent a vector in Space using unit vectors (i, j, k)

2.4 State and explain triangle law, parallelogram law, and polygon law of addition of Vectors

2.5 Define Dot product of two vectors with examples (Work done, Power), mention the Properties of dot product

2.6 Define cross product of two vectors with examples (Torque, Linear velocity) Mention the properties of Cross product.

2.7 Solve the related numerical problems

3.0 Concept of Dynamics

3.1 Write the equations of motion in a straight line. Explain the acceleration due to Gravity.

3.2 Explain vertical motion of a body and derive expressions for a) Maximum Height, b) Time of ascent, c) time of descent, and d) time of flight

3.3 Derive height of a tower when a body projected vertically upwards from the top of a tower.

3.4 Explain projectile motion with examples

3.5 Explain horizontal projection and derive an expression for the path of a projectile in horizontal projection

3.6 Explain oblique projection and derive an expression for it. Derive formulae for a) Maximum Height b) time of ascent c) time of descent and d) time of flight e) Horizontal Range, f) Maximum range

3.7 Define force, momentum, angular displacement, angular velocity, angular acceleration, angular momentum, moment of inertia, torque

3.8 Solve the related numerical problems

4.0 Concept of Friction

4.1 Define friction and classify the types of friction.

4.2 Explain the concept of normal reaction.

4.3 State the laws of friction.

4.4 Define coefficients of friction, Angle of friction and angle of repose.

4.5 Derive expressions for acceleration of a body on a rough inclined plane. (Upwards and downwards)

4.6 List the advantages and disadvantages of friction.

4.7 Mention the methods of minimizing friction.

4.8 Explain why it is easy to pull a lawn roller than to push it.

4.9 Solve the related numerical problems.

5.0 Concepts of Work, Power, and Energy

5.1 Definethe terms Work, Power and Energy. State SI units and dimensional Formulae.

5.2 Define potential energy and give examples, derive an expression for potential energy.

5.3 Define Kinetic energy and give examples, derive an expression for kinetic energy.

5.4 State and derive Work-Energy theorem.

5.5 Derive the relation between Kinetic energy and momentum.

5.6 State the law of conservation of energy and verify it in the case of a freely falling body.

5.7 Solve the related numerical problems.

6.0 Concepts of Simple harmonic motion

6.1 Define Simple harmonic motion, Give examples, state the conditions.

6.2 Explanation of uniform circular motion of a particle is a combination of two perpendicular S.H.M.s.

6.3 Derive expressions for displacement, velocity, acceleration, Frequency, Time period of a particle executing SHM.
6.4 Define phase of SHM.
6.5 Define Ideal simple pendulum and derive expression for time period of simple pendulum.
6.6 State the laws of motion of simple pendulum.
6.7 Solve the related numerical problems.

7.0 Concept of heat and thermodynamics

7.1 Explain the concept of expansion of gases
7.2 State and explain Boyle's and Charles laws.
7.3 Define absolute zero temperature, absolute scale of temperature
7.4 Define ideal gas and distinguish from real gas
7.5 Derive Ideal gas equation. Define specific gas constant and universal gas constant, write S.I unit and dimensional formula. Calculate the value of R.
7.6 Explain why universal gas constant is same for all gases
7.7 State and explain isothermal process and adiabatic process
7.8 State first and second laws of thermodynamics and state applications
7.9 Define specific heats and molar specific heats of a gas, Derive C_P-C_V =R
7.10 Solve the relevant numerical problems

8.0 Concept of Sound

8.1 Concept of the sound, Wave motion. (longitudinal and transverse wave)
8.2 Distinguish between musical sound and noise.
8.3 Explain noise pollution and state SI unit for intensity level of sound.
8.4 Explain causes, effects and methods of minimizing of noise pollution.
8.5 Explain the phenomenon of beats state the applications.
8.6 Define Doppler effect, list the applications.
8.7 Define reverberation and reverberation time and write Sabine's formula.
8.8 Define and explain echoes state its applications.
8.9 State conditions of good auditorium.
8.10 Solve the related numerical problems.

9.0 Concepts of properties of matter

9.1 Explain the terms elasticity, stress, strain and types of stress and strain.
9.2 State and explain Hooke's law.
9.3 Definitions of Modulus of elasticity, Young's modulus(Y), Bulk modulus (K), Rigidity modulus (n),Poisson's ratio (σ),
9.4 Define surface tension and give examples.
9.5 Explain Surface tension with reference to molecular theory.
9.6 Define angle of contact and capillarity and write formula for Surface Tension.
9.7 Explain the concept of viscosity, give examples, write Newton's formula.
9.8 Define co-efficient of viscosity and write its units and dimensional formula and State Poiseulle's equation for Co-efficient of viscosity.
9.9 Explain the effect of temperature on viscosity of liquids and gases.
9.10 Solve the related numerical problems.

10. Concepts of Electricity and Magnetism

10.1 Explain Ohm's law in electricity and write the formula.

10.2 Define specific resistance, conductance and state their units.

10.3 Explain Kichoff's laws.

10.4 Describe Wheatstone's bridge with legible sketch.

10.5 Describe Meter Bridge for the determination of resistivity with a circuit diagram.

10.6 Explain the concept of magnetism. State the Coulomb's inverse square law of Magnetism.

10.7 Define magnetic field and magnetic lines of force and write the properties of magnetic lines of force.

10.8 Derive an expression for the moment of couple on a bar magnet placed in a uniform magnetic field.

10.9 Derive equations for Magnetic induction field strength at a point on the axial line and on the equatorial line of a bar magnet.

10.10 Solvethe related numerical problems

11.0 Concepts of modern physics

11.1 State and explain Photo-electric effect and Write Einstein's photo electric Equation.

11.2 State laws of photo electric effect.

11.3 Explain the Working of photo electric cell, write its applications.

11.4 Recapitulation of refraction of light and its laws, critical angle, total Internal Reflection.

11.5 Explain the principle and working of Optical fiber, mention different types of Optical fiber, state the applications.

11.6 Define super conductor and super conductivity and mention examples.

11.7 State the properties of super conducting materials and list the applications.

11.8 Nanotechnology definition, nano materials, applications.

COURSE CONTENT

1. Units and Dimensions:

Introduction, Physical quantity, Fundamental and Derived quantities, Fundamental and Derived units, SI units, Multiples and Sub multiples, Rules for writing S.I. units, Advantages of SI units. Dimensions and Dimensional formulae, Dimensional constants and Dimensionless quantities, Principle of homogeneity, Advantages and limitations of dimensional analysis, Errors in measurement, Absolute error, relative error, percentage error, significant figures, Problems.

2. Elements of Vectors:

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

3. Dynamics

Introduction-Concept of acceleration due to gravity-Equations of motion for a freely falling body and for a body thrown up vertically- Projectiles- Horizontal and Oblique projections- Expressions for maximum height, time of flight, range-Define force, momentum, angular displacement, angular velocity, angular acceleration, angular momentum, moment of inertia, torque–problems.

4. Friction:

Introduction to friction- Causes- Types of friction- Laws of friction- Angle of repose-Angle of friction- rough inclined plane- Advantages and disadvantages of friction-Methods of reducing friction–Problems.

5. Work, Power and Energy:

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

6. Simple Harmonic Motion:

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

7. Heat and Thermodynamics:

Expansion of Gases, Boyle's law, absolute scale of temperature- Charles laws- Ideal gas equation- Universal gas constant- Differences between gas constant(r) and universal gas constant(R),Isothermal and adiabatic processes, Laws of thermodynamics, Specific heats - molar specific heats of a gas -Different modes of transmission of heat ,laws of thermal conductivity, Coefficient of thermal conductivity-Problems.

8. Sound:

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

9. Properties of matter

Definition of Elasticity –Definition of stress and strain -the units and dimensional formulae for stress and strain-The Hooke's law-Definitions of Modulus of elasticity, Young's modulus(Y), Bulk modulus(K), Rigidity modulus (n),Poisson's ratio (σ), relation between Y, K, n and σ(equations only no derivation)

Definition of surface tension-Explanation of Surface tension with reference to molecular theory - Definition of angle of contact -Definition of capillarity -The formula for surface tension based on capillarity - Explanation of concept of Viscosity - Examples for surface tension and Viscosity - Newton's formula for viscous force- Definition of co-efficient of viscosity- The effect of temperature

on viscosity of liquids and gases - Poiseuille's equation for Co-efficient of viscosity- The related numerical problems.

10. Electricity & Magnetism:

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

11. Modern Physics;

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

REFERENCEBOOKS

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

➢ **Model Blue Print with Weightage for Blooms category and questions for chapter and Cos mapped**

S. No	Unit Title/Chapter	No of Periods	Weightage of marks	Marks wise distribution of Weightage				Question wise distribution of Weightage				Mapped with CO
				R	U	Ap	An	R	U	Ap	An	
1	Units and Dimensions	08	03	3	0	0	0	1	0	0	0	CO1
2	Elements of Vectors	12	11	3	8	0	0	1	1	0	0	CO1
3	Dynamics	12	11	3	8	0	0	1	1	0	*	CO2
4	Friction	10	11	3	0	8	0	1	0	1	0	CO2
5	Work, Power and Energy	12	11	3	8	0	0	1	1	0	0	CO3
6	Simple harmonic motion	12	11	3	8	0	0	1	1	0	*	CO3
7	Heat and Thermodynamics	12	11	0	8	3	0	0	1	1	*	CO4
8	Sound	10	11	0	8	3	0	0	1	1	0	CO4
9	Properties of matter	10	08	0	8	0	0	0	1	0	0	CO5
10	Electricity and Magnetism	12	14	6	0	8	0	2	0	1	0	CO5
11	Modern physics	10	08	0	8	0	0	0	1	0	0	CO5
Total		**120**	**110**	**24**	**64**	**22**	**0**	**8**	**8**	**4**	***10**	

***One question of HOTs for 10 marks from any of the unit title 3 or 6 or 7**

➢ **Table specifying the scope of syllabus to be covered for Unit Tests**

Unit Test	Learning outcomes to be covered
Unit Test – 1	From 1.1 to 4.9
Unit Test – 2	From 5.1 to 7.10
Unit Test – 3	From 8.1 to 11.8

➢ **Model question paper for Unit Tests I,II,III with COs mapped**

ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES

Course code	Course Title	No. of Periods per week	Total No. of Periods	Marks for FA	Marks for SA
A-104	Engineering Chemistry and Environmental Studies	4	120	20	80

S.No	Unit Title/Chapter	No of Periods	COs Mapped
1	Fundamentals of Chemistry	18	CO1
2	Solutions	10	CO1
3	Acids and bases	10	CO1
4	Principles of Metallurgy	8	CO1
5	Electrochemistry	16	CO2
6	Corrosion	8	CO2
7	Water Treatment	10	CO3
8	Polymers	12	CO4
9	Fuels	6	CO4
10	Chemistry in daily life	6	CO4
11	Environmental Studies	16	CO5
	Total	**120**	

- **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 metallurgical process and alloys
	CO2	Explain electrolysis, Galvanic cell, emf and corrosion
	CO3	Explain the chemistry involved in the treatment of water by advanced method
	CO4	Synthesise of Plastics, rubber and applications of fuel chemical compounds used in our daily life.
	CO5	Explain the causes, effects and control methods of air and water pollution and measures to protect the environment

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

S.No	Unit Title/Chapter	No of Periods	Weight age of marks	Marks wise distribution of Weightage				Question wise distribution of Weightage				Mapped with CO
				R	U	Ap	An	R	U	Ap	An	
1	Fundamentals of Chemistry	18	19	8	8	3		1	1	1		CO1
2	Solutions	10	11	0	0	8	3			1	1	CO1
3	Acids and bases	10	11	0	8	0	3		1		1	CO1
4	Principles of Metallurgy	8	8	8	0	0		1				CO1
5	Electrochemistry	16	11	8	3	0		1	1		*	CO2
6	Corrosion	8	8	0	8	0			1			CO2
7	Water Treatment	10	11	8	3	0		1	1			CO3
8	Polymers	12	11	3	8	0		1	1		*	CO4
9	Fuels	6	3	3	0	0		1				CO4
10	Chemistry in daily life	6	3	0	0	3				1		CO4
11	Environmental Studies	16	14	3	11	0		1	2			CO5
Total		**120**	**110**	**12**	**6**	**6**	**6**	**20**	**35**	**5**	***10**	

***One question of HOTs for 10 marks from any of the unit title 5 or 8**

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.
1.4 Explain 1. Aufbau principle, 2 Pauli's exclusion principle 3 Hund's rule.
1.5 Define Orbital of an atom and draw the shapes of s, p and d- Orbitals.
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 , MgO, $*H_2$,$*O_2$ and $*N_2$. (* Lewis dot method)
1.10 List out the Properties of Ionic compounds and covalent compounds and distinguish between their properties.
1.11 Structures of ionic solids-define a) Unit cell b) co-ordination number and the structures of NaCl and CsCl unit cells.

2.0 Solutions

2.1 Define the terms 1.Solution, 2.Solute and 3.Solvent
2.2 Classify solutions based on physical state and solubility
2.3 Define mole and problems on mole concept.
2.4 Define the terms 1. Atomic weight, 2.Molecular weight and 3. Equivalent weight and
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, $CaCO_3$)
2.5 Define molarity and normality and 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

3.0 Acids and bases

3.1 Explain Arrhenius theory of Acids and Bases and give the limitations of Arrhenius theory of Acids and Bases.
3.2 Explain Bronsted–Lowry theory of acids and bases and give the limitations of Bronsted–Lowry theory of acids and bases.
3.3 Explain Lewis theory of acids and bases and give the limitations of Lewis theory of acids and bases.
3.4 Explain the Ionic product of water
3.5 Define pH and explain P^H scale and solve the Numerical problems on pH(Strong Acids and Bases)
3.6 Define and explain buffer solution and give the examples of buffer solutions.
3.7 State the application of buffer solutions

4.0 Principles of Metallurgy

4.1 List out the Characteristics of Metals and non-metals
4.2 Distinguish between Metals and Non-metals
4.3 Define the terms 1.Mineral, 2.Ore, 3. Gangue, 4.Flux5.Slag
4.4 Describe the methods of concentration of Ore; 1.Handpicking, 2.Levigation and 3. Froth Floatation
4.5 Describe the methods involved in extraction of crude metal- Roasting, Calcination and Smelting.
4.6 Explain the purification of Copper by Electrolytic Refining
4.7 Define an Alloy and Write the composition and uses of the following alloys. 1. Brass 2. Germen silver 3. Nichrome.

5.0 Electrochemistry

5.1 Define the terms1. Conductor 2. Semiconductor 3.Insulator, 4.Electrolyte5.Non–electrolyte.Give two examples each.
5.2 Distinguish between metallic conduction and Electrolytic conduction
5.3 Explain electrolysis by taking example fused NaCl
5.4 Explain Faraday's laws of electrolysis
5.5 Define 1.Chemical equivalent (E) 2.Electrochemicalequivalent (e) and their relation.
5.6 Solve the Numerical problems on Faraday's laws of electrolysis and applications of electrolysis (Electro plating)
5.7 Define Galvanic cell and explain the construction and working of Galvanic cell.
5.8 Distinguish between electrolytic cell and galvanic cell
5.9 Explain the electrode potentials and standard electrode potentials
5.10 Explain the electrochemical series and its significance
5.11 Explain the emf of a cell and solve the numerical problems on emf of the cell based on standard electrode potentials.

6.0 Corrosion

6.1 Define the term corrosion.
6.2 state the Factors influencing the rate of corrosion
6.3 Describe the formation of a) composition cell b) stress cell c)concentration cell during corrosion.
6.4 Define rusting of iron and explain the mechanism of rusting of iron.
6.5 Explain the methods of prevention of corrosion
a) Protective coatings (anodic and cathodic coatings)
b) Cathodic protection (Sacrificial anode process and Impressed–voltage process)

7. 0 Water Treatment

7.1 Define soft water and hard water with respect to soap action.
7.2 Define and classify the hardness of water.
7.3 List out the salts that causing hardness of water (with Formulae)
7.4 State the disadvantages of using hard water in industries.
7.5 Define Degree of hardness and units of hardness (mg/L) or(ppm).
7.6 Explain the methods of softening of hard water: a) Ion-exchange process, b)Permutit process or zeolite process
7.7 State the essential qualities of drinking water.
7.8 Chemistry involved in treatment of water (Coagulation, Chlorination, deflouridation)
7.9 Explain Osmosis and Reverse Osmosis with examples.

7.10 State the applications of Reverse Osmosis.

8.0 Polymers

8.1 Explain the concept of polymerisation

8.2 Describe the methods of polymerization a)addition polymerization of ethylene b)condensation polymerization of Bakalite(Only flow chart)

8.3 Define thermoplastics and thermosetting plastics with examples.

8.4 Distinguish between thermo plastics and thermosetting plastics

8.5 List the Characteristics of plastics and state the disadvantages of using plastics.

8.6 State the advantages of plastics over traditional materials.

8.7 Explain the methods of preparation and uses of the following plastics: 1. PVC, 2.Teflon, 3. Polystyrene 4. Nylon 6,6

8.8 Explain processing of Natural rubber and write the structural formula of Natural rubber.

8.9 List the Characteristics of raw rubber

8.10 Define and explain Vulcanization and List out the Characteristics of Vulcanized rubber.

8.11 Define the term Elastomer and describe the preparation and uses of the following synthetic rubbers a) Buna-s and b)Neoprene rubber.

9.0 Fuels

9.1 Define the term fuel

9.2 Classify the fuels based on physical state and based on occurrence.

9.3 List the characteristics of good fuel.

9.4 State the composition and uses of gaseous fuels.
a)water gas b) producer gas, c) natural gas, d) Coal gas, e)Biogas.

10.0 Chemistry in daily life

10.1 Give the basic chemical composition, applications, health aspects and pollution impacts of
a) soaps, and detergents b) vinegar c) Insect repellents d) activated charcoal e) Soft drinks

11.0 ENVIRONMENTALSTUDIES

11.1 Define the term environment and explain the scope and importance of environmental studies

11.2 Define the segments of environment 1).Lithosphere, 2).Hydrosphere, 3).Atmosphere, 4).Biosphere,

11.3 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) Consumers 14) Decomposers with examples

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

11.5 Explain biodiversity and threats to biodiversity

11.6 Define air pollution and classify the air pollutants-based on origin and physical state of matter.

11.7 Explain the causes, effects of air pollution on human beings, plants and animals and control methods of air pollution.

11.8 State the uses of forest resources.

11.9 Explain causes and effects of deforestation

11.10 Explain the causes and effects of the following
1.) Greenhouse effect, 2) Ozone layer depletion and 3) Acid rain

11.11 Define Water pollution, explain the causes, effects and control methods of Water pollution.

COURSE CONTENT

ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES

1. Fundamentals of Chemistry

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

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

2. Solutions

Introduction of concentration methods – mole concept, molarity and normality – Numerical problems on mole, molarity and normality.

3. Acids and Bases

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

4. Principles of Metallurgy

Characteristics of Metals and non-metals –Distinguish between Metals and Non-metals, Define the terms i) Metallurgy ii) ore iii) Gangue iv) flux v) Slag - Concentration of Ore –Hand picking, Levigation, Froth floatation – Methods of Extraction of crude Metal – Roasting, Calcination, Smelting – Alloys – Composition and uses of brass, German silver and nichrome.

5. Electrochemistry

Conductors, semiconductors, insulators, electrolytes and non-electrolytes – electrolysis – Faraday's laws of electrolysis-application of electrolysis(electroplating) -numerical problems on Faraday's laws – Galvanic cell – standard electrode potential – electrochemical series–emf and numerical problems on emf of a cell .

6. Corrosion

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

7. Water technology

Introduction–soft and hard water–causes of hardness–types of hardness –disadvantages of hard water – degree of hardness (ppm and mg/lit) – softening methods – permutit process – ion exchange process– qualities of drinking water –Chemistry involved in treatment of water (Coagulation, Chlorination, defluoridation) - Osmosis, Reverse Osmosis –Applications of Reverse osmosis.

8. Polymers

Introduction – polymerization – types of polymerization – addition, condensation with examples – plastics – types of plastics – advantages of plastics over traditional materials-Disadvantages of using plastics –

Preparation and uses of the following plastics i).PVC ii) Teflon iii) Polystyrene iv) .Nylonn 6,6 –Processing of natural rubber - Vulcanization – Elastomers-Preparation and applications of Buna-s, Neoprene rubbers.

9. Fuels

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

10. Chemistry in daily life

Basic composition, applications, health aspects and pollution impacts of soaps and detergents, vinegar, insect repellents, soft drinks, activated charcoal.

1. ENVIRONMENTALSTUDIES

Introduction– environment –scope and importance of environmental studies – important terms related to environment– renewable and non-renewable energy sources–Concept of ecosystem – Biotic components –Forest resources – Deforestation -Biodiversity and its threats-Air pollution – causes-effects–Global environmental issues – control measures – Water pollution – causes – effects – control measures.

REFERENCEBOOKS

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

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 3.7
Unit Test – 2	From 4.1 to 7.10
Unit Test – 3	From 8.1 to 11.11

ENGINEERING MECHANICS

Subject Title	Subject Code	Periods/Week	Periods per Year
ENGINEERING MECHANICS	A-105	04	120

TIME SCHEDULE

Sl. No.	Major topic	Periods Allocated	Weightage of marks	Part – A Short Type (3 marks)	Part – B Essay Type (8 Marks)	Part – C Essay Type (10 Marks)
1	Statics	26	14	2	1	
2	Friction	20	11	1	1	
3	Simple machines	28	14	2	1	
4	Basic Link Mechanisms	16	9	3	-	
5	Transmission of power	30	22	2	2	
Part – C Question having 10 marks weightage from CO3 or CO5			10			**1**
	Total	**120**	**80**	**10**	**5**	**1**

Course Code: A-105	Title: ENGINEERING MECHANICS	Total No. Of Periods: 120
Course Objectives:	**Upon completion of the course the student shall be able to**	
	1.0 Understand the effects of forces under equilibrium. 2.0 Apprehend the working principles of Simple Machines, friction and mechanisms 3.0 Comprehend the different mechanical means of power transmission.	

CO No.		Course Outcome
C01	**A-105.1**	Apply laws of equilibrium to solve simple problems in mechanics
C02	**A-105.2**	Apply the concepts of friction to solve simple problem in engineering
C03	**A-105.3**	Evaluate condition for maximum efficiency and mechanical advantage in simple machines
C04	**A-105.4**	Describe various basic link mechanisms
C05	**A-105.5**	Solve numerical related to various methods of power transmission

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

1.0 Statics

1.1 Explain the meaning of mechanics in Engineering and state its importance.

1.2 Review the system of units used.

1.3 Explain the concept of force.

1.4 List the types of forces.

1.5 Explain the force system a) Co-planar and Non-Coplanar, b) Parallel and Non-Parallel, c) Like and Unlike, d) Concurrent and Non-concurrent

1.6 Explain the concept of equilibrium.

1.7 State a) Parallelogram law of forces, b) Triangle law of forces, c) Polygon law of forces d) Lami‘s theorem.

1.8 Explain the concept of free body diagram

1.9 Solve the problems involving concurrent coplanar forces, non-concurrent coplanar forces and Lami‘s theorem

1.10 Define the term couple and moment of couple with legible sketch.

1.11 Explain the properties of a couple

1.12 State the condition of equilibrium of a body acted upon by co-planar forces.

2.0 Friction

2.1 Explain the concept of friction.

2.2 State the laws of friction.

2.3 Identify the machine members in which friction exists and desirable.

2.4 Explain the concept of friction in screw jack.

2.5 Compute the effort required raising and lowering the load by using screw jack.

2.6 Compute the efficiency of Screw jack.

2.7 State the purpose of bearings, types of bearings and designation of bearings.

2.8 Compute the friction in journal bearings.

2.9 Resolve the forces acting on bodies moving on horizontal plane.

2.10 Resolve the forces acting on bodies moving along the inclined planes.

2.11 Solve the related numerical problems.

3.0 Simple Machines

3.1 Define the important terms of simple machines a) Machine, b) Mechanical Advantage, c) Velocity Ratio, d) Efficiency.

3.2 Illustrate the use of three classes of simple lever.

3.3 Show that an inclined plane is a simple machine to reduce the effort in lifting loads.

3.4 Derive an expression for Velocity Ratio in cases of Wheel & Axle, Weston Differential pulley blocks, Pulleys, Worm & Worm wheel, Winch crabs, Screw jack, Rack & Pinion.

3.5 Compute the efficiency of a given machine.

3.6 Compute effort required to raise or lower the load under given conditions.

3.7 Interpret the law of machine.

3.8 State the conditions for self-locking and reversibility.

3.9 Calculate effort lost in friction and load equivalent of friction.

3.10 Evaluate the conditions for maximum Mechanical Advantage & Maximum efficiency.

4.0 Basic Link mechanisms

4.1 Define important terms of basic link mechanism a) Link, b) Kinematic pair, c) Kinematic chain, d) Mechanism & e) Machine

4.2 Explain kinematic pair and kinematic chain with the help of legible sketch.

4.3 List examples for Lower and Higher pairs.

4.4 Explain four bar chain and its inversions.

4.5 Explain slider crank chain and its inversions.

5.0 Transmission of power

5.1 Identify various power transmitting modes like belt, chain, rope, gears.

5.2 Select suitable material for belt and explain the belt fasteners.

5.3 Derive the expression for velocity ratio of a belt drive

5.4 Explain the term slip in belt and its effect on velocity ratio and explain the combined effect of belt thickness and slip on velocity ratio and calculate velocity ratio by considering this combined effect.

5.5 Explain the use of jockey pulley.

5.6 Distinguish between open belt drive and cross belt drive and determine the length of the belt in case of open belt and cross belt drives.

5.7 Explain the tensions in tight and slack sides of a belt and Calculate velocity ratio, angle of contact, length of the belt and power transmitted by belt drive.

5.8 Explain the rope drive, chain drive and gear drive state the advantages and limitations.

5.9 Explain the types of chain.

5.10 Classify the gears and explain nomenclature of gear

5.11 Discuss the simple and compound gear train.

5.12 Explain the applications of the above drives in engineering.

COURSE CONTENT

1.0 Statics

The meaning of word mechanics - Application of Mechanics in Engineering - System of Units - Definition and specification of force - System of forces - Resolution of force - Equilibrium and Equilibrant - Statement of Parallelogram law of forces, Triangle law of forces, Polygon law of forces and Lami's theorem - Drawing the free body diagram - Numerical problems related to

concurrent coplanar forces - Couple and moment of a couple - Condition for equilibrium of a rigid body subjected to number of coplanar non-concurrent forces - Related numerical problems

2.0 Friction

Definition of static friction, dynamic friction and impending friction - Laws of solid and fluid friction - Derivation of limiting angle of friction and angle of repose - Concept of reduction in friction by using bearings – types & Designation of Bearings - Friction in screw jack, journal bearings -Resolution of forces considering friction when a body moves on horizontal plane - Resolution of forces considering friction when a body moves on inclined plane - Numerical examples on the above cases

3.0 Simple Machines

Definition of Simple machine, and uses of simple machine, levers and inclined plane - Fundamental terms like mechanical advantage, velocity ratio and efficiency - Expressions for VR in case of Simple/Differential pulley/pulleys of 3 systems, Worms and Worm wheel, Rack and pinion, Winch crabs, & Screw jack - Conditions for reversibility and self locking - Law of Simple Machine - Effort lost in friction, Load equivalent of friction, Maximum Mechanical Advantage, and Maximum efficiency.

4.0 Basic Link Mechanism

Definition of terms: Link, Kinematic pair, Kinematic chain, Mechanism, Structure and Machine. Differentiate structure and machine, machine and mechanism - Quadric cycle chain and its inversions - Slider Crank chain and its inversion.

5.0 Transmission of power:

Belt drive, Materials for the belt drive and belt fasteners - (a) Explanation of the terms i)Velocity ratio, in terms of diameters of pulleys - ii)Slip, percentage of slip and its effect on velocity ratio - iii)Thickness of belt and its effect on velocity ratio - iv)Tight side and Slack side of the belt - Open belt and Cross belt drive - Effective tension ($T_1 – T_2$) - Velocity of the belt and Power transmitted by belt - Length of open belt and cross belt drives- Problems – Velocity ratio, Slip, length of the belts and Power transmitted in a belt drive - Rope drive – Advantages and limitations over a belt drive - Chain drive – Advantages and limitations over a belt drive - Types of chains - Gears and Gear trains - Nomenclature of gear - Types of gears – spur, helical, bevel, and spiral - Simple and compound gear trains - Velocity ratio in gear drive processes and problems - Advantages and limitations of gear drive over a belt drive.

REFERENCE BOOKS:

1	Basic Mechanical Engineering	by	V.N Kumar
2	Elements of Mechanical engineering	by	Roy &Choudary
3	Engineering Mechanics	by	Singer B.S.Publications
4	Engineering Mechanics	by	Basudeb Bhattacharya – Oxford Publishers
5	Engineering Mechanics	by	A Nelson Mc Graw Hill Publishers
6	Engineering Mechanics	by	I.B.Prasad
7	Engineering Mechanics	by	R.S.Khurmi S.Chand & Comp

8	Theory of Machines	by	S.S.Rathan TMH P
9	Theory of Machines	by	R.S. Khurmi
10	Theory of Mechanisms and Machines	by	Malik &Ghoshe

Blueprint of Question Paper

A-105, ENGINEERING MECHANICS

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks wise Distribution of Weight age				Question wise Distribution of Weight age			
				R	U	Ap	An	R	U	Ap	An
1	Statics	26	14	3	3	8	-	1	1	1	-
2	Friction	20	11	-	3	8	-	-	1	1	-
3	Simple Machines	28	14	3	-	8	3	1	-	1	1
4	Basic Link Mechanisms	16	9	3	3	3	-	1	1	1	-
5	Transmission of Power	30	22	3	3	8	8	1	1	1	1
Part – C Question having 10 marks weightage from CO3 or CO5			10				10				1
Total:		**120**	**80**	**12**	**12**	**35**	**21**	**4**	**4**	**5**	**3**

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

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 2.11
Unit Test – II	From 3.1 to 4.5
Unit Test – III	From 5.1 to 5.12

WORKSHOP TECHNOLOGY

Course Title	Course Code	Periods per Week	Periods per Year
WORKSHOP TECHNOLOGY	A-106	04	120

TIME SCHEDULE

Sl. No	Major topic	Periods Allocated	Weightage of marks	Part – A Short Type (3 marks)	Part – B Essay Type (8Marks)	Part – C Essay Type (10Marks)
1	Basic Workshop tools & operations					
	(1.1) Carpentry	20	6	2	-	
	(1.2) Fitting	25	14	2	1	
	(1.3) Forging	15	11	1	1	
	(1.4) Sheet metal	12	6	2	-	
2	Drilling	08	11	1	1	
3	Foundry	22	11	1	1	
4	Mechanical working of metals	18	11	1	1	
Part-C Question having 10 marks weightage from CO2 or CO3 or CO4			10	-	-	1
Total:		**120**	**80**	**10**	**5**	**1**

Course Code: A-106	Course: Workshop Technology	No. of Periods: 120
COURSE OBJECTIVES	**Upon completion of the course the student shall be able to** 1.0 Know basic workshop tools and operations in carpentry, fitting, forging and sheet metal 2.0 Know the drilling operation 3.0 Understand foundry and mechanical working of metals	

CO No.		Course Outcome
C01	**A-106.1**	Explain different tools and operations used in 1. Carpentry, 2. Fitting, 3.Forging and 4. Sheet metal
C02	**A-106.2**	Discuss various drilling machines and operations on drilling machine.
C03	**A-106.3**	Discuss the process of foundry.
C04	**A-106.4**	Analyse mechanical working of metals.

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

1.0 Basic workshop tools and its operation

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

1.1 **Carpentry**

a. Identify various carpentry tools.
b. List work holding devices.
c. Explain wood working processes viz., sawing, chiselling and planning.
d. Explain the use of carpentry joints such as lap joint, dovetail Joint, mortise and tenon joint with legible sketch
e. Explain the working of wood working machines.

1.2 **Fitting**

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

1.3 **Forging**

a. List various tools used in black-smithy.
b. List equipment used in a forging shop.
c. Explain the important smithy operations
d. Explain the working principle of machine forging
e. Explain machine forging operations such as upsetting, drawing down and punching with legible sketch
f. Explain the working principle of forging press with legible sketch.
g. List the forging defects

1.4 **Sheet Metal**

a. List various marking tools in sheet metal work
b. List various stakes
c. List various measuring tools used in sheet metal work
d. List various sheet metal joints.
e. Describe sheet metal operations such as shearing, bending, drawing and squeezing
f. Differentiate between riveting, soldering & brazing

2.0 Drilling

2.1 State the working principle of drilling.
2.2 List out different types of drilling machines.
2.3 Draw the line diagrams of the sensitive and radial drilling machines.
2.4 Identify the parts of sensitive and radial drilling machines
2.5 Describe the functions of each part of sensitive and radial drilling machines
2.6 List the different operations on drilling machine.

3.0 Foundry

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

4.0 Mechanical working of metals

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

COURSE CONTENT

1 **Introduction :**

Basic workshop tools and its operation

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

1.1 **Carpentry**

Marking & measuring tools: scales, rules, fourfold wooden rule, flexible measuring rule (tape), straight edge, try square, bevel square, combination square, marking knife, marking gauge, mortise gauge, wing compass, trammel, divider, spirit level

Cutting Tools

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

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

Planes: Jack plane (wooden jack plane, metal jack plane), rough plane, smoothing plane, rebate plane, plough plane, router, spoke shave.

Boring Tools: Gimlet, braces-wheel brace, ratchet brace, bit shell bit, expansion bit, centre-bit, countersink-bit,

Striking tools: Hammers - Warrington hammer, claw hammer, mallet,

Holding devices: Bench vice, bench stop, sash cramp (bar cramp) G-cramp.

Miscellaneous tools: Rasps and files, scraper, oilstone, glass paper, pincer, screwdriver

Carpentry Processes: Marking, measuring, sawing, chiselling, planning, boring, grooving

Carpentry joints: Halving Joint, mortise and tenon joint, bridle joint, butt joint, dowel joint,

Tongue& groove joint, screw & slot joint, dovetail joint, corner joint.

Wood working machines: Wood working lathe (wood turning lathe), circular saw, band saw, wood Planer, sanding machine, belt sander

1.2 **Fitting**

Cutting tools

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

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

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

Saws: Hand hacksaw - solid frame, adjustable frame, specifications & uses.

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

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

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

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

Striking Tools

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

Holding Devices

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

Marking Tools

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

Miscellaneous Tools

Screw drivers, spanners, cutting pliers, nose pliers, Allen keys.

Checking and measuring instruments

Checking instruments:

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

Measuring instruments:

Combination set, sine bar, Gauges- plug gauge, feeler gauge, Thread gauge, plate & wire gauge, ring gauge, snap gauge specifications & uses, Vernier callipers, Vernier height gauge, Vernier depth gauge, micro meter - outside & inside, - specifications and uses.

Fitting Operations:

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

1.3 **Forging**

Hand forging tools: Anvil, swage block, hand hammers - types; sledgehammer, specifications and uses, tongs - types, specifications & uses, chisel -hot & cold chisels specifications & uses. Swages - types and sizes, fullers, flatters, punch and drift - sizes and uses.

Equipment: Forge-parts-Open and closed hearth, heating furnaces, open and stock fire, fuels-charcoal, coal, oil and gaseous fuels-characteristics of fuel.

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

Forging hammers - spring hammer, pneumatic hammer, drop hammer, hydraulic press - line diagram, machine forging operations – Hot drawing, upsetting, punching, Advantages and dis advantages of forging.

Forging defects: Types and remedies.

1.4 **Sheet Metal Work**

Metals used for sheet metal work.

Sheet metal hand tools:

Measuring tools - steel rule, circumference rule, thickness gauge, sheet metal gauge, straight edge, scriber, divider, trammel points, punches, chisels, hammers, snips or shears, straight snip, double cutting shear, squaring shear, circular shear, bench & block shears.

Stakes: Double seaming stake, beak horn stake, bevel edged square stake, Hatches stake, needle stake, blow Horn stake, hollow mandrel stake, groovers and 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, planishing, flanging.

Drawing: Deep drawing, shallow or box drawing.

Squeezing: Sizing, coining, hobbing, ironing, riveting.

Sheet Metal Joints

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

Seam joint -lap seam, grooved seam, single seam, double seam, dovetail seam, burred bottom seam or flanged seam.

Notches – straight notch, square notch and slant notch

Fastening Methods

Riveting, soldering, brazing & spot welding.

2 **Drilling**

Type of drilling machines: sensitive & radial and their constructional details and specifications.

Operations: Drilling, reaming, boring, counter boring, counter sinking, tapping, spot facing and trepanning.

3 **Foundry**

Introduction: Development of foundry as a manufacturing process, advantages and limitations of casting over other manufacturing processes.

Foundry equipment:

Hand moulding tools: shovel, riddle, rammers, trowels, slicks, lifter, strike - off bar, sprue pin bellow, swab, gate cutter, mallet, vent rod, draw spike, rapping plate or lifting plate, , spirit level, moulding boxes, snap box & flash box.

Sands: Properties of moulding sand - porosity, flowability, collapsibility, adhesiveness, cohesiveness and refractoriness.

Types of moulding sand : green sand, dry sand, loam sand, facing sand, backing sand, parting sand, core sand, systems and their ingredients and uses.

Pattern making: Materials such as wood, cast Iron, aluminium, brass, plastics their uses and relative advantages, classification of patterns such as solid (one piece),split pattern- two piece and three pieces, gated patterns and sweep patterns, sequence in pattern making, pattern allowances .

Cores: Need of cores, types of cores.

Casting: green sand and dry sand moulding, shell moulding, defects in castings and their remedies.

Special casting processes: (Principles and applications only) die casting – hot chamber, centrifugal casting, investment casting.

4 **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.

Hot working operations, advantages & limitations of hot working of metals.

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

Advantages & limitations of cold working.

REFERENCE BOOKS

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

BLUEPRINT OF QUESTION PAPER
A-106, WORKSHOP TECHNOLOGY

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks wise Distribution of Weightage				Question wise Distribution of Weightage			
				R	U	Ap	An	R	U	Ap	An
1	Basic Workshop tools & operations										
	(1.1) Carpentry	20	6	3	3	0	0	1	1	0	0
	(1.2) Fitting	25	14	3	3	8	0	1	1	1	0
	(1.3) Forging	15	11	0	3	8	0	0	1	1	0
	(1.4) Sheet metal	12	6	3	3	0	0	1	1	0	0
2	Drilling	08	11	3	0	8	0	1	0	1	0
`3	Foundry	22	11	3	0	8	0	1	0	1	0
4	Mechanical working of metals	18	11	0	3	8	0	0	1	1	0
Part – C Question having 10 marks weightage from CO2 or CO3 or CO4			10				10				1
Total:		**120**	**80**	**15**	**15**	**40**	**10**	**5**	**5**	**5**	**1**

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

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 1.3
Unit Test – II	From 1.4 to 2.6
Unit Test – III	From 3.1 to 4.6

ENGINEERING DRAWING

Subject Title	Subject Code	Periods/Week	Periods Per Year
ENGINEERING DRAWING	A–107	06	180

TIME SCHEDULE

S.No	Major Topics	No. of Drawing plates	Periods	Weightage of Marks	Short Answer Questions	Essay type Questions
1	Importance of Engineering Drawing	--	01	-	-	-
2	Engineering Drawing Instruments	01	05	-	-	-
3	Free hand lettering & Numbering	01	06	5	1	-
4	Dimensioning Practice	01	09	5	1	-
5	Geometrical constructions	03	24	15	1	1
6	Projections of points, Lines, Planes & Auxiliary Views	03	21	5	1	
7	Projections of Solids	01	12	10		1
8	Sections of Solids	01	21	10	-	1
9	Orthographic Projections	01	30	10	-	1
10	Isometric Views	01	30	10	-	1
11	Development of surfaces	01	21	10	-	1
Total		**14**	**180**	**80**	**04**	**06**

Course Code: A-107	Course: Engineering Drawing	No. of Periods: 180
COURSE OBJECTIVES	Upon completion of the course the student shall able to understand the basic graphic skills and use them in preparation of engineering drawings, their reading and interpretation	

CO No.		Course Outcome
C01	**A-107.1**	Practice the use of engineering drawing instruments
C02	**A-107.2**	Familiarise with the conventions to be followed in engineering drawing as per BIS specifications.
C03	**A-107.3**	Construct the i) basic geometrical constructions ii) engineering curves
C04	**A-107.4**	Visualise and draw the orthographic projections of i) Points ii) Lines iii) Regular Planes iv) Regular Solids V) Sections of Regular Solids and the isometric views of machine components
CO5	**A-107.5**	Draw the developments of surfaces of regular solids and thereby the components used in daily applications

LEARNING OUTCOMES

Upon completion of the course the student shall able to

1.0 Importance 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 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 different purposes

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 Plate 1: (Having two exercises)

3.0 Free Hand Lettering and Numbering

3.1 Write titles using sloping lettering and numerals of 7mm, 10mm and 14mm height

3.2 Write titles using vertical lettering and numerals of 7mm, 10mm and 14mm height

3.3 Select suitable sizes of lettering for different layouts and applications

Drawing plate 2: (Having 5 to 6 exercises)

4.0 Understand Dimensioning Practice

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

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

Drawing Plate 3: (Having 08 to10 exercises)

5.0 Apply Principles of Geometric Constructions

5.1 Practice the basic geometric constructions like i) dividing a line into equal parts

ii) exterior and interior tangents to the given two circles iii) tangent arcs to two given lines and arcs

5.2 Draw any regular polygon using general method when i) side length is given

ii) inscribing circle radius is given iii) describing circle radius is given

5.3 Draw the conics using general and special methods,

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

5.5 Identify the applications of the above constructions in engineering practice.

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

Drawing Plate -5: Having problems of construction of conics

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

6.0 Apply Principles of Projection of points, lines, planes &auxiliary planes

6.1 Explain the basic principles of the orthographic projections

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 reference

Planes (up to lines parallel to one plane and inclined to other plane)

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

6.5 Identify the need of Auxiliary views for a given engineering drawing.

6.6 Draw the auxiliary views of a given engineering component

Drawing Plate -7: Having problems up to projection of points and Lines (15 exercises)

Drawing Plate -8: Having problems of projection of planes (6 exercises)

Drawing Plate -9: Having problems on auxiliary planes (Having 4 exercises)

7.0 Draw the Projections of Solids

7.1 Visualise and draw the projections of solids (up to axis of solids parallel to one plane and inclined to other plane) Drawing plate No.10: Having problems of projection of solids (10 exercises)

8.0 Appreciate the need of Sectional Views

8.1 Identify the need to draw sectional views.

8.2 Differentiate between true shape and apparent shape of section

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

Drawing Plate–11: Having problems of section of solids (6 exercises)

9.0 Apply principles of orthographic projection

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

9.2 Draw the minimum number of views needed to represent a givenobject fully.

Drawing Plate 12 : (Having 10 to 12 exercises)

10.0 Prepare pictorial drawings

10.1 identify the need of pictorial drawings.

10.2 Differentiate between isometric scale and true scale.

10.3 Prepare Isometric views for the given orthographic drawings.

Drawing plate 13: (Having 10 to 12 exercises)

11.0 Interpret Development of surfaces of different solids

11.1 State the need for preparing development drawing.

11.2 Draw the development of simple engineering objects (cubes, prisms, cylinders, cones, pyramid) using parallel line and radial line method.

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

Drawing plate No. 14: (Having 05 exercises)

Competencies and Key competencies to be achieved by the student

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

10.	Isometric Views	• Differentiate between isometric scale and true scale. • Draw the isometric views of given objects,.
11.	Development of surfaces	• Prepare development of Surface of regular solids and other components like i) funnel ii) 90^0 elbow

COURSE CONTENT

NOTES: 1. B.I.S Specification should invariably be followed in all the topics.

2. A-3 Size Drawing Sheets are to be used for all Drawing Practice Exercises.

1.0 The importance of Engineering Drawing

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

2.0 Engineering drawing Instruments

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

Lay out of sheet – as per SP-46-1988 to a suitable scale.

Simple Exercises on the use of Drawing Instruments. Importance of Title Block.

3.0 Free hand lettering & numbering

Importance of lettering – Types of lettering -Guide Lines for Lettering

Practicing of letters & numbers of given sizes (7mm, 10mm and 14mm)

Advantages of single stroke or simple style of lettering - Use of lettering stencils

4.0 Dimensioning practice

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

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

5.0 Geometric Construction

Division of a line: to divide a straight line into given number of equal parts

Construction of tangent lines: to draw interior and exterior tangents to two circles of given radii and centre distance

Construction of tangent arcs:

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

ii) Tangent arc of given radius touching a circle or an arc and a given line.

iii)Tangent arcs of radius R, touching two given circles internally and externally.

Construction of polygon: construction of any regular polygon by general method for given side length, inscribing circle radius and describing/superscribing circle radius

Conics: Explanation of Ellipse, Parabola, Hyperbola, as sections of a double cone and a loci of a moving point, Eccentricity of above curves – Their Engg. Applications viz. Projectiles, reflectors, P-V Diagram of a hyperbolic process, Construction of any conic section of given eccentricity by general method Construction of ellipse by concentric circles method, Oblong Method and Arcs of circles method, Construction of parabola by rectangle method and Tangent method Construction of rectangular hyperbola

General Curves: Involute, Cycloid and Helix, explanations as locus of a moving point, their engineering application, viz., Gear tooth profile, screw threads, springs etc. –

their construction

6.0 Projection of points, lines and planes & Auxiliary views

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

Projections of points in different quadrants

Projections of straight line -

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

Projections of regular planes

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

Auxiliary views

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

7.0 Projections of regular solids

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

8.0 Sections of Solids

Need for drawing sectional views – what is a sectional view - Hatching – Section of regular solids inclined to one plane and parallel to other plane

9.0 Orthographic Projections

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

10.0 Pictorial Drawings

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

11.0 Development of Surfaces

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

REFERENCE BOOKS

- Engineering Graphics by P I Varghese – (McGraw-hill)
- Engineering Drawing by Basant Agarwal & C.M Agarwal - (McGraw-hill)
- Engineering Drawing by N.D.Bhatt.
- T.S.M. & S.S.M on " Technical Drawing" prepared by T.T.T.I., Madras.
- SP-46-1998 – Bureau of Indian Standards.

BASIC WORKSHOP PRACTICE

Subject Title	Subject Code	Periods/Week	Periods per Year
Basic Workshop Practice	A -108	06	180

TIME SCHEDULE

S.No	Major Topics	No of Periods
1.	Fitting shop	36
2.	Forging shop	39
3.	Carpentry shop	51
4.	Sheet metal work	48
5	Plumbing	06
	Total	**180**

Course Code: A-108	**Title: Basic Workshop Practice**	**Total No. Of Periods: 180**
Course Objectives:	**Upon completion of the course the student shall be able to**	
	1.0 To Familiarize tools used in Basic workshop processes 2.0 To handle the tools appropriately and safely 3.0 To reinforce theoretical concepts by practising relevant exercises of basic workshop process	

CO No.		Course Outcome
C01	**A-108.1**	Practice the operations in Fitting Shop
C02	**A-108.2**	Practice the operations in Forging Shop
C03	**A-108.3**	Practice the operations in Carpentry Shop
C04	**A-108.4**	Practice the operations in Sheet metal Shop
CO5	**A-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. Preparation of a hexagonal bolt and nut

10.1 Identify the holding and striking tools
10.2 Heat the specimen to the appropriate temperature
10.3 Remove the specimen and hold it on the anvil
10.4 Hammer the specimen to the required shape

11. Cutting of wood with hand saw

11.1 Identify the orientation of grains
11.2 Select appropriate saw for cutting in each of the directions viz. across and along the grains
11.3 Select appropriate work holding device
11.4 Handle appropriate measuring and marking tools(Steel rule, Try square, Marking gauge)
11.5 Mark dimensions on work using Marking gauge
11.6 Fix the work in the vice
11.7 Perform cutting along the grains using Rip saw
11.8 Perform cutting perpendicular to the grains using cross cut saw

12. Planning of wood

12.1 Identify the direction for planning wood stock
12.2 Select appropriate jack plane
12.3 Prepare the jack plane for planning
12.4 Load and unload the blade of a jack plane
12.5 Select appropriate work holding device
12.6 Perform marking on work using appropriate tool
12.7 Fix the work in the vice
12.8 Plane the surfaces on all four sides using jack plane

13. Chiselling of wood

13.1 Select appropriate chisels and saw

13.2 Select appropriate work holding device
13.3 Select appropriate measuring and marking tools
13.4 Fix the work in the vice
13.5 Mark the position of grooves on work using marking gauge
13.6 Cut sides of grooves by hand saw
13.7 Chip the material using firmer chisel by applying pressure with mallet
13.8 Finish the grooves with rasp file

14. Preparation of a Dove-tail joint

14.1 Select the appropriate cutting tools and work holding devices
14.2 Plane the wooden pieces on all sides
14.3 Mark at an angle of 150 with bevel square
14.4 Trim the dovetail by chisel to exact size
14.5 Cut the dovetail groove on second piece
14.6 Finish the groove
14.7 Assemble the two pieces to prepare dovetail halving joint by using mallet

15. Preparation of Mortise and Tenon joint

15.1 Select the appropriate cutting tools and work holding devices
15.2 Plane the two pieces to the required size using jack plane
15.3 Mark the dimensions to make Tenon using mortise gauge
15.4 Cut tenon with tenon saw along the marked lines
15.5 Use firmer chisel to remove the excess material to set finished tenon
15.6 Mark the dimension to make mortise on the second piece with mortise gauge
15.7 Use mortise chisel to provide recess in the second piece to accommodate tenon
15.8 Assemble the two pieces by fitting the tenon into mortise

16. Wood turning on lathe

16.1 Select appropriate tools
16.2 Plane the four corners of the work piece using jack plane
16.3 Mark the centres of the work on either side
16.4 Mount the work between head stock & tailstock centres
16.5 Fix the tool in the tool post & Position it in appropriate height
16.6 Start the lathe to make the work piece to revolve at desired speed
16.7 Feed the bevel gauge against the rotating work to get the required size and shape
16.8 Use outside callipers to check the diameter of the pin
16.9 Use parting off tool to reduce the diameter on either ends of the pin
16.10 Remove the rolling pin between centres and cut off excess material on either sides

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

17.1 Prepare the drawings of a stool required for a particular drawing table
17.2 State the specifications of the wood stock required
17.3 Identify the type of joints to be made
17.4 Identify the operations to be made and their sequence
17.5 Perform operations to produce pieces of joint
17.6 Assemble all joints as per the drawing

18. Practice on cutting of sheet

18.1 Cut the required sheet from the stock using snip
18.2 Mark the dimensions on the sheet using scriber & steel rule
18.3 Draw the circular shapes using divider
18.4 Perform rough cutting of the curved shapes using chisel and finish cutting using snips
18.5 Cut the straight edges using straight snip

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

19.1 Cut the sheet into two halves
19.2 Form the flange on the sheet by folding the sheet along scribed lines using mallet & stakes
19.3 Perform bending edges of sheets applying moderate pressure using mallet
19.4 Interlock the bent edges and apply pressure with mallet to make required joint

20. Preparation of a rectangular open type tray

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 using hatchet stake
20.7 Form the sheet into desired shape using stakes
20.8 Seam the corners by inserting laps of the adjacent sides with single them

21. Preparation of hollow cylinder

21.1 Draw the development of the object to be made
21.2 Place the pattern on the sheet
21.3 Mark the dimensions using scriber
21.4 Shear the required piece from the stock using straight snips

21.5 Mark the lines on the sheet to form bends
21.6 Strengthen the sides of sheet by single hem on top & bottom side using hatchet stake
21.7 Form the flat sheet into cylindrical shape by cylindrical stake and apply pressure using mallet
21.8 Prepare single hem on to longitudinal sides in opposite directions
21.9 Interlock the sides and apply pressure to make a strong joint

22. .Preparation of pipe elbow

22.1 Draw the development of a cylindrical pipe truncated at an angle of 450 on one side
22.2 Cut the sheet over the marked dimensions using curved snips
22.3 Form the sheet into cylindrical shape using stakes
22.4 Seam the sides of two pipes using mallet
22.5 Seam the two pipes
22.6 Solder the joint to make leak proof

23. Preparation of funnel

23.1 Draw the development of upper and bottom conical parts
23.2 Place the pattern on the sheet and cut to required size
23.3 Form the sheet into conical shape using appropriate stake and mallet
23.4 Seam the top conical part and bottom conical part to obtain required funnel

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

24.1 Draw the development of given dust pan
24.2 Scribe the lines on the sheet and cut to required size
24.3 Hem all the four sides to strengthen the edges
24.3 Form the sheet into designed shape using suitable stakes and mallet
24.4 Solder the corner lap joints to make the required dust pan

24.b. 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.
5. Preparation of a hexagonal bolt and nut.

CARPENTRY SHOP

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

SHEET METAL WORK

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

Plumbing Practice

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

REFERENCE BOOKS

1. Manufacturing Technology (Voll) by P N Rao (McGraw Hill)
2. Principles of Foundry Technology by P L Jain (McGraw Hill)
3. Workshop Practice Vol- I by Hajra Choudhury Media Promoters and Publishers Pvt Ltd.

PHYSICS LAB PRACTICE
(C-20 CURRIUCULUM COMMON TO ALL BRANCHES)

Subject Code	Subject Title	Periods per week	Total periods per year
A-109	Physics Laboratory	03	90

TIMESCHEDULE

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

Objectives:

Upon completion of the course the student shall be able to

1.0 Practice with Vernier calipers to determine the volumes and areas of a cylinder and sphere
and their comparison etc .

2.0 Practice with Screw gauge to determine thickness of a glass plate, cross sectional area
of a wire and volumes of sphere and also their comparison etc

3.0 Verify the parallelogram law and Triangle law

4.0 Determine the value of acceleration due to gravity using Simple Pendulum

5.0 Determine the velocity of sound in air at room temperature and its value at zero degree centigrade.

6.0 Calculate the Focal length and focal power of convex lenses using distant object method , U- method , U-V graph and 1 / U – 1 / V graph methods and their comparison.

7.0 Determine the refractive index of a solid using travelling microscope.

8.0 Verify the Boyle's law employing a Quill tube.

9.0 Determine the specific resistance of material of a wirel using Meter Bridge.

10.0 Drawing magnetic lines of force under N-S and N-N methods and locate null points.

11.0 Determine the surface tension of a liquid using travelling Microscope (**Demo)**

12.0 Determine the viscosity of a liquid using capillary method (**Demo)**

Competencies and Key competencies to be achieved by the student

Name of the Experiment	Competencies	Key competencies
1. Hands on practice on Vernier Calipers(03)	• Find the Least count • Fix the specimen in posit • Read the scales • Calculate the physical quantities of given object	• Read the scales • Calculate the requisite physical quantities of given objects
2. Hands on practice on Screw gauge(03)	• Find the Least count • Fix the specimen in posit • Read the scales • Calculate thickness of glass place and cross section of wire and other quantities	• Read the scales • Calculate thickness of given glass plate • Calculate cross section of wire and other quantities
3. Verification of Parallelogram law of forces and Triangle law of forces(03)	• Fix suitable weights • Note the positions of threads on drawing sheet • Find the angle at equilibrium point • Construct parallelogram • Compare the measured diagonal Construct triangle	• Find the angle at equilibrium point • Constructing parallelogram • Construct triangle • Compare the ratios of force and length

4. Simple pendulum(03)	• Fix the simple pendulum to the stand • Adjust the length of pendulum • Find the time for number of oscillations • Find the time period • Calculate the acceleration due to gravity	• Find the time for number of oscillations • Find the time period • Calculate the acceleration due to gravity • Draw l-T and l-T^2 graph
5. Velocity of sound in air –Resonance method (03)	• Arrange the resonance apparatus • Adjust the reservoir level for booming sound • Find the first and second resonanting lengths • Calculate velocity of sound	• Adjust the reservoir level • Find the first and second resonanting lengths • Calculate velocity of sound at room temperature • Calculate velocity of sound at 0^0 C
6. Focal length and Focal power of convex lens (Separate & Combination) (03)	• Fix the object distance • Find the Image distance • Calculate the focal length and power of convex lens and combination of convex lenses • Draw u-v and 1/u – 1/v graphs	• Calculate the focal length and power of convex lens • Draw u-v and 1/u – 1/v graphs
7. Refractive index of solid using traveling microscope(03)	• Find the least count of vernier on microscope • Place the graph paper below microscope • Read the scale • Calculate the refractive index of glass slab	• Read the scale • Calculate the refractive index of glass slab

8. Boyle's law verification (03)	• Note the atmospheric pressure • Fix the quill tube to retort stand • Find the length of air column • Find the pressure of enclosed air • Find and compare the calculated value P x l	• Find the length of air column • Find the pressure of enclosed air • Find the value P x l
9. Meter bridge(03)	• Make the circuit connections • Find the balancing length • Calculate unknown resistance • Find the radius of wire • Calculate the specific	• Find the balancing length • Calculate unknown resistance • Calculate the specific resistance
10. Mapping of magnet lines of force(03)	• Draw magnetic meridian • Placed the bar magnet in NN and NS directions • Draw magnetic lines of force • Locate the neutral points along	• Draw magnetic lines of force • Locate the neutral points along equatorial and
11. Surface tension of liquid using traveling microscope(03)	• Find the least count of vernier on microscope • Focus the microscope to the lower meniscus & bent pin • Read the scale • Calculate height of liquid rise • Calculate the surface	• Read the scale • Calculate height of liquid rise • Calculate the surface tension of water

12.. Coefficient of viscosity by capillary method(03)	• Find the least count of vernier • Fix the capillary tube to aspiratory bottle • Find the mass of collected water • Find the pressure head • Calculate rate of volume of liquid collected • Find the radius of capillary tube • Calculate the viscosity of water using capillary method	• Find the pressure head • Calculate rate of volume of liquid collected • Find the radius of capillary tube • Calculate the viscosity of water

Scheme of Valuation for end Lab Practical Examination :

A. Writing Aim, Apparatus, Formula, Graph, Precautions carries 10 (Ten) Marks
B. For Drawing the table, taking Readings, Calculation work, Drawing the graph, finding result carries 15 (Fifteen) Marks
C. Viva Voice 05 (Five) Marks

Total **30 (Thirty) Marks**

➢ **Course outcomes**

Course Outcomes	CO1	Experiments with Vernier calipers, Screw gauge, Parallelogram law and Triangle law
	CO2	Experiments with Simple pendulum, Resonance apparatus (Velocity of sound in air)
	CO3	Experiments with Convex lens, Refractive index of solid by travelling microscope
	CO4	Experiments with quill tube (Boyles law verification), Meter bridge, Mapping of magnetic lines of force
	CO5	Experiments with Surface tension and Viscosity

CHEMISTRY LABORATORY
(C-20 curriculum common to all Branches)

Subject Code	Subject Title	Periods per week	Total periods per year
A -110	**Chemistry Laboratory**	**03**	**90**

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

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

TIMESCHEDULE

S. No	Name of the Experiment	No.of Periods	Mapped with COs
1.	a) Recognition of chemical substances and solutions used in the laboratory by senses. b) Familiarization of methods for Volumetric analysis	03	CO 1
2.	Preparation of Std Na_2CO_3 and making solutions of	03	CO1
3.	Estimation of HCl solution using Std.Na_2CO_3 solution	03	CO2
4.	Estimation of NaOH using Std.HCl solution	03	CO2
5.	Estimation of H_2SO_4usingStd.NaOH solution	03	CO2
6.	Estimation of Mohr's Salt using Std.$KMnO_4$	03	CO3
7.	Determination of acidity of water sample	03	CO2
8.	Determination of alkalinity of water sample	03	CO2
9.	Determination of total hardness of water using Std. EDTA	03	CO4
10.	Estimation of Chlorides present in water sample	03	CO4
11.	Estimation of Dissolved Oxygen(D.O)in water sample	03	CO5
12.	Determination of pH using pH meter	03	CO
13.	Determination of conductivity of water and adjusting ionic	03	CO

14.	Determination of turbidity of water	03	CO
15.	Estimation of total solids present in water sample	03	CO
	Total:	**45**	

Objectives:

Upon completion of the course the student shall be able to

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

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. HCl solution for estimation of NaOH

5.0 Conduct titrations adopting standard procedures and using Std. NaOH solution for estimation of H_2SO_4

6.0 Conduct titrations adopting standard procedures and using Std.$KMnO_4$solution for estimation of Mohr's Salt

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

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

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

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

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

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

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

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

15.0 To determine the total solids present in given samples of water (One ground water and one surface / tap water)

Competencies and Key competencies to be achieved by the student

Name of the Experiment (No of Periods)	Competencies	Key competencies
Familiarization of methods for Volumetric analysis. Recognition of chemical substances And solutions (03)	-	--
Preparation of Std Na_2CO_3 and making solutions of different dilution(03)	▪ Weighing the salt to the accuracy of .01 mg ▪ Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette ▪ Making appropriate	▪ Weighing the salt to the accuracy of .01 mg ▪ Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette ▪ Making appropriate
Estimation of HCl solution using Std. 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
Estimation of NaOH using Std.HCl solution (03)		
Estimation of H_2SO_4 using Std.NaOH solution (03)		
Estimation of Mohr's Salt using Std.$KMnO_4$ (03)		
Determination of acidity of water sample (03)		
Determination of alkalinity of water sample (03)		
Determination of total hardness of water using Std. EDTA solution (03)		
Estimation of Chlorides present in water sample (03)		
Estimation of Dissolved Oxygen(D.O) in water sample (By titration method) (03)		
	▪ Familiarize with	▪ Prepare standard

Determination of pH using pH meter (03) Determination of conductivity of water and adjusting ionic strength to required level (03) Determination of turbidity of water (03)	instrument ▪ Choose appropriate 'Mode' / 'Unit' ▪ Prepare standard solutions / buffers, etc. ▪ Standardize the instrument with appropriate standard solutions ▪ Plot the standard curve ▪ Make measurements accurately ▪ Follow Safety	solutions / buffers, etc. ▪ Standardize the instrument with appropriate standard solutions ▪ Plot the standard curve ▪ Make measurements accurately
Estimation of total solids present in water sample (03)	▪ Measuring the accurate volume and weight of sample ▪ Filtering and air drying without losing any filtrate ▪ Accurately weighing the filter paper, crucible and filtrate ▪ Drying the crucible in	▪ Measuring the accurate volume and weight of sample ▪ Filtering and air drying without losing any filtrate ▪ Accurately weighing the filter paper, crucible and filtrate

SCHEME OF VALUATION

A) Writing Chemicals, apparatus ,principle and procedure	5M
B) Demonstrated competencies	20M
Making standard solutions	
Measuring accurately the standard solutions and titrants	
Effectively controlling the flow of the titrant	
Identifying the end point	
Making accurate observations	
C) Viva-voce	5M
Total	**30M**

COMPUTER FUNDAMENTALS LAB

Course code	Course Title	No. of Periods/Weeks	Total No. of periods	Marks for FA	Marks for SA
A-111 (common to all branches)	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.

Course Outcomes	At the end of the course students will be able to		
	CO1	A-110.1	Identify hardware and software components
	CO2	A -110.2	Prepare documents with given specifications using word processing software
	CO3	A -110.3	Use Spread sheet software to make calculation and to draw various graphs / charts.
	CO4	A -110.4	Use Power point software to develop effective presentation for a given theme or topic.
	CO5	A -110.5	Edit digital or scanned images using Photoshop

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 with standard toolbox
34. To edit a photograph.
35. To insert Borders around photograph.
36. To change Background of a Photograph.
37. To change colours 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 details of the computer	a. Find the details of Operating System being used	Access the properties of computer and find

		b. Find the details of Service Pack installed	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-Review-View	a. Create/Open a document b. Use Save and Save as features c. Work on two Word documents simultaneously d. Choose correct Paper size and Printing options	a. Create a Document and name appropriately and save b. Set paper size and print options
7.	To practice Word Processing Basics	a. Typing text b. Keyboard usage c. Use mouse (Left click / Right click / Scroll) d. Use Keyboard shortcuts e. Use Find and Replace features in MS-word f. Use Undo and Redo Features g. Use spell check to correct Spellings and Grammar	a. Use 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	a. Insert table in the word document and edit b. Use sort option for arranging data.

		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	
10.	To Insert objects, clipart and Hyperlinks	a. Create a 2-page document. &Insert hyperlinks and t Bookmarks. b. Create an organization chart c. Practice examples like preparing an Examination schedule notice with a hyperlink to Exam schedule table.	a. Insert hyperlinks &Bookmarks b. Create organization charts/flow charts
11.	To Use Mail merge feature of MS Word	a. Use mail merge to prepare individually addressed letters b. Use mail merge to print envelopes.	Use Mail merge feature
12.	To use Equations and symbols features.	a. Explore various symbols available in MS Word b. Insert a symbol in the text c. Insert mathematical equations in the document	Enter Mathematical symbols and Equations in the word document
13.	To Practice with MS-EXCEL	a. Open /create an MS Excel spreadsheet and familiarize with MS Excel 2007 layout like MS office Button- b. Use Quick Access Toolbar- Title Bar- Ribbon-Worksheets- Formula Bar-Status Bar	a. Familiarize with excel layout and use b. Use various features available in toolbar
14.	To access and Enter data in the cells	a. Move Around a Worksheets-Quick access -Select Cells b. Enter Data-Edit a	a. Access and select the required cells by various

		Cell-Wrap Text-Delete a Cell Entry-Save a File-Close Excel	addressing methods b. Enter data and edit
15.	To edit spread sheet Copy, Cut, Paste, and selecting cells	a. Insert and Delete Columns and Rows-Create Borders-Merge and Center b. Add Background Color-Change the Font, Font Size, and Font Color c. Format text with Bold, Italicize, and Underline-Work with Long Text-Change a Column's Width	Format the excel sheet
16.	To use built in functions and Formatting Data	a. Perform Mathematical Calculations verify - AutoSum b. Perform Automatic Calculations-Align Cell Entries	Use built in functions in Excel
17.	To enter a Formula for automatic calculations	a. Enter formula b. Use Cell References in Formulae c. Use Automatic updating function of Excel Formulae d. Use Mathematical Operators in Formulae e. Use Excel Error Message and Help	Enter formula for automatic calculations
18.	To Create Excel Functions, Filling Cells	a. Use Reference Operators b. Work with sum, Sum if , Count and Count If Functions c. Fill Cells Automatically	a. Create Excel sheets involving cross references and equations b. Use the advanced functions for conditional calculations
19.	To sort and filter data in table	a. Sort data in multiple columns b. Sort data in a row c. Sort data using Custom order	a. Refine the data in a worksheet and keep it organized b. Narrow a

		d. Filter data in work sheet	worksheet by selecting specific choice
20.	To Practice Excel Graphs and Charts	a. Produce an Excel Pie Chart b. Produce c. Excel Column Chart	a. Use data in Excel sheet to Create technical charts and graphs Produce Excel Line Graph b. Produce a Pictograph in Excel
21.	To develop lab reports of respective discipline	Create Lab reports using MS Word and Excel	a. Insert Practical subject name in Header and page numbers in Footer
22.	To format a Worksheet in Excel, page setup and print	a. Shade alternate rows of data b. Add currency and percentage symbols c. Change height of a row and width of a column d. Change data alignment e. Insert Headers and Footers f. Set Print Options and Print	a. Format Excel sheet b. Insert headers &footers and print
23.	To familiarize with Ribbon layout &features of PowerPoint 2007.	Use various options in PowerPoint a. Home b. Insert c. Design d. Animation e. Slideshow f. View g. Review	Access required options in the tool bar
24.	To create a simple PowerPoint Presentation	a. Insert a New Slide into PowerPoint b. Change the Title of a PowerPoint Slide c. PowerPoint Bullets d. Add an Image to a PowerPoint Slide e. Add a Textbox to a 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	a. Setup Master slide and format b. Add notes

		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 g. Add Notes to a PowerPoint Presentation	
26.	To Insert Text and Objects	a. Insert Text and objects b. Set Indents and line spacing c. Insert pictures/ clipart d. Format pictures e. Insert shapes and word art f. Use 3d features g. Arrange objects	Insert Text and Objects Use 3d features
27.	To insert a Flow Chart / Organizational Charts	a. Create a Flow Chart in PowerPoint b. Group and Ungroup Shapes c. Use smart art	Create organizational charts and flow charts using smart art
28.	To insert a Table	a. PowerPoint Tables b. Format the Table Data c. Change Table Background d. Format Series Legend	Insert tables and format
29.	To insert a Charts/Graphs	a. Create 3D Bar Graphs in PowerPoint b. Work with the PowerPoint Datasheet c. Format a PowerPoint Chart Axis d. Format the Bars of a Chart e. Create PowerPoint Pie Charts f. Use Pie Chart Segments g. Create 2D Bar Charts in PowerPoint h. Format the 2D Chart e. Format a Chart Background	Create charts and Bar graphs, Pie Charts and format.
30.	To Insert audio &	a. Insert sounds in the slide	a. Insert Sounds

	video, Hyperlinks in a slide Add narration to 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	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 with standard toolbox	a. Open Adobe Photoshop b. Use various tools such as i. The Layer Tool ii. The Color & Swatches Tool iii. Custom Fonts & The Text Tool iv. Brush Tool v. The Select Tool vi. The Move Tool vii. The Zoom Tool viii. The Eraser ix. The Crop Tool x. The Fill Tool	Open a photograph and save it in Photoshop
34	To edit a photograph	a. Use the Crop tool b. Trim edges	a. Able to edit image by using

		c. Change the shape and size of a photo d. Remove the part of photograph including graphics and text	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. d. Type text and apply color and style e. Apply effects using blended options	Able to prepare cover page for the book

39	To adjust the brightness and contrast of picture to give an elegant look	a. open a file. b. Go to image→ adjustments→ Brightness/Contrast. c. adjust the brightness and contrast. d. 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

DIPLOMA IN AUTOMOBILE ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
III Semester

Subject Code	Name of the Subject	Instruction period / week		Total Periods	Scheme of Examination			
		Theory	Practical/Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
A-301	Engineering Mathematics - II	4	-	60	3	20	80	100
A-302	Automobile Power Plants	4	-	60	3	20	80	100
A-303	Automobile Transmission System	4	-	60	3	20	80	100
A-304	Engineering Materials and Manufacturing Processes	4	-	60	3	20	80	100
A-305	Thermal Engineering	4	-	60	3	20	80	100
A-306	Automobile Electrical and Electronics Systems	4	-	60	3	20	80	100
PRACTICAL								
A-307	Machine Drawing	-	6	90	3	40	60	100
A-308	Automobile Laboratory	-	3	45	3	40	60	100
A-309	Workshop Practice – II	-	6	90	3	40	60	100
A-310	Automobile Electrical & Electronics Laboratory	-	3	45	3	40	60	100
TOTAL		24	18	360+270	-	280	720	1000

ENGINEERING MATHEMATICS-II

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

S.No.	Unit Title	No. of periods	COs mapped
1	Indefinite Integration	22	CO1
2	Definite Integration and its applications	24	CO2
3	Differential Equations of first order	14	CO3
	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 them.

Course Outcomes	CO1	Integrate various functions using different methods.
	CO2	Evaluate definite integrals with applications.
	CO3	Obtain differential equations and solve differential equations of first order and first degree.

ENGINEERING MATHEMATICS – II

L**earning 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 Integrals $\int (u + v)\,dx$ and $\int ku\,dx$ where k is constant and u, v are functions of x.

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

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

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

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

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

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

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

1.6. Evaluate the integrals of the form $\int \sin^m x \cos^n x\,dx$ where m and n are suitable positive integers.

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

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

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

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

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

1.9. Evaluate the integrals of the type

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

1.10. Evaluate integrals using decomposition method.

1.11. Solve problems using integration by parts.

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

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

Unit-II

C.O.2 Evaluate definite integrals with applications.

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

2.2. Explain the concept of definite integral.

2.3. Solve problems on definite integrals over an interval using the above concept.

2.4. State various properties of definite integrals.

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

Syllabus for Unit test-I completed

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

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

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

2.9. Obtain the volumes of solids of revolution.

2.10. Solve some problems using Trapezoidal rule, Simpson's 1/3 rule for approximation of integrals.

Unit -III

C.O. 3 Form differential equations and solve differential equations of first order and first degree.

L.O. 3.1 Define a Differential equation, its order and degree

3.2 Find order and degree of a given differential equation.

3.3 Form a differential equation by eliminating arbitrary constants.

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

3.5 Solve Homogeneous differential equation of first order and first degree.

3.6 Solve exact differential equation of first order and first degree.

3.7 Solve linear differential equation of the form dy/dx + Py = Q, where P and Q are functions of x or constants.

3.8 Solve Bernoulli's differential equation reducible to linear form.

3.9 Solve simple problems arising in engineering applications.

Syllabus for Unit test-II completed

ENGINEERING MATHEMATICS – II

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. Integrals of the form $\int \sin^m x.\cos^n x\,dx$, where at least one of m and n is odd positive integers. Integrals of suitable powers of tanx. secx and cosecx.cotx by substitution.

Evaluation of integrals which are reducible to the following forms:

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

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

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

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

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

Unit-II

Definite Integral and its applications:

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

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

Unit -III

Differential Equations:

3. 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 methods, variables separable, homogeneous, exact, linear differential equation, Bernoulli's equation.

Textbook:

Engineering Mathematics-II, a textbook for 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.

BLUE PRINT

S. No	Chapter/Unit title	No of Periods	Weightage allotted	Marks wise distribution of weight age				Question wise distribution of weight age				COs mapped
				R	U	Ap	An	R	U	Ap	An	
1	Unit – I: Indefinite Integration	22	28	11	11	06	0	2	2	2	0	CO1
2	Unit – II: Definite Integration and its applications	24	33	11	03	11	08	2	1	2	1	CO2
3	Unit – III: Differential Equations of first order	14	19	03	03	03	10	1	1	1	1	CO3
	Total	**60**	**80**	**25**	**17**	**20**	**18**	**5**	**4**	**5**	**2**	

R: Remembering Type : 25 Marks
U: understanding Type : 17 Marks
Ap: Application Type : 20 Marks
An: Analysing Type : 18 Marks

Engineering Mathematics – II
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 2.6 to L.O 3.9

AUTOMOBILE POWER PLANTS

Course Title	Course Code	Periods/Week	Periods/Semester
Automobile Power Plants	A-302	04	60

TIME SCHEDULE

Sl. No.	Major Topic	Periods Allocated	Weightage of marks	Part – A Sho Type (3 marks)	Part – B Essay Type (8	Part – C Essay Type (10
1	Engine Construction	8	7	1	½	
2	IC Engines	10	11	1	1	
3	Inlet and Exhaust System	06	6	2	0	
4	Fuel supply System in Petrol Engine	08	11	1	1	
5	Fuel Supply System in Diesel Engine	08	11	1	1	
6	Lubrication System	06	11	1	1	
7	Cooling System	06	7	1	½	
8	Fuels & Combustion	08	6	2	0	
Part C Question having 10 marks weightage from CO3 or CO4 or C05			10			1
TOTAL		**60**	**80**	**10**	**5**	**1**

Course Code: A – 302	**Title: Automobile Power Plants**	**Total No. of Periods: 60**
Course Objectives:	**Upon completion of the course the student shall be able to**	
	1. Understand the constructional details and working of I.C. Engines 2. Understand the working of inlet, exhaust, cooling and lubrication system of I.C engine 3. Appreciate the working of fuel supply system in diesel and petrol engines, fuel and combustion and combustion phenomenon in petrol and diesel engines.	

CO No.		Course Outcome
C01	**A-302.1**	Explain the classification and constructional details of I.C engine.
C02	**A-302.2**	Distinguish between 2 stroke and 4 stroke I.C. engine.
C03	**A-302.3**	Discuss the working of 1. Inlet 2.exhaust, 3. Cooling and 4. Lubrication systems of an I.C engine.
C04	**A-302.4**	Analyse the fuel supply system in diesel and petrol engines
C05	**A-302.5**	Analyse the combustion phenomenon in diesel and petrol engines.

LEARNING OUTCOMES:

Upon completion of the course the student shall be able to

1.0 Engine Construction

1.1 State the types of engines

1.2 List the components of I.C engine

1.3 Explain the constructional details, materials use and functions of engine components.

1.4 Explain the use of 1. Wet liner 2. Dry liner & 3. Piston ring.

1.5 State the firing order arrangement for 4 - cylinders, 6 - cylinders and 8 – cylinder in line and V-type engines

1.6 Explain the valve arrangement in L-type, I-type, F-type & T-type engines with sketches

1.7 List types of gaskets used in an engine and their material

1.8 State the function of valve actuating mechanism, its components, tappet and valve

1.9 Explain the overhead valve and i-VTEC (intelligent variable valve timing and lift electronic control) mechanism with neat sketches.

1.10 State the function, importance of flywheel and vibration damper

2.0 I.C. Engines

2.1 List the Classification of I.C. Engines

2.2 Explain the working principle of 2 stroke and 4 stroke petrol engines with sketches

2.3 Explain the working principle of 2 stroke and 4 stroke diesel engines with sketches

2.4 Differentiate between petrol and diesel engines

2.5 Differentiate between 2 stroke and 4 stroke engines

2.6 Draw the valve timing diagram for 4 stroke petrol and diesel engines

2.7 State the function of combustion chamber

2.8 List types of combustion chambers in C.I and S.I (diesel and petrol) engine

2.9 Explain different types of C.I Engine combustion chambers with sketches

2.10 State the advantages and disadvantages of different types of C.I Engine

combustion chambers

3.0 Inlet and Exhaust System

3.1 State the functions of air cleaner

3.2 List different types of air cleaners

3.3 Explain the working of different types of Air cleaners

3.4 State the necessity of Manifolds

3.5 State the requirement of good manifold design

3.6 State the necessity of Mufflers

3.7 Describe different types of Mufflers with simple sketches

4.0 Fuel Supply System in Petrol (S.I) Engines

4.1 Sketch the line diagram of petrol engine fuel supply system and identify the parts

4.2 Describe the function of each component of fuel supply system viz., fuel tank, fuel filter, fuel Pump, carburettor etc.,

4.3 List the types of fuel pumps

4.4 Explain the construction and working of mechanical and electrical fuel pumps

4.5 State the functions of carburettor

4.6 Describe simple carburettor with a sketch

4.7 List the types of defects in simple carburettor

4.8 State the air fuel ratio for different operating conditions of petrol engine

4.9 Explain various circuits of a carburettor

5.0 Fuel Supply System in Diesel (C.I) Engines

5.1 Draw the line diagram of fuel supply system in diesel engine and identify the parts

5.2 State the function of fuel filter, fuel feed pump, fuel injection pump and fuel injector

5.3 List the types of fuel filters and fuel Injectors.

5.4 State the requirement of fuel injection pump

5.5 List different types of fuel injection system in C I Engines like air injection, solid injection, unit injection system, individual pump, distributor pump system, common rail diesel injection system

5.6 Explain the layout of common rail diesel injection system (CRDI)

5.7 Explain the working of fuel injection pump and fuel injector with neat sketches.

5.8 State the function of governor and classify them

5.9 Explain the working of mechanical and pneumatic governors.

6.0 Lubrication System

6.1 State the necessity of lubrication in I.C engines

6.2 Classify the lubricants used in I.C. engines

6.3 State the properties of lubricants

6.4 Illustrate SAE number of lubricants

6.5 Describe construction & working of Petroil, Splash and Pressure or forced feed system of lubrication with sketches

6.6 Explain the dry sump lubricating system
6.7 State the difference between Bypass filter and Full flow filter arrangements
6.8 List the various additives of lubricants

7.0 Cooling System

7.1 State the necessity of cooling system in I.C engines
7.2 List the types of cooling systems
7.3 Explain the constructional details and working principle of Air cooling and Water cooling systems with the help of line diagrams
7.4 Explain the functions and constructional details of water pump and thermostat
7.5 Explain different types of Thermostats, Radiator and Pressure cap
7.6 State the necessity of Anti-freeze and Anti-rusting liquids
7.7 List the Anti-freeze and Anti-rusting liquids

8.0 Fuels and Combustion

8.1 Define the term fuel
8.2 Classify different types of fuels used in I.C. Engine
8.3 List the properties of fuels
8.4 Define higher and lower calorific value of fuel
8.5 identify the importance of Octane and Cetane rating and HUCR and fuel additives
8.6 State the meaning of Homogeneous mixture and Heterogeneous mixture
8.7 Discuss the stages of combustion in S.I. engines
8.8 State the Phenomenon of pre-ignition & detonation and their effects on the performance of S.I. engine
8.9 Describe the stages of combustion in C.I. engines
8.10 Define diesel knock and about factors influencing diesel knock

COURSE CONTENT

1) Engine Construction

Engine – types of engines: EC and IC engines - Cylinder Block – Cylinder Bore and Stroke - Cylinder Head - Cylinder Liners - Arrangement of Cylinders – Crankcase - Oil Pan – Gaskets – Piston - Piston Pin - Piston Rings – Connecting Rod – Crankshaft – Firing Order – Connecting Rod bearings – Flywheel – Vibration dampers – Valves: L, I, F and T-type - Valve mechanism - over-head valve - i-VTEC – function of components of valve actuating mechanism: cam shaft, valve lifter, valve guide, valve spring, push rod, rocker arm, rocker arm shaft, rocker arm spring

2) I.C. Engines

Introduction to Internal combustion Engines - Classification of I.C. engines – working Principle of 2 stroke and 4 stroke petrol engine - working Principle of 2 stroke and 4 stroke diesel engine – differences between petrol and diesel engines - comparison between 2-stroke and 4-stroke engines - valve timing diagrams 4-stroke petrol and diesel engine - Combustion chamber – Requirements of S.I. and C.I. Engine combustion chambers - Types of C.I. engine combustion chambers and functions – Direct injection type, pre-

combustion chambers, Turbulence chamber type and Air cell combustion chamber - Relative advantages and disadvantages.

3) Inlet and Exhaust System

Air Cleaners – constructional details of different types of air cleaners- Oil bath and Oil wetted type - Inlet and Exhaust Manifolds – Consideration for good manifold design – Types of Manifolds – constructional details – Mufflers – types of Mufflers – Constructional details and working principle of different types of Mufflers

4) Fuel Supply System in Petrol Engines

Line diagram of petrol engine fuel systems - details of fuel tank and fuel filters – working principle with constructional details of fuel pumps Mechanical and Electrical - constructional details of simple carburettor - defects in simple carburettor - air fuel ratios for different operating conditions - Types of carburettors.

5) Fuel Supply System in Diesel Engines

Line diagram of diesel engine fuel system – Function of diesel fuel feed pump - Types of Diesel filter – Requirements of fuel injection system – type of fuel injection systems – layout of common rail system (CRDI) – constructional details and working of fuel injection pump and injectors - types of injectors – Types of Nozzles – governing system – mechanical and pneumatic types of governors.

6) Lubrication System

Requirements of lubrication of Motor vehicle engine and Other Components - Types of lubricants – Properties of a lubricant –S.A.E Number - Grades of Lubricants used in Engine, Gear-Box, Differential - -Types of lubrication systems - Petroil type, Splash type and Force feed lubrication system - Dry Sump Lubrication - Oil filters - Types of filters - Full flow and By-pass filter arrangements - Additives of Lubricants

7) Cooling System

Necessity of cooling - Disadvantages of over cooling and under cooling - Types Of cooling systems - air cooling - constructional details of an Air cooled engine - water cooling types - Thermo syphon - Force feed type water cooling – types of Radiators - Constructional details and Working principle of water pump - Radiators – Thermostat – Wax pellet, Bellows type - Radiator pressure cap - Anti freezing additives - Anti rusting additives

8) Fuels and combustion

Definition of fuel – classification of fuels – properties of fuels – calorific value of fuels – H.C.V & L.C.V –Fuels used in I.C. Engines – Rating of I.C engine fuels - Octane rating, Cetane rating, and HUCR – Fuel dopes or additives -

Combustion of fuels - Homogeneous mixture – Heterogeneous mixture – Combustion in I.C. engines – Stages of combustion in S.I. engines – detonation in S.I. engines – pre-ignition in S.I. engines – stages of combustion in C.I. engines – Diesel knock , Factors influencing diesel knock.

REFERENCE BOOKS

1. Heat Engines - by R.S. Kurmi – S.Chand & Company
3. Heat Engines - by Pandya and Shah – Charotar Publishing House
4. Automobile Engineering Vol – I & II - by Kirpal Singh
5. Automobile Engineering - by G.B.S. Narang –Khanna Publishers
6. Automobile Engineering - by R.B.Gupta –Standard Publishers
7. Automobile mechanics - by William Chrouse – Mc Graw Hill Education.
8. Internal Combustion Engines - by Mathur &Sharma –Dhanpat Rai Publications
9. Automobile Engineering Vol I - Anil Chhikaria -Satya Prakashan Publisherti

Blueprint of Question Paper
A – 302, Automobile Power Plants

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks wise Distribution of Weightage				Question wise Distribution of Weightage			
				R	U	Ap	An	R	U	Ap	An
1	Engine Construction	08	7	3		4		1		1/2	
2	IC Engines	10	11		3	8			1	1	
3	Inlet and Exhaust System	06	6	3	3			1	1		
4	Fuel supply System in Petrol Engine	08	11		3	8			1	1	
5	Fuel Supply System in Diesel Engine	08	11	3		8		1		1	
6	Lubrication System	06	11		3	8			1	1	
7	Cooling System	06	7		3	4			1	1/2	
8	Fuels & Combustion	08	6	3	3			1	1		
Part – C Question having 10 marks weightage from CO3 or or CO4 or CO5			10				10				1
Total		**60**	**80**	**12**	**18**	**40**	**10**	**4**	**6**	**5**	**1**

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	1.1 to 4.9
Unit Test – II	5.1 to 8.10

AUTOMOBILE TRANSMISSION SYSTEMS

Course Title	Course Code	No. of periods/week	Total Periods /Semester
Automobile Transmission Systems	A-303	04	60

TIME SCHEDULE

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Part – A Short Type (3 marks)	Part – B Essay Type (8 Marks)	Part – C Essay Type (10 Marks)
1	Transmission system and Clutch	12	14	02	01	
2	Gear Box	12	14	02	01	
3	Universal joint and propeller shaft	06	08	00	01	
4	Differential	10	14	02	01	
5	Front axle & Rear axle	10	09	03	00	
6	Wheels and Tyres	10	11	01	01	
Part – C Question having 10 marks weight age from CO2 or CO3 or CO4			10			01
Total		60	80	10	5	01

Course Code : A-303	Course Name : Automobile Transmission Systems No. of Periods : 60
Course Objectives	**Upon completion of the course the student shall be able to** 1. Understand the need and working of an Automobile Transmission system. 2. Understand the function and working of clutch, gear box, gear shifting, over drive, fluid coupling, torque converter, universal joint, propeller shaft, differential, front axle and rear axle. 3. Appreciate the term wheels, tyres and dynamics of moving vehicles.

CO No.		Course Outcome
C01	**A-303.1**	Describe the need of transmission system and clutch.
C02	**A-303.2**	Discuss various types of Gear box used in automobiles
C03	**A-303.3**	Discuss universal joints and propeller shaft.

C04	**A-303.4**	Discuss different types of 1. Front axles, 2. Rear axles, 3. Final drive and 4. Differential systems.
C05	**A-303.5**	Distinguish between different tyres and wheels.

Learning Outcomes:

1.0 Transmission System and Clutch

1.1 State the necessity of Automobile transmission system.

1.2 State the functions of various components in Automobile transmission system.

1.3 Explain the arrangement of components of transmission system.

1.4 State the functions of a Clutch.

1.5 Describe the general requirements of an automobile clutch.

1.6 List any six types of clutches.

1.7 Explain the principles of operation of the clutch.

1.8 Explain the working of 1. Single plate, 2. Multi plate, 3. Centrifugal, Semi Centrifugal and 4. Diaphragm Clutches with neat figures.

1.9 Explain the working principles of vacuum, electromagnetic, hydraulically Operated clutches.

1.10 Describe the types of friction materials used in clutches.

2.0 Gear Box

2.1 List three resistances encountered by vehicle.

2.2 Define the terms Traction and tractive effort.

2.3 Solve simple problems on the traction and tractive effort.

2.4 State the objectives of the gear box in the transmission system

2.5 Explain the principles and operation of sliding mesh, Constant mesh, and Synchromesh and Epicyclic gear box.

2.6 Describe floor shifting & steering column mounted shifting mechanism.

2.7 Explain about Inter locking device.

2.8 Explain free wheel unit and overdrive mechanism.

2.9 Explain the working principle of the torque converter and fluid coupling.

2.10 List advantages of automatic transmission system

3.0 Propeller shaft and Universal joints

3.1 State the function of the propeller shaft.

3.2 Draw the line diagram of propeller shaft with slip joint and universal joints.

3.3 Explain the types of universal joints – Cross type or Spider and two yoke types,

Ball and trunnion type.

3.4 List the three types of Constant velocity type joints.

3.5 Explain the Rzeppa and Tripod type Constant velocity joints.

4.0 Differential unit

4.1 Explain the purpose of the final drive – Hypoid gear arrangement - Worm and

worm wheel.

4.2 Explain the working principle of Single and Double reduction final drives.

4.3 State the necessity of differential unit

4.4 Explain the working principle of differential and differential locking systems.

4.5 Explain the working principle of Limited slip differential.

4.6 State the purpose of the four wheel drive.

4.7 Explain the working principle of four wheel drive.

4.8 Explain the working of Transaxle.

5.0 Front axle and Rear axle

5.1 Differentiate between live and dead axles.

5.2 List four components of front axle assembly.

5.3 Explain front axle assembly.

5.4 Explain Stub axle and list various types of stub-axles.

5.5 State four loads acting on the rear axles.

5.6 Explain types of rear axles.

5.7 List the types of rear axle casing.

5.8 Explain Hotchkiss drive and Torque-tube drive.

5.9 Describe the types of real axle drives.

6.0 Wheels and Tyres

6.1 State the requirements of automobile wheel.

6.2 List the types of automobile wheels and wheel rims.

6.3 Explain the wheel assembly and wheel balancing.

6.4 State desirable properties of tyre.

6.5 Explain Tube tyre and tubeless tyre.

6.6 Describe the construction of tyres and tyre designation.

6.7 Explain carcass types – 1. Cross ply, 2. Radial ply and 3. Belted bias ply tyres.

6.8 State tyre wear, its causes and tyre properties.

6.9 Describe the tyre pressure monitor system.

6.10 Define the terms 1. Tyre rotation, 2. Vulcanizing and 3. Retreading.

COURSE CONTENT

1.0 Transmission System and Clutch:

Purposes of the automotive transmission system – Manual Transmission- Arrangement and functions of various components in the manual transmission in automotive vehicle, Functions of the clutch-General requirements of an automobile clutch - Principle of Operation--constructional details of different types of clutches – Single plate – Multi plate – Centrifugal – Semi centrifugal – Diaphragm clutches –Working principles of vacuum, electromagnetic and Hydraulically operated clutches - friction materials of clutch.

2.0 Gear box

Types of resistances encountered by a vehicle - Road resistance, Gradient resistance, Air resistance-Traction -Tractate effort – Simple related problems, Object of the gear box in the transmission system – types of gear boxes – Principles and operation of sliding mesh, constant mesh and synchromesh gearbox- types of gear shifting mechanism – floor shifting and steering column shifting-Inter lock devices – Automatic Transmission system-Epicyclic gear box-principle and working of freewheeling –overdrive mechanism – transfer case-Fluid coupling - Advantages and disadvantages –Constructional details of fluid coupling-Torque converter and its principle –principle of automatic transmission system and advantages.

3.0 Propeller shaft and Universal joint:

Propeller shaft – Function of propeller shaft - slip joint or sliding joint – Universal joint -. Types of universal joints – cross type or spider and two yoke type – ball and trunnion type – constant velocity type– Different types of Constant velocity joints – Rzeppa and Tripode type.

4.0 Differential:

Final drive – purpose of final drive, types of final drive – Bevel, worm and worm wheel, Hypoid gear -single and double reduction final drives –Differential gear-differential - differential lock – manual and Automatic differential locks – Four wheel drive – Transaxle.

5.0 Front Axle and Rear Axle:

Live and dead axles – Components of Front axle assembly –stub axle – types of stub axles –Elliot – Reverse Elliot – Lamoine – Reverse Lamoine. Loads on the rear axle – Types of rear axles - semi floating – Three quarter floating– fully floating axles, Types of drives – Hotchkiss drive, Torque tube drive– Axle casings and types –Split, Banzo and Salisbury types.

6.0 Wheels and Tyres:

Wheel assembly – functions of the wheels – Types of wheels, types of rims– Types of tyres – Construction of tyres-constituents of tyre- cross ply tyre – radial tyre –belted bias ply - merits of radial tyre over cross ply tyre-tube tyre - tubeless tyre –tyre tread patterns – tyre pressure & wear –Desirable tyre properties – causes of tyre wear – tyre designation- speed rating, width, aspect ratio, load index, ply rating, tread wear indication, tyre pressure monitor system, Wheel balancing- static and dynamic balancing, Tyre rotation –Vulcanizing – Retreading.

REFERENCE BOOKS:

1. Automobile Engineering- Vol-I & Vol –II –Kirpal Singh – Standard Publishers.
2. Automobile Engineering – R.B.Gupta – Standard Publishers.
3. Automotive Engineering - G.B.S. Narang – Khanna Publishers.
4. Automotive Mechanics – William Crouse – Mc Graw Hill Education
8. Problems in Automobile Mechanics - Dr. N K Giri – Khanna Publishers.

Blueprint of Question Paper
A-303, Automobile Transmission Systems

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks wise Distribution of Weightage				Question wise Distribution of Weightage			
				R	U	Ap	An	R	U	Ap	An
1	Transmission system and Clutch	12	14	3	3	8	0	1	1	1	0
2	Gear Box	12	14	3	3	8	0	1	1	1	0
3	Universal joint and propeller shaft	06	08	0	0	8	0	0	0	1	0
4	Differential	10	14	3	3	8	0	1	1	1	0
5	Front axle & Rear axle	10	09	3	6	0	0	1	2	0	0
6	Wheels and Tyres	10	11	3	0	8	0	1	0	1	0
Part – C Question having 10 marks weightage from CO2 or CO3 or CO4			10				10				1
	Total:	60	80	15	15	40	10	5	5	5	1

- **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 3.5
Unit Test – II	From 4.1 to 6.10

ENGINEERING MATERIALS AND MANUFACTURING PROCESSES

Course Title	Course Code	No. of Periods/Week	Total periods/Semester
ENGINEERING MATERIALS AND MANUFACTURING PROCESSES	A - 304	04	60

TIME SCHEDULE

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Part – A Short Type (3 marks)	Part – B Essay Type (8 Marks)	Part – C Essay Type (10 Marks)
1	Mechanical Properties & testing procedure of materials	10	14	2	1	
2	Iron– Carbon equilibrium diagram	06	14	2	1	
3	Manufacture of Iron & steel and Heat	12	11	1	1	
4	Ferrous and Non-ferrous Metals and	06	06	2	0	
5	Welding	12	11	1	1	
6	Lathe and lathe work	14	14	2	1	
Part-C Question having 10 marks weightage from CO2 or CO5.			10	-	-	1
	Total:	**60**	80	**10**	**5**	**1**

Course Code: A-304	Course Title: Engineering Materials and Manufacturing Processes	No. of Periods: 60
COURSE OBJECTIVES	**Upon completion of the course the student shall be able to** 1. List the mechanical properties of materials and testing procedures 2. Understand Iron and Carbon equilibrium diagram and heat treatment processes 3. Know the manufacturing process of Iron and steel and to know the properties and uses of ferrous and non-ferrous metals and alloys 4. Understand the manufacturing process 0of welding and lathe work	

CO No.		Course Outcome
C01	**A-304.1**	Explain mechanical properties of materials and their testing procedures
C02	**A-304.2**	Analyse the Iron – Carbon equilibrium diagram
C03	**A-304.3**	Describe manufacturing of Iron, steel and various heat treatment processes
C04	**A-304.4**	Compare properties of ferrous and non-ferrous metals and alloys
C05	**A-304.5**	Discuss the various types of welding, Lathe, capstan and turret lathe operation

LEARNING OUTCOMES:

Upon completion of the course the student shall be able to

1.0 Mechanical properties and their testing procedures

1.1 State Tensile, compressive strength, stiffness, elasticity and plasticity
1.2 Define the terms ductility, malleability, hardness, brittleness, toughness impact strength, fatigue and creep resistance.
1.3 List the different properties of materials in engineering applications.
1.4 Describe the tensile and compressive tests on mild steel
1.5 Describe the tests to measure impact strength of steel
1.6 List the principles of non-destructive testing methods.
1.7 Select the appropriate testing method for a given application

2.0 Iron – Carbon equilibrium diagram

2.1 State the meaning of space lattice, unit cell.
2.2 Explain the three main types of space lattice
2.3 Explain the cooling curves of pure Iron
2.4 List the allotropic forms of pure iron with temperature, their crystal structures.
2.5 Draw Iron–Carbon equilibrium diagram.

3.0 Manufacturing methods of iron & steel and Heat treatment

3.1 Describe the operations involved in the manufacturing of cast-iron in cupola furnace.
3.2 Explain the sequence of steps to be followed in the manufacture of steel by Bessemer converter, L.D. process, electric arc furnace and electric induction furnace.
3.3 Explain these quench of operations involved for different heat treatment methods such as annealing, normalizing, hardening, tempering, case-hardening, Nitriding and carburizing.
3.4 Explain the change in mechanical properties of materials when the above heat treatment methods are used.
3.5 Describe the appropriate heat treatment methods for a given application.

4.0 Ferrous metals and Non-ferrous metals and their alloys

4.1 State the composition properties and application of different types of cast iron and plain carbon steel.
4.2 Describe the need for alloying steel with other elements.
4.3 Describe the composition properties, Industrial applications of common alloy steels.

4.4 Describe the proper alloy steel for a given engineering application.
4.5 Describe the composition, properties and industrial applications of the non-ferrous alloys.
4.6 State the proper non-ferrous alloys for given engineering applications.

5.0 principle of joining metals by fusion and explain welding processes of metals

5.1 Explain the working principle of arc welding process
5.2 List the equipment used in arc welding and state their functions.
5.3 State the principle of gas welding and List the procedure of gas welding
5.4 Explain three types of flames Used in gas welding and list their applications.
5.5 List any three limitations of gas and arc welding processes.
5.6 Describe arc welding, metal arc welding, inert gas welding, TIG welding, MIG Welding, Atomic hydrogen welding and submerged arc welding processes.
5.7 State the principle of electric resistance welding and its type's spot welding, seam welding.

6.0 W orking principle of lathe and Capstan& Turret lathes

6.1 List the classification of lathe and State the parts of lathe and their functions.
6.2 List the steps to be followed in the following operations involved in turning, facing, forming, taper turning, screw cuttings and knurling.
6.3 Explain any three Methods of taper turning
6.4 Explain the working principle of Turret and Capstan Lathes.
6.5 Compare the Capstan and Turret lathes
6.6 Explain the working of Turret Indexing mechanism.

COURSE CONTENT

1. Mechanical properties and testing procedure of Materials

Introduction–Importance of materials in modern Technology-Mechanical properties: Tensile strength, compressive strength, stiffness, elasticity, brittleness, ductility, malleability, hardness, toughness, fatigue resistance, creep, impact strength

Types of testing: Destructive and non-destructive - testing methods to determine tensile strength, compressive strength, impact strength – non-destructive tests: Magnetic particles test, Radiography (X-ray and Gamma ray) Test, Ultrasonic test, Spark stream.

2. Iron – Carbon equilibrium diagram

Space lattice, unit cell, types of metallic space lattices: BCC, FCC and HCP– Cooling curve for pure Iron–allotropic forms of pure iron– Iron - Carbon equilibrium diagram

3. Manufacture of Iron& Steel and Heat Treatment

Manufacture of cast iron – Cupola Furnace - manufacture of steel – Bessemer converter – L.D. process – Electric arc furnace- Electric Induction furnace. Heat Treatment - Purpose of Heat Treatment – Types of Heat treatment processes - brief description of annealing, hardening, tempering, normalizing - case hardening: Nitriding - carburizing – Applications of these heat treatment processes.

4. Ferrous and Non–Ferrous Metals and Alloys

Types of cast iron: white, grey, modular, malleable and alloy cast iron – properties and uses of white and grey cast iron - Types of plain carbon steel: low carbon, medium and high carbon steel –alloying elements in steel – purpose of adding alloying elements – composition, properties and uses of alloy steels: stainless steel and high speed steel, composition, properties and uses of non-ferrous alloys: brass, bronze, gunmetal and solder metal

5. Welding

Introduction – Types of welding: pressure and Non-pressure welding - Principle of Electric Arc, Metal Arc, Atomic Hydrogen, TIG, MIG and submerged Arc welding processes – types of welding rods - Principle of Resistance, spot, seam and Butt welding processes – Principle of oxy-acetylene gas welding -Types of oxy-acetylene gas flames and their uses

6. Lathe and lathe work

Types of lathes - engine Lathe – engine lathe construction and working – lathe Specifications – Work holding Devices – Tool holding Devices - Lathe operations: plain turning, step turning, taper turning, thread cutting, knurling, facing, parting off, drilling, boring, reaming - methods of taper turning – Constructional details and working principle of capstan and turret lathes - comparison between capstan and turret lathe - principle of turret indexing mechanism.

REFERENCE BOOKS

1. Engineering Material and Manufacturing Processes – by V.N. Kumar Falcon Publishers.
2. Engineering Materials-by Ray & Chowdhury –S. Chand Publishing.
3. Elements of workshop Technology Vol I &II-Hazra Chowdhary –Media Promoters & Publishers.
5. A course in workshop Technology vol. I & vol. II- by Raghu vamsi – Dhanpat Rai & Co.

Blueprint of Question Paper
A-304, ENGINEERING MATERIALS & MANFACTURING PROCESSES

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks wise Distribution of Weightage				Question wise Distribution of Weightage			
				R	U	Ap	An	R	U	Ap	An
1	Mechanical Properties &testing procedure of materials	10	14	3	3	8	0	1	1	1	0
2	Iron– Carbon equilibrium diagram	06	14	3	3	8	0	1	1	1	0
3	Manufacture of Iron & steel and Heat treatment	12	11	3	0	8	0	1	0	1	0
4	Ferrous and Non-ferrous Metals and alloys	06	06	3	3	0	0	1	1	0	0
5	Welding	12	11	3	0	8	0	1	0	1	0
6	Lathe and lathe work	14	14	3	3	8	0	1	1	1	0
Part – C Question having 10 marks weightage from CO2 or CO5			10				10				1
Total:		**60**	**80**	**18**	**12**	**40**	**10**	**6**	**4**	**5**	**1**

- **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 1.0 to 3.5
Unit Test – II	From 4.0 to 6.6

THERMAL ENGINEERING

Course Title	Course Code	Periods / Week	Periods /Semester
Thermal Engineering	A–305	04	60

TIME SCHEDULE

Sl. No.	Major Topic	Periods Allocated	Weightage of marks	Part – A Short Type (3 marks)	Part – B Essay Type (8 marks)	Part – C Essay Type (10 marks)
1	Fundamentals of Thermodynamics	10	14	2	1	
2	Laws of perfect gases	10	14	2	1	
3	Thermodynamic Processes	14	17	3	1	
4	Air Standard Cycles	14	14	2	1	
5	Performance of IC engines	12	11	1	1	
	Part – C Question having 10 marks weightage from CO3 OR CO5	-	10	-	-	**1**
	Total:	**60**	**80**	**10**	**5**	**1**

Course Code : A-305	**Course Title : Thermal Engineering**	**No of Periods : 60**
Course Objectives	Upon completion of the course the student shall be able to 1. Understand the laws of thermodynamics and laws of perfect gases. 2. Understand the thermodynamic processes. 3. Understand the air standard cycles and performance of Internal combustion engines.	

CO No.		**Course Outcome**
C01	**A-305.1**	Explain fundamentals and laws of thermodynamics.
C02	**A-305.2**	solve simple problems on laws of perfect gases

C03	**A-305.3**	Develop an expression to evaluate work done in various thermodynamic processes.
C04	**A-305.4**	Solve problems in various air standard cycles.
C05	**A-305.5**	Explain various performance parameters and calculation of performance parameters.

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

1.0 Fundamentals and laws of Thermodynamics

1.1 Define the various terms associated with the Thermodynamic System.
1.2 Name the types of thermodynamic Systems.
1.3 Explain the closed system and open system with Examples.
1.4 Explain the isolated system with Examples.
1.5 List the thermodynamic Properties of System.
1.6 Define the various thermodynamic properties.
1.7 State quasi-static work, flow of work, Zeroth law of thermodynamics, first law of thermodynamics and second law of thermodynamics.
1.8 Solve problems dealing with conversion of heat into work and vice–versa.
1.9 Write non-flow energy equation and steady flow energy equation.
1.10 Solve simple problems on non-flow energy equation.

2.0 Laws of perfect gases

2.1 Define the term Perfect Gas.
2.2 State 1. Boyle‘s Law, 2. Charle‘s Law, 3. Avagadro‘s Law, 4. Regnault‘s Law and 5. Joule‘s Law.
2.3 Derive Characteristic gas equation.
2.4 Write the Universal Gas Equation.
2.5 State relationship between characteristic gas constant (R), Universal gas constant (G) and molecular weight (M).
2.6 Define Specific heat, Specific heat at constant pressure (C_P) and Specific heat at constant volume (C_V).
2.7 Derive the relationship between C_P , C_V and R .
2.8 Solve problems using gas laws.

3.0 Thermodynamic Processes on gases

3.1 List out the different thermodynamic processes on gases.
3.2 Derive expression for work done in Iso-choric process, Iso-baric process, Hyperbolic process, Polytropic process and Isentropic process.
3.3 Compute the change in internal energy of gas during a process.
3.4 Explain the relationship between heat supplied, internal energy and work done.
3.5 Solve problems on these processes.

4.0 Study of air standard cycles

4.1 Define the term Air Standard cycle, Reversible Cycle and Irreversible cycle.

4.2 Explain with the help of a p-v and T-S diagram the Working of carnot cycle.

4.3 State the assumptions made in Carnot cycle.

4.4 Derive the formula for the air standard efficiency of a Carnot cycle.

4.5 Solve problems on Carnot Cycle.

4.6 Explain the working of Otto Cycle with the help of a p-v and T-S diagram.

4.7 State the assumptions made in Otto Cycle and diesel cycle.

4.8 Derive the formula for air standard Efficiency of Otto Cycle and diesel cycle.

4.9 Solve problems on Otto Cycle and diesel cycle.

4.10 Explain the working of a Diesel cycle with the help of a p-v and T-S diagram.

5.0 Performance of Internal Combustion Engines

5.1 Compute Indicated Power, Brake Power and Frictional Power.

5.2 Compute Mechanical efficiency and Specific Fuel consumption.

5.3 Compute Indicated, Brake Thermal Efficiency and Volumetric Efficiency.

5.4 Prepare Heat Balance sheet for a given test result of an Internal Combustion engine.

COURSE CONTENT

1.0 Fundamentals and laws of Thermodynamics

Definitions for system - boundary, surrounding, state of a system-Types of thermodynamic systems – closed, open and isolated systems with examples- Properties of a system- Intrinsic and Extrinsic properties with examples - Definitions for properties like Pressure (p), Volume (v), Temperature (T), Enthalpy (H), Internal energy (U) and their units - Definitions for quasi-static work, flow- work, Zeroth, first, second laws of thermodynamics, simple problems on conversion of Heat into Work and vice versa – Non flow energy equation, Steady flow energy equation (without proof) - simple problems of elementary type.

2.0 Laws of perfect gases

Brief explanation of perfect Gas Laws – Boyle‘s law, Charle‘s Law – Avagadro‘s, Joule‘s law and Regnault‘s law- Derive characteristic gas equation – universal gas equation- universal gas constant and their relationship with molecular weight of gas – Specific Heat, Specific heat at constant pressure, specific heat at constant volume for a gas. Derivation for an expression showing the relationship between the two specific heats and characteristic gas constant - Simple problems on gas equation.

3.0 Thermodynamic processes on gases

Types of thermodynamic processes - Isochoric, Isobaric, Isothermal, Isentropic and Polytropic- Equations representing the processes-- Derivation for work done and change in internal energy for the above processes - Calculation of heat supplied or rejected during the above processes - Simple problems on the above processes.

4.0 Air standard cycles

Air standard cycle-Applications -Reversible and irreversible process - Brief description of Carnot cycle with P-V and T-S diagrams - Assumptions made – Efficiency - Problems on Carnot cycle - Brief explanation of Otto cycle with P-V and T-S diagrams- assumptions made – Efficiency - Simple problems on Otto cycle – Brief description of Diesel cycle with P-V and T-S diagrams- Assumption made –Efficiency - Simple problems on Diesel cycle.

5.0 Performance of I.C. Engines

Need for Engine performance testing – Mean effective Pressure - Indicated, Brake and Frictional Power - Mechanical Efficiency and Thermal Efficiency – Specific Fuel Consumption - Volumetric efficiency - Heat Balance - Problems pertaining to performance of Internal combustion Engines and heat balance.

REFERENCE BOOKS

1. Thermal Engg.Vol I & Vol II — Mathur & Mehta Jain Brothers.
2. Heat Engines — R. C. Pate & Karamchandan Acharya
3. IC. Engine Fundamentals - — Heywood Tata McGraw-Hill
4. Engineering Thermodynamics — P. K. Nag Tata McGraw-Hill
5. Engineering Thermodynamics — C. P. Arora Tata McGraw-Hill
6. Thermal Engineering - — R. S. Khurmi S Chand
7. Thermal Engineering — Kumar & Vasundari S Chand

Blueprint of Question Paper
A-305, THERMAL ENGINEERING

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks wise Distribution of Weightage				Question wise Distribution of Weightage			
				R	U	Ap	An	R	U	Ap	An
1	Fundamentals of Thermodynamics	10	14	3	3	8	0	1	1	1	0
2	Laws of perfect gases	10	14	3	3	8	0	1	1	1	0
3	Thermodynamic Processes	14	17	6	3	8	0	2	1	1	0
4	Air Standard Cycles	14	14	3	3	8	0	1	1	1	0
5	Performance of IC engines	12	11	3	0	8	0	1	0	1	0
Part – C Question having 10 marks weightage from CO3 or or CO4 or CO5.			10	-	-	-	10	-	-	-	1
Total:		**60**	**80**	**18**	**12**	**40**	**10**	**6**	**4**	**5**	**1**

- **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 3.2
Unit Test – II	From 3.3 to 5.4

AUTOMOBILE ELECTRICAL AND ELECTRONICS SYSTEMS

Course Title	Course Code	No of periods/week	Total periods /Semester
Automobile Electrical and Electronics Systems	A-306	04	60

TIME SCHEDULE

Sl. No.	Major Topic	Periods Allocated	Weightage of marks	Part – A Short Type (3 marks)	Part – B Essay Type (8 Marks)	Part – C Essay Type (10 Marks)
1.	Basic Electrical and Electromagnetic Induction laws	8	9	3	-	
2.	Electronic devices in Automobiles	8	9	3	-	
3.	Batteries	8	11	1	1	
4.	Ignition Systems	8	11	1	1	
5.	Starting System	8	11	1	1	
6	Generating System	8	8	-	1	
7.	Automobile Wiring Systems, Lighting and Accessories	12	11	1	1	
Part – C Question having 10 marks weightage from CO3 or CO4 or CO5			10			01
Total		60	80	10	5	1

Course Code: A-306	Title: Automobile Electrical and Electronics Systems	Total No. Of Periods: 60
Course Objectives:	Upon completion of the course the student shall be able to 1.0 Apprehend the basic principles of electrical and electronics. 2.0 Understand the electrical systems used in automobiles. 3.0 Understand the wiring system and lighting system in the automobiles.	

CO No.		Course Outcome
C01	A-306.1	Define basic electrical and electromagnetic induction laws and solve simple problems based on them.
C02	A-306.2	Interpret the functions of basic electronics devices
C03	A-306.3	Analyse the features of batteries used in automobiles
C04	A-306.4	Discuss the Ignition System, Starting System and Generating System of an automobile
C05	A-306.5	Describe the features of Automobile Wiring Systems, Lighting System and Electrical Accessories

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

1.0 Basic Electrical and Electromagnetic Induction laws

1.1 State and explain Ohm's Law

1.2 Differentiate between series and parallel Electrical circuits

1.3 Compute the resistance of a conductor for a given length, area and resistivity.

1.4 State the Faraday's laws of electromagnetic induction.

1.5 State Fleming's Right hand rule

1.6 State Lenz's law

1.7 Distinguish between self and mutual inductance.

1.8 Calculate inductance of a given coil.

1.9 State the Energy stored in a magnetic field (only formula)

1.10 Describe the Lifting power of a magnet (no derivation)

2.0 Electronic devices in automobiles

2.1 Define conductors, insulators and semiconductors & their applications

2.2 State the formation of P-N junction diode and its applications

2.3 State the formation of P-N-P & N-P-N transistors and their applications.

2.4 Explain the Binary system and its suitability to switching

2.5 Define integrated circuits and list the types

2.6 List the different voltage levels required for Automobiles.

2.7 Describe the basic microprocessor (8085) and list its functions

2.8 Describe the basic micro controller (8051) and list its functions

2.9 Explain the interfacing of Microprocessor and microcontroller with sensors.

2.10 Explain electronic navigation system in Automobiles.

3.0 Batteries

3.1 List the types of battery; and parts of Lead acid battery

3.2 State the three functions of batteries.

3.3 State the physical and chemical changes noticed during the charging and discharging of a lead acid battery.

3.4 State the ampere hour and watt-hour efficiency of the battery

3.5 List three different methods of charging of battery.

3.6 Explain the trickle charging of battery.

3.7 List the four methods to test a lead acid battery for fully charged and discharged condition.

3.8 State the maintenance of a lead acid battery.

3.9 Describe the maintenance free battery.

4.0 Ignition Systems

4.1 Explain the working principle of ignition system
4.2 Explain the necessity of ignition system.
4.3 Draw the circuit diagram of coil ignition system and identify its components.
4.4 State the function of each component of coil ignition system
4.5 Explain the constructional details of distributor.
4.6 State the function of contact breaker points and the condenser.
4.7 State the specifications of a spark plug.
4.8 State the terms spark plug, plug gap and C.B. point gap.
4.9 State the principle of Electronic ignition system.
4.10 Explain the working principle of transistorized ignition system
4.11 List five Advantages of transistorized ignition system over conventional ignition system and state applications of magneto ignition systems.
4.12 Describe the magneto ignition system

5.0 Starting System

5.1 State the principle of DC Motor.
5.2 State the functions of self-starter.
5.3 Explain the conditions for starting an engine by a self-Starter motor.
5.4 Describe the use of series motor as self-starter.
5.5 Explain the working principle of Bendix drive with a sketch.
5.6 Explain the constructional details of self-starter.
5.7 Describe the working of Lucas drive and Follow-through drive with sketches.
5.8 State the functions of over running clutch drive.
5.9 Explain the working principle of a solenoid switch with a sketch.

6.0 Generating System

6.1 Sketch the components of DC Generator
6.2 Explain the function of each component
6.3 State the need of cut out in charging system
6.4 Explain the working principle of cut out
6.5 State the need for voltage and current regulation while charging the battery by using dynamo
6.6 Describe generation of alternating emf and alternating currents.

7.0 Automobile Electrical wiring systems, Lighting and Accessories

7.1 Differentiate between earth return and insulated return wiring systems.
7.2 State the meaning of wire harnessing.
7.3 Analyse the wiring layout of a passenger car with petrol engine with diagram.
7.4 Analyse the wiring layout of a commercial vehicle with diesel engine with diagram.
7.5 Analyse the wiring layout of two wheeler with diagram.
7.6 Explain the constructional details of sealed beam head light.

7.7 Describe the adjustment of head lights.

7.8 Identify the colour code and Symbols used in Automotive wiring Diagram.

7.9 Explain the working principles of 1. Horn, 2. Wind screen wiper, 3. Traffic indicator, 4. Flash type directional indicator lights, 5. Fuel, 6. Oil and 7.Water Gauge circuits with circuit diagrams.

COURSE CONTENT

1.0 Basic Electrical and Electromagnetic Induction laws:

Electrical Units of current, voltage, power, Energy – S.I. Units –Ohm's Law – Series and parallel circuits - Resistance of a conductor– Determination of total resistance of a given conductor - Basic principle of flux production due to electric current - Fleming's Right hand rule - Lenz's law - Faradays laws of electromagnetic induction – Self and Mutual Inductance.

2.0 Electronic Devices in Automobiles

Conductors, insulators and semiconductors - P-N Junction Diode & its applications – PNP and NPN transistors & their applications – Introduction to Binary system - Suitability of Binary system in switching – Integrated Circuits and types - Basic Microprocessor (8085) - Basic Microcontroller (8051) – Interfacing of Microprocessor and Microcontroller with Sensors – Electronic Navigation system in Automobiles.

3.0 Batteries

Types of batteries – Primary and secondary cells –Different types of batteries – Parts of a lead acid battery - Constructional features of a lead acid battery - Chemical reaction during charging and discharging - Ampere-hour efficiency- Watt-hour efficiency –Charging of a battery – different methods [trickle charging] - Battery tests – voltage test, specific gravity test, high discharge test, cadmium cells test - Care and maintenance of lead acid battery maintenance free battery.

4.0 Ignition systems

Requirements of ignition system - Types of ignition system-coil ignition and magneto ignition systems - Constructional details and working principle of coil and magneto ignition systems with circuit diagrams-study of the components in detail –Distributor, C B Points, Condenser ,H T Coil, Spark Plug- Specifications of a spark plug - Ignition Timing – advancing and retarding of ignition- Automatic advance mechanics - - Electronic ignition - Transistorized ignition system and Capacitor Discharge Ignition (CDI)-working principle with circuit Diagrams-advantages over conventional ignition systems

5.0 Starting Motors

Working principle of a D.C. Motor - Need of self-starter - Conditions of self-starter during starting of an engine - Need of series motor as self-starter –Constructional details of self-starter and solenoid switch – Self Starter Drive mechanisms – Bendix drive, Folo through drive - Over running clutch drive.

6.0 Generating System:

Principle of DC Generator – Constructional details of DC Generator – Function of Cut-out - Voltage and current regulator – Limitation of DC Generator – Principle of alternating current – constructional details of alternator –advantages.

7.0 Automobile Wiring System, Lighting and Accessories

Types of wiring systems- earth return and insulated return system – 12v and 24 volts systems - Meaning of wire harnessing - Principle of Automobile Illumination - Head lamps – construction of sealed beam lamps – Halogen screen wiper circuit - Traffic Indicators - Instrument panel – Speedometer, Odometer - Fuel level gauge - Oil pressure gauge - Water temperature gauge-Automatic wiper-Automatic Head lamp - Colour code & Symbols of wiring Diagram

REFERENCES

1. Automotive Electrical systems equipment: by N.R. Khatawate - (S.Chand& Co.)
2. Basic Electrical Engineering. : by M.L. Gupta
3. Electrical Technology: by B.L.Theraja
4. Electrical Equipment of Automobiles: by Parker Smith
5. Automobile Electrical Equipment: by P.L. Kohli
6. Basic Automobile Electricity: by C.P. Nakra
7. Automobile Electrical Engineering: by Arora &Dass
8. Automobile Engineering: by K.K. Ramalingam
9. Microcontroller & application (8051): Mazdi & Mazdi
10. Digital Electronics- Morris Mano
11. Instrumentation by – A.K.Sawhaney
12. Automotive Mechanics- S.Srinivasan

Blueprint of Question Paper
A-306, Automobile Electrical and Electronics Systems

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks wise Distribution of Weightage				Question wise Distribution of Weightage			
				R	U	Ap	An	R	U	Ap	An
1.	Basic Electrical and Electromagnetic Induction laws	8	9	3	3	3	-	1	1	1	-
2.	Electronic devices in Automobiles	8	9	3	3	3	-	1	1	1	-
3.	Batteries	8	11	3	-	8	-	1	-	1	-
4.	Ignition Systems	8	11	-	3	8	-	-	1	1	-
5.	Starting System	8	11	-	3	8	-	-	1	1	-
6	Generating System	8	8	-	-	8	-	-	-	1	-
7.	Automobile Wiring Systems, Lighting and Accessories	12	11	3	-	8	-	1	-	1	-
Part – C Question having 10 marks weightage from CO3 or CO4 or CO5			10				10				1
Total:		60	80	12	12	46	10	4	4	7	1

- **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 4.12
Unit Test – II	From 5.1 to7.9

MACHINE DRAWING

Subject Title	Subject Code	Periods/Week	Periods per Semester
MACHINE DRAWING	A-307	6	90

TIME SCHEDULE

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated
1	Nuts and Bolts	18	15
2	Rivets and Riveted joints	21	15
3	Keys	12	10
4	Assembly Drawing *	39	20
	Total:	**90**	**60**

Course Code: A-307	Title: MACHINE DRAWING	Total No. Of Periods: 90
Course Objectives:	**Upon completion of the course the student shall be able to draw to scale the various views of Machine elements like**	
	1.0 Various types of nuts and bolts.. 2.0 Various types of riveted joints & keys and 3.0 Various types of joints, couplings & bearings.	

CO No.		Course Outcome
C01	A-307.1	Draw to scale various views of different types of nuts and bolts, from the given data or drawing.
C02	A-307.2	Draw to scale various views of different types of rivets & riveted joints from the given data or drawing.
C03	A-307.3	Draw to scale various views of different types of keys and joints-knuckle & cotter joints from the given data or drawing.
C04	A-307.4	Draw assembly drawing to the given parts of the couplings, knuckle and cotter joints.
C05	A-307.5	Draw assembly drawing to the given parts of the bearing

Learning Objectives: Upon completion of the course the student shall be able to draw to scale of different views of

1.0 NUTS AND BOLTS

1.1 . Draw Screw nomenclature, External and internal threads – front view.
1.2 Draw Left hand and right hand threads – front view.
1. 3 Draw Multiple threads – front view.
1.4 Draw Forms of V threads- B.S.W. threads, B.A, threads, Multiple threads,

sellers threads, metric threads –front view.

1.5 Draw the forms of square threads, knuckle threads Acme, Buttress threads International metric thread form –front view.

1.6 Draw the hexagonal nut, square nut, cap nut, capstan nut, and flanged nut –front view, top view.

1.7 Draw the hexagonal headed bolt –front view, side view.

1.8 Draw Square headed bolt, Cheese head bolt and Cup headed bolt –front view, side view

1.9 Draw Hook bolt and Eye bolt –front view, side view.

1.10 Draw Foundation bolts-Lewis foundation bolt, eye foundation bolt, Rag foundation bolt – front views.

2.0 Rivets and riveted joints

2.1 Draw the various types of rivets: Snap, cup, conical. Round conical, countersunk - front views.

2.2 Draw Lap joint: single riveted and double riveted Lap joints (Chain and Zig - Zag) - front view, top views.

2.3 Draw Butt joint: Single cover and double cover of single riveted and double riveted (Chain and Zig - Zag) Butt joints - front view, top view.

3.0 Keys

3.1 Draw Sunk Taper key –front view, side view.

3.2 Draw Saddle keys – flat, hollow keys –front view, side view.

3.3 Draw Feather keys and types – peg, single head, double headed feather keys –front view.

3.4 Draw Gib headed key–front view, side view.

3.5 Draw Wood ruff key –front view, side view.

4.0 Assembly drawing

4.1. Draw Joints : Knuckle joint & Cotter joint –sectional front view, top view.

4.2. Draw Couplings :Muff coupling, Split Muff coupling, Oldham's coupling - sectional front view, side view.

4.3. Draw Flange coupling, protected type flange coupling and Universal coupling - sectional front view, side view.

4.4 Draw Bearings : Solid bearing - front view, top view, Bushed bearings, pedestal Bearings and Footstep bearings- sectional front view, top view.

COURSE CONTENT

1. Nuts and Bolts

Screw nomenclature, external and internal threads, left hand and right hand threads, multiple threads, forms of V threads, B.S.W. threads, B.A threads, Multiple threads, sellers threads, metric threads and able to draw.

Draw the forms of square threads, knuckle threads, Acme, Buttress threads International Metric thread form. Draw the hexagonal nut square nut, cap nut, capstan nut, and flanged nut.

Draw the hexagonal headed bolt square headed bolt, cheese head bolt, cup headed bolt hook bolt, eye, bolt, and foundation bolts-Lewis foundation bolt, eye foundation bolt, Rag foundation bolt.Draw the collar stud, square neck stud, round neck stud.

2. Rivets and Riveted joints:

Draw the various types of rivets; lap joint: single riveted and double riveted Lap joints (Chain and Zig - Zag), butt joint: Single cover and double cover of single riveted and double riveted (Chain and Zig - Zag) Butt joints.

3. Keys

Draw the views different types of Keys.

4. Assembly drawing

Joints : Knuckle joint, Cotter joint,

Couplings :Muff coupling, split Muff coupling, Oldham's coupling, flange coupling-

protected type flange coupling- universal coupling

Bearings : Solid bearing, Bushed bearings, pedestal bearings- Footstep bearings.

REFERENCE BOOKS

1. Machine Drawing byN. D. Bhatt – Charoter Publications
2. Machine Drawing byN. Siddeswar, Kannaiah, Sastri-Mc Graw Hill Educations
3. Machine Drawing byG. R. Nagpal – Khanna Publishers
4. Machine Drawing by R. B. Gupta – Tech India Publication Series.

BLUE PRINT OF MARKS
A-307, MACHINE DRAWING

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks wise Distribution of Weightage				Question wise Distribution of Weightage			
				R	U	Ap	An	R	U	Ap	An
1	Nuts and Bolts	18	15	5	10			1	1		
2	Rivets and Riveted joints	21	15	5	10			1	1		
3	Keys	12	10	5	5			1	1		
4	Assembly Drawing *	39	20			20				1	
	Total:	90	60	15	25	20		3	3	1	

AUTOMOBILE LABORATORY

Course Title	Course Code	Periods per week	Total Periods/Semester
Automobile Laboratory	A-308	3	45

TIME SCHEDULE

Sl. No.	Major Topic	Periods
1.	Identification of tools and equipment	5
2.	Demonstration of working of two and four stroke petrol and diesel engines	8
3.	Dismantling and assembling of engine	10
4.	Demonstration of working procedure of fuel supply, cooling, lubrication and intake and exhaust system of an engine with the aid of simulator	10
5.	Dismantling and assembling of mechanical fuel pump, carburettor, single and multi-plate clutch, constant and synchromesh gear box and	12
6.	Demonstration of driving skills ***(One batch will go for Two wheeler driving practice and another batch will do the experiment)***	
Total:		**45**

Course Code: A-308 Course Title: AUTOMOBILE LABORATORY No. of Periods: 45	
COURSE OBJECTIVES	**Upon completion of the course the student shall able to** 1. Understand the dismantling of engine, identify the components and assemble the engine components 2. Know the working procedure of fuel supply, cooling, lubrication and intake and exhaust system of an engine with the aid of simulator 3. Understand the dismantling and assembling of Mechanical fuel pump, carburettor, clutch, gear box and differential also know the driving skills

CO No.		Course Outcome
C01	**A-308.1**	Identify the tools and equipment used in automobile laboratory
C02	**A-308.2**	Assemble the dismantled engine
C03	**A-308.3**	Demonstrate the working procedure of 1.fuel supply, cooling, and 2. Lubrication 3. intake and exhaust system of an engine with the aid of simulator
C04	**A-308.4**	Manage the dismantling and assembling of 1. Mechanical fuel pump, 2 Electrical fuel pump. 3. Carburettor, 4. Single plate clutch, 5. Multi plate clutch, 6. Constant mesh gear box 7. Synchromesh gear box and 8. Differential
C05	**A-308.5**	Demonstrate driving skills on two wheeler vehicle

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

LIST OF EXPERIMENTS

1. Identify the different tools, gauges and various instruments used in Automobile Laboratory
2. Demonstrate working principle of two stroke and four stroke engines (Petrol and Diesel) with the aid of cut model
3. Dismantle a given I.C. Engine and identify the various basic components such as Cylinder, Cylinder block, Cylinder head, Piston, Piston rings, Connecting rod, Crank shaft, Valves, Valve actuating mechanism, Timing gears, Crankcase, Spark plug, Fuel pump, Carburettor, Fuel Injector, Fuel Injection pump
4. Demonstrate the fuel system of a multi cylinder petrol and diesel engines with the aid of simulator
5. Demonstrate the Inlet and Exhaust system of a multi cylinder engine with the aid of a simulator
6. Demonstrate the lubrication system of a multi cylinder engine with the aid of a simulator
7. Demonstrate the water cooling system of a multi cylinder engine with the aid of a simulator
8. Dismantling and Assembling of A.C. Mechanical fuel pump and Electrical fuel pump.
9. Dismantling and Assembling of Carburettor
10. Dismantling and Assembling of a single plate clutch and multi plate clutch
11. Dismantling and Assembling of Constant mesh & synchromesh gear box.
12. Dismantling and Assembling of a Differential
13. Demonstrate the driving skills on Two wheeler vehicle/driving simulator

The competencies and key competencies to be achieved by the student

S no	Title of the experiment	Key competencies	Competencies
1	Identification Of Tools, gauges and Instruments.	1) Identify the tools required for a Particular task. 2) Identify the gauges required for a particular task and also able to identify the ranges. 3) Identify the measuring Instrument required for a Particular task.	1) State different types of tools and their applications. 2) State different types of gauges. 3)State different types of measuring Instruments and also use of each instrument
2	working principle of two stroke and four	Identify the engine parts in cut model of petrol and diesel engine	Appreciate the working principle of two stroke and four stroke petrol and diesel engines

	stroke engines (Petrol & Diesel)		
3	Engine Dismantling and assembling	1) Dismantle the Engine from the Vehicle. 2) Dissemble the engine 3) Report on the condition 4) Assembling the Engine 5) Check the Running Condition of the engine.	1) Identify the tools required for Dismantling. 2) Use Of appropriate tools dismantle the engine parts and keep the parts without damage in order. 3) Clean all the parts with appropriate tool / medium. 4) Assemble all the parts in order. 5) Check the running condition of the engine.
4	Fuel System of a Multi Cylinder Engine.	1) Identify the components of a Fuel system. 2) Know the function of each component in the system	1)Draw a line diagram of a fuel System of a given Multi Cylinder Engine
5	Inlet and Exhaust System of a Multi Cylinder Engine.	1) Understand the need of inlet and exhaust system. 2) Know the function of each component in the system	1)Draw a line diagram of a Inlet and Exhaust System of a given Multi Cylinder Engine
6	Lubrication System of a Multi Cylinder Engine	1) Identify the components of a Lubricating system. 2) Know the function of each component in the system	1)Draw a line diagram of a Lubrication System of a given Multi Cylinder Engine
7	Cooling System of a Multi Cylinder Engine	1) Identify the components of a Cooling system. 2) Know the function of	1)Draw a line diagram of a Cooling System of a given Multi Cylinder Engine

S no	Title of the experiment	Key competencies	Competencies
8	AC Mechanical Pump& Electrical fuel	1) Dismantle the component from the Vehicle. 2) Dissemble the component 3) Report on the condition 4) Assembling the component 5) Check the Running Condition of the component	1) Identify the tools required for Dismantling the component. 2) Use of appropriate tools to dismantle the component 3) Keep the dismantled parts without any damage in order 4) Clean all the parts with appropriate tool / medium 5) Assemble the component 6) Check and bring to the operating condition
9	Carburettor		
10	Single plate and Multi plate clutch		
11	Constant mesh and synchromesh Gear box		
12	Differential		
13	Driving Practice	1) Know the foot controls of the vehicle 2) Know the hand controls of the vehicle 3) Familiarity of all Driving Controls 4) Operate all the above Controls simultaneously whenever needed. 5) To Know the various Road signs and signals used while driving a vehicle. 6) Legal requirements to drive a vehicle on road.	1) Identify the Hand & Foot Controls of a Two Wheeler i.e A,B,C 2) State the Purpose of Foot Controls. 3) Operate the foot controls efficiently 4) Operate to change of gear by gear Shift lever 5) Identify the various accessories like Horn, Lights and Indicators. 6) Operate all the above Controls Simultaneously.

WORKSHOP PRACTICE – II

Course Title	Course Code	Periods per Week	Periods per Semester
Workshop Practice-II	A – 309	6	90

TIME SCHEDULE

Sl. No.	Major Topics	Periods
1.	Machine Shop (Turning)	30
2.	Welding Practice	30
3.	Special Machine Shop	30
Total		90

Course Code: A-309	Title: Workshop Practice- II	Total No. Of Periods: 90
Course Objectives :	Upon completion of the course the student shall be able to	
	1.0 Perform various operations on lathe 2.0 Practice the arc welding 3.0 Practice on special machines	

CO No.		Course Outcome
C01	A-309.1	Produce an object as per model by performing on or more of the following operations viz., plain turning, step turning, taper turning, knurling and thread cutting.
C02	A-309.2	Design and model a lap joint, a butt joint and a T – joint by fastening the plates with arc welding.
C03	A-309.3	Prepare a component by using shaping machine, milling machine and planer machine.

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

1.0 Perform various operations on the Lathe

1.1 Perform a plain turning operation on a lathe machine.
1.2 Select proper tool to perform the job.
1.3 Centering the job by dial gauge
1.4 Select the suitable speed for different operations
1.5 Make use of various measuring instruments for taking dimensions.
1.6 Perform step turning operation on lathe.
1.7 Calculate the taper angle.
1.8 Practice the different taper turning methods on lathe
1.9 Turn the required tapers by swivelling the compound rest.
1.10 Produce articles of industrial application such as ring gauges, plug gauges, handle etc.

2.0 Practice the Arc Welding

2.1 Prepare the edges for welding
2.2 Select the suitable electrode, voltage and current
2.3 Handle the Electrode Holder for laying welding beads.
2.4 State the operation of welding transformer and generator.
2.5 Perform various weld joint operations.

3.0 Hands on practice on Special Machines

3.1 Perform the operation of groove cutting by using Shaper.
3.2 Perform the operation of gear cutting by using Milling Machine
3.3 Perform the surface finishing operation by using planning machine.

COURSE CONTENT

1 Machine Shop (Turning)

a. Plain Turning
b. Step Turning
c. Taper Turning
d. Turning Collars
e. Knurling
f. Facing

2. Welding

a. Practice of Handling of Electrode
b. Butt joints.
c. Lap joints.
d. T-Joint.

3.0 Special Machines

a. Shaping (Preparation of Groove)
b. Milling (Gear Cutting Operation)
c. Planning (Surface finishing Operation)

The competencies and key competencies to be achieved by the student

Title of the experiment	Key competency
Plain turning	• Centering of the work piece using dial gauge • Fixing the cutting tool at proper inclination • Selecting the suitable speed, feed and depth of cut for rough and finishing operations • Checking the dimensions
Step turning	• Centering of the work piece using dial gauge • Fixing the cutting tool at proper inclination • Selecting the suitable speed, feed and depth of cut for rough and finishing operations • Checking the dimensions
Taper turning	• Centering of the work piece using dial gauge • Fixing the cutting tool at proper inclination • Selecting the suitable speed, feed and depth of cut for rough and finishing operations • Checking the dimensions • Rotating the compound rest to the suitable angle
Knurling	• Centering of the work piece using dial gauge • Fixing the cutting tool at proper inclination • Selecting the suitable speed, feed and depth of cut for rough and finishing operations • Checking the dimensions • Fixing the knurling tool and selecting the suitable speed and feed
Title of the experiment	**Key competency**
Thread Cutting	• Centering of the work piece using dial gauge • Fixing the cutting tool at proper inclination • Selecting the suitable speed, feed and depth of cut for rough and finishing operations • Checking the dimensions • Fixing the knurling tool and selecting the suitable speed and feed
Welding	• Edge preparation • Holding the electrode at suitable angle and distance with respect to the work piece to maintain the arc • Checking the bead
Lap joint	• Edge preparation • Holding the electrode at suitable angle and distance with respect to the work piece to maintain the arc • Checking the bead

Butt joint	• Edge preparation • Holding the electrode at suitable angle and distance with respect to the work piece to maintain the arc • Checking the bead
T-Joint	• Edge preparation • Holding the electrode at suitable angle and distance with respect to the work piece to maintain the arc • Checking the bead
Shaping	• Prepare the work surface • Holding the component on a T slotted table fixed to the vice and check the distance with respect to the work piece to maintain tool clearance • Shape the component on given sides
Milling	• Prepare the work surface • Position the given milling cutter • Hold the work piece at suitable position and maintain the distance with respect to the milling cutter to attain milling operation • Clean the machine before and after use
Planning	• Prepare the work surface • Position the tool head • Hold the work piece at suitable position and maintain the distance with respect to the cutting tool to attain planning operation • Clean the machine before and after use

Automobile Electrical and Electronics Laboratory

Course Title	Course Code	Periods per Week	Periods per Semester
Automobile Electrical and Electronics Laboratory	A – 310	3	45

TIME SCHEDULE

Sl. No.	Major Topics	Periods
1.	Automobile Wiring System	8
2.	Batteries	8
3.	Automobile Ignition System	10
4.	Automobile Charging System	10
5.	Automobile Electrical Accessories	9
Total		45

Course Code: A-310	Title: Automobile Electrical and Electronics Laboratory	Total No. Of Periods: 45
Course Objectives:	**Upon completion of the course the student shall be able to**	
	1.0 Familiarize the Automobile Electrical Circuits 2.0 Handle the tools appropriately and safely 3.0 To reinforce theoretical concepts by practising relevant exercises.	

CO No.		Course Outcome
C01	**A-310.1**	Identify different colour code systems used in automotive wiring diagrams
C02	**A-310.2**	Able to conduct Service of lead – acid batteries
C03	**A-310.3**	Diagnose Ignition System, Starting system, Charging System and Electrical accessories.
C04	**A-310.4**	Test Starter Motor, Alternator and overhaul it.

Learning Objectives:

1. Identify different colour code systems used in automotive wiring system.
2. Prepare Electrolyte for Lead – Acid battery
3. Conduct a test on different batteries and their construction
4. Diagnose the ignition system
5. Dismantling and assemble the starter motor used in automobile.
6. Test the given starter Motor and Alternator
7. Dismantling and assemble the alternator used in automobile.
8. Diagnose the wiring of Head light, Trafficators, and Horn
9. Test the various sensors used in automobiles.

Key competencies to be achieved by the students:

Exp No.	Name of the Experiment	Key Competencies
1.	Identify different colour code systems used in automotive wiring system	Comprehend the commonly used colour codes in automotive wiring system. a. Starting circuit – Red b. Charging circuit – Yellow c. Relays and switches – Black d. Wiper circuit – Blue Various colours for various Fuse boxes.
2.	Prepare Electrolyte for Lead – Acid battery	a. Prepare electrolyte for Lead – Acid battery by mixing proper ratio of acid and distilled water. b. Check the specific gravity of electrolyte.
3.	Conduct a test to study different battery condition and construction	a. Inspect battery condition b. conduct open circuit voltage test c. Hydrometer test to get specific gravity of the electrolyte d. battery load test
4.	Diagnose the Ignition System	a. Check primary circuit b. secondary circuits
5.	Dismantle and assemble starter motor used in automobile.	a. Familiarize with the parts of starter motor. b. Test the starting motor for continuity, faults, if any c. Step by step dismantling of starting motor d. Chronological order to be followed for assembling the starter motor.
Exp No.	**Name of the Experiment**	**Key Competencies**
6.	Conduct a test on Starter Motor and Alternator to identify the condition of various parts.	a. Check the condition of carbon Brushes b. Check the movement of Bendix drive c. Conduct no load test on starter motor d. Check Alternator performance characteristics. e. Test Alternator output f. Check Cut – in and Cut – out voltage of alternator
7.	Dismantle and assemble the alternator used in automobile.	a. Step by step dismantling of alternator. b. Chronological order to be followed for assembling the alternator.
8.	Diagnose the wiring of Head light, Trafficators, and Horn	a. Check the fuse in fuse box and replace b. Check the connection to the battery c. Check the brightness of the head lamps and honk horn d. Check the alignment of head lamps
9.	Test the given sensors	a. Test Temperature Sensor b. Test O_2 Sensor c. Test Throttle position sensor c. Test Pressure sensors

IV SEMESTER

DIPLOMA IN AUTOMOBILE ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
IV Semester

Subject Code	Name of the Subject	Instruction period / week		Total Periods	Scheme of Examination			
		Theory	Practical/Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY (for a duration of 9 weeks):								
A-401	Engineering Mathematics - III	3		45		20	80	100
A-402	Strength of Materials and Fluid Mechanics	5		75		20	80	100
A-403	Automobile Chassis and Body Engineering	4		60		20	80	100
A-404	Automobile Servicing and Maintenance	4		60		20	80	100
A-405	Special Purpose Vehicles	4		60		20	80	100
A-406	Motor Transport Organisation	4		60		20	80	100
PRACTICALS								
A-407	Automobile Engineering Drawing	-	6	90	3	40	60	100
A-408	Communication Skills	-	3	45	3	40	60	100
A-409	Automobile Servicing and Maintenance Laboratory	-	6	90	3	40	60	100
A-410	Hydraulic and Pneumatic Controls Laboratory	-	3	45	3	40	60	100
TOTAL		24	18	360+270	-	280	720	1000

ENGINEERING MATHEMATICS-III

Course Code	Course Title	No. of Periods/week	Total No. of periods	Marks for FA	Marks for SA
A-401	Engineering Mathematics-III	3	45	20	80

S.No.	Unit Title	No. of periods	COs mapped
1	Higher order Linear Differential equations with constant coefficients	15	CO1
2	Laplace Transforms	18	CO2
3	Fourier Series	12	CO3
	Total Periods	45	

Course Objectives	(i) To learn the principles of solving differential equations of second and higher order. (ii) To comprehend the concept of Laplace transformations and inverse Laplace transformations. (iii) To understand the concept of Fourier Series expansion of functions.

Course Outcomes	CO1	Solve homogeneous and non-homogeneous differential equations of second and higher order.
	CO2	Find Laplace and inverse Laplace transforms of various functions.
	CO3	Expand given functions as Fourier series and half- range Fourier Sine and Cosine series.

ENGINEERING MATHEMATICS – III

Learning Outcomes

Unit-I

Differential Equations of higher order

C.O. 1 Solve homogeneous and non-homogeneous differential equation of second and higher order.

L.O 1.1 Solve Differential equations of the type $(aD^2 + bD + c)\, y = 0$ where a, b, c are real numbers and provide examples.

1.2 Solve higher order homogeneous differential equations with constant coefficients and provide examples.

1.3 Define complementary function, particular Integral and general solution of a non-homogeneous differential equation.

1.4 Describe the methods of solving $f(D)\, y = X$ where $f(D)$ is a polynomial of n^{th} order and X is a function of the forms $k,\ e^{ax},\ \sin ax, \cos ax,\ x, x^n$ and their linear combinations where n is a positive integer, with examples.

Unit-II

Laplace Transforms

C.O. 2 Find Laplace and inverse Laplace transforms of various functions.

L.O. 2.1 Define Laplace Transform and explain the sufficient conditions of existence of Laplace Transform

2.2. Obtain Laplace transforms of standard functions and solve simple problems.

2.3 Write the properties of Laplace Transform – Linearity property, First shifting theorem (without proof) and Change of Scale property and solve simple problems.

2.4. Write the Laplace Transform of unit step function and second shifting theorem (without proof) and solve simple problems.

2.5. Write formulae for Laplace transform of functions with multiplication by t^n and division by t, Laplace transform of derivatives, evaluation of some definite integrals using Laplace Transforms and solve simple problems.

Syllabus for Unit test-I completed

2.6 Define inverse Laplace Transform, obtain inverse Laplace Transforms of standard functions and solve simple problems.

2.7 Write linearity property, first and second shifting theorems (without proof), change of scale property of inverse Laplace transform and solve simple problems.

2.8 Write inverse Laplace transforms of derivatives and integrals and solve simple problems.

2.9 Write inverse Laplace transforms of functions with multiplication by s and division by s and solve simple problems.

2.10 Write inverse Laplace transforms of functions using partial fractions and solve some simple problems.

2.10 Define convolution of two functions, state convolution theorem (without proof) and solve simple problems.

Unit-III

Fourier series

C.O. 3 Expand given functions as Fourier series and half- range Fourier Sine and Cosine series

L.O. 3.1 Define the orthogonality of functions in an interval.

3.2 Define Fourier series of a function in the intervals $(c, c+2\pi)$ and $(c, c+2l)$ and write the Euler's formulae for determining the Fourier coefficients.

3.3 Write sufficient conditions for the existence of Fourier series expansion of a function.

3.4 Find Fourier series of simple functions in the range (0 , 2π) and (-π , π)

3.5 Write Fourier series for even and odd functions in the interval $(-\pi, \pi)$ and $(-l, l)$ expand simple functions.

3.6 Write Fourier series expansion of a function over the interval (0, 2l) and $(-l, l)$ and expand simple functions.

3.7 Write half-range Fourier sine and cosine series of a function over the interval (0, π) and $(0, l)$ and expand simple functions.

Syllabus for Unit test-II completed

ENGINEERING MATHEMATICS – III
(Common Subject)
Course Content

Unit I: Differential Equations of higher order

1. Solve Homogenous linear differential equations with constant coefficients of order two and higher with emphasis on second order.
2. Solve Non-homogenous linear differential equations with constant coefficients of the form f(D) y = X where X is in the form k(constant), e^{ax}, sinax, cosax, x^n, where n is a positive integer, finding complimentary function, particular integral and general solution.

Unit II: Laplace Transforms

3. Definition, sufficient conditions for existence of LT, LT of elementary functions, linearity property, state first shifting theorem, change of scale property, multiplication by t^n, division by t, LT of derivatives and integrals, LT of unit step function, state second shifting theorem, inverse Laplace transforms- state shifting theorems and change of scale property, multiplication by s^n and division by s, derivatives, integrals, examples of inverse LT using partial fractions, state convolution theorem with simple examples.

Unit III: Fourier series

4. Orthogonality of trigonometric functions, Representation of a function in Fourier series over the interval $(c\ ,\ c+2\pi)$ and $(c\ ,\ c+2l)$, Euler's formulae , sufficient conditions for existence of Fourier series expansion of a function, Fourier series expansion of basic functions limited to k(constant), $x, x^2, \sin ax, \cos ax, e^{ax}$ and their combinations over the intervals $(0,\ 2\pi), (-\pi, \pi), (0,\ 2l), (-l, l)$, Fourier series for even and odd functions over $(-\pi, \pi)$ and $(-l, l)$, Fourier half-range sine and cosine series over $(0,\ \pi)$ and $(0,\ l)$

Textbook:

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

Reference Books:

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers
2. M.R. Spiegel, Schaum's Outline of Laplace Transforms, Schaums' Series
3. M.Vygodsky, Mathematical Handbook: Higher Mathematics, Mir Publishers, Moscow.

Blue print

S. No	Chapter/ Unit title	No of Periods	Weightage allotted	Marks wise distribution of weightage				Question wise distribution of weightage				COs mapped
				R	U	Ap	An	R	U	Ap	An	
1	Unit – I Higher order Linear Differential equations with constant coefficients	15	28	11	11	3	3	2	2	1	1	CO1
2	Unit - II Laplace Transforms	18	33	11	11	11	0	2	2	2	0	CO2
3	Unit - III Fourier Series	12	19	3	3	3	10	1	1	1	1	CO3
Total		**45**	**80**	**25**	**25**	**17**	**13**	**5**	**5**	**4**	**2**	

R: Remembering Type : 25 Marks
U: understanding Type : 25 Marks
Ap: Application Type : 17 Marks
An: Analysing Type : 13 Marks

Engineering Mathematics – III
Unit Test Syllabus

Unit Test	Learning Outcomes to be Covered
Unit Test-I	From LO 1.1 to 2.5
Unit Test-II	From LO 2.6 to 3.7

STRENGTH OF MATERIALS AND FLUID MECHANICS

Subject Title	Subject Code	Periods /week	Periods /year/Semester
Strength of Materials and Fluid Mechanics	A – 402	5	75

TIME SCHEDULE

Sl. No	Major topic	Periods Allocated	Weightage of marks	Part – A Short Type (3 marks)	Part – B Essay Type (8 Marks)	Part – C Essay Type (10 Marks)
STRENGTH OF MATERIALS						
1.	Simple stresses, strains &Torsion	12	11	1	1	
2.	Geometrical Properties of sections	12	14	2	1	
3.	S.F and B.M diagrams	12	14	2	1	
FLUID MECHANICS						
4.	Properties of Fluids	12	14	2	1	
5.	Flow of fluids	12	07	1	1/2	
6	Oil Power hydraulics & Pneumatics	10	06	2	-	
7	Hydraulic Machinery	05	04	0	1/2	
Part – C Question having 10 marks weightage from CO3 or CO4		-	10	-	-	1
Total:		**75**	**80**	**10**	**05**	**1**

Course Code: A-402	Title: Strength of Materials and Fluid Mechanics	Total No. Of Periods: 75
Course	**Upon completion of the course the student shall be able to**	

Objectives:	1.0 Understand the behaviour of materials under simple stresses and strains and Torsion. 2.0 Understand the centre of gravity, centroid, Moment of inertia & Radius of gyration for a given area of cross section. 3.0 Understand types of Beams, properties of fluids and concept of flow of fluids 4.0 Understand the concept of oil power Hydraulic control unit ,pneumatics and hydraulic machinery.

CO No.		**Course Outcome**
C01	**A-402.1**	Explain the behaviour of materials under simple stresses, strains and Torsion
C02	**A-402.2**	Determine centroid, Moment of Inertia and Radius of gyration.
C03	**A-402.3**	Evaluate shear force and bending moments in various types of beams.
C04	**A-402.4**	Analyse the concept of fluid flow.
C05	**A-402.5**	Explain oil power-hydraulic control unit, pneumatics and Hydraulic machinery

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

1.0 **Simple stresses, strain and Torsion.**

1.1 Define the terms: 1. Stress, 2. strain, 3. Modulus of elasticity, 4. longitudinal strain, 5. lateral strain, 6. Poisson's ratio, 7. Modulus of rigidity, 8. Bulk modulus, 9. working stress, 10. factor of safety.

1.2 Distinguish between different kinds of stresses and strains.

1.3 Explain the salient points in stress-strain curve for ductile materials (mild steel**)**

1.4 State Hooke's law and limits of Proportionality.

1.5 Solve problems on relationship between simple stress and simple strain under axial loading on uniform bars and stepped bars.

1.6 State the relationship between the elastic constants.

1.7 Solve Problems on relationship between elastic constants.

1.8 Explain the concept of torque equation.

1.9 State the assumptions made in pure torsion.

2.0 Geometrical properties of sections

2.1 Define centroid, centre of gravity, centre of mass, Moment of inertia, and radius of gyration.

2.2 State the necessity of finding the centroid and centre of gravity for various engineering applications.

2.3 Calculate positions of centroids for simple plane figures from first principles.

2.4 Explain the method of determining the centroid by ' method of moments'.

2.5 Determine the position of centroids of standard sections-T and I-sections.
2.6. Define moment of inertia and radius of gyration.
2.7. State the necessity of finding moment of inertia for various engineering applications.
2.8 Determine MI of standard sections by applying parallel axes and perpendicular axis theorem
2.9 Explain the term radius of gyration

3.0 SF & BM Diagram

3.1 Define different types of beams Viz., a) Cantilever beam and b) Simply supported beam c) Overhanging beam
3.2 Define different types of loads viz., a) Point load and b) Uniformly distributed load
3.3 Discuss the terms a) Shear force and b) Bending moment
3.4 State the relationship among the rate of loading, shear force and bending moment.
3.5 Evaluate shear force and bending moments on cantilever and simply supported beam for Simple cases of loading as Point load, uniformly distributed load.
3.6 Describe the procedures for sketching the shear force diagrams (SFD) and Bending Moment diagrams (BMD)
3.7 Develop Shear Force Diagrams (SFD) and Bending Moment Diagrams (BMD) for cantilever and Simply Supported Beams.
3.8 Define Point of contra flexure
3.9 Evaluate the Shear Force, Bending Moment and Point of contra flexure for overhanging beams.
3.10 Develop Shear Force Diagrams (SFD) and Bending Moment Diagrams (BMD) for overhanging beams.

4.0 Properties of fluids

4.1 Analyse between compressible and Incompressible fluids.
4.2 Discuss various properties of fluids.
4.3 Analyse Pascal law and its applications
4.4 Evaluate a). Atmospheric pressure, b).Absolute Pressure and c). Pressure head of fluid.
4.5 Discuss the working principle of pressure Gauges.
4.6 Problems on manometers.

5.0 Flow of fluids

5.1 Explain the fluid flow of steady, unsteady, laminar and turbulent flows.
5.2. Write the Equation of continuity of flow and work done in overcoming pressure.

5.3 Solve 1. Total energy equation of fluid in motion. 2. Bernoulli's theorem (proof not necessary) and its practical applications in venturimeter and Simple problems.
5.4 Explain the laws of fluid friction, Reynolds number, change of stream lined flow into Turbulent flow and critical velocity.
5.5 Explain the various losses in a fluid flow. Loss of friction – Darcy's expressions (without proof) simple problems.

6.0 Oil power hydraulics and Pneumatics

6.1 Explain the function of the power source
6.2 List the parts of the power source.
6.3 Explain the function of each part of the power source.
6.4 Classify the a). Gear pump, b). Vane pump and c). Rotary pump (other pumps not necessary).
6.5 Explain the constructional details of a). Gear pump (external and internal gear type), b).Vane pump, c).Rotary pump and the working principle.
6.6 List the different types of actuators.
6.7 Explain the concept of pneumatics.
6.8 Write the basic symbols used in pneumatic circuit.
6.9 List Advantages and limitations of Pneumatics over hydraulic control.

7.0 Hydraulic Machinery

7.1 Explain Hydraulic press
7.2 Describe Hydraulic jack
7.3 Explain the working principle of Hydraulic lift
7.4 Discuss the working of Hydraulic crane

COURSE CONTENT:

STRENGTH OF MATERIALS

1.0 Simple stresses, strains &Torsion

Simple stresses and strains – strain diagram, Hooke's law, Factor of Safety- Ultimate stress and Design stress - Young's modulus, ,Modulus of Rigidity - Bulk Modulus – Poisson's ratio - Relation among elastic constant, Torsion equation, assumptions in it.

2.0 Geometrical properties of sections

Centre of gravity of geometric figures - Square, Rectangle, Triangle and Circle - neutral axis- Moment of Inertia- Radius of gyration- Parallel and perpendicular axis theorems- Polar moment of inertia – Calculation of moment of inertia of I, T, C and L – sections

3.0 S.F. and B.M. diagram

Types of beams – Cantilever, simply supported and overhanging beams -subjected to point or concentrated and U.D. loads - S.F. and B.M. calculations and diagrams for the above cases – Bending Moment, Shear force and load.

FLUID MECHANICS

4.0 Properties of fluids

Definition of fluid – compressible and incompressible fluids – Properties - Density, Specific weight, viscosity, surface Tension – Pressure- Pascal's law – Intensity of pressure – Gauge and absolute pressure – Measurement of pressure by Piezo meter, U- tube and differential manometers.

5.0 Flow of Fluids

Types of flow- concept of Reynolds's number – Equation of continuity of flow – Bernoulli's equation and practical applications – Problems on Bernoulli's equation – Loss of head in pipes due to friction – Darcy's (without proof) – Hydraulic Gradient – Total energy line – Power transmitted – Condition for maximum power transmission (without Derivation)- Simple problems.

6.0 Oil power hydraulics & Pneumatics

Basic components of an oil power hydraulic control circuit like power source, control element and actuator, Function of each basic component- Major parts of the power source – types of oil pumps and their constructional details-Definition of Pneumatics-Advantages and limitations of Pneumatics over hydraulic control.

7.0 Hydraulic Machinery

Constructional details and working principle of

1. Hydraulic press
2. Hydraulic jack
3. Hydraulic lift
4. Hydraulic crane

REFERENCE BOOKS

1. Strength of Materials -by R.S.Khurmi –S.Chand Publications
2. Solid Mechanics -by Pakirappa – Durga Publishing House.
3. Strength of Materials -by Ramamrutham –Dhanpat Rai Publishing Company
4. Hydraulics -by R.S. Khurmi – S.Chand Publications
5. A Test book of FM & Hydraulic Machine –by Dr. R.K Bansal-LP Publishers
6. Hydraulics -by Reya and Rao – Radiant Publishing House.
7. A text book of Fluid Mechanics and Hydraulic Machines – R.K. Rajput-S.Chand Publications

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A-402, STRENGTH OF MATERIALS & FLUID MECHANICS

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks wise Distribution of Weightage				Question wise Distribution of Weightage			
				R	U	Ap	An	R	U	Ap	An
1	Simple stresses and strains &Torsion	12	11	3		8		1		1	
2	Geometrical Properties of sections	12	14	3	3	8		1	1	1	
3	S.F and B.M diagrams	12	14	3	3	8		1	1	1	
4	Properties of Fluids	12	14	3	3	8		1	1	1	
5	Flow of fluids	12	07	3		04		1		½	
6	Oil Power hydraulics & Pneumatics	10	6	3	3			1	1		
7	Hydraulic Machinery	05	04		04				1/2		
Part – C Question having 10 marks weightage from CO4			10				10				1
Total:		75	80	18	16	36	10	6	4 1/2	4 1/2	1

- **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 3.10
Unit Test – II	From 4.1 to 7.4

AUTOMOBILE CHASSIS AND BODY ENGINEERING

Course Title	Course Code	Periods / Week	Periods / Semester
Automobile Chassis and Body Engineering	A- 403	04	60

TIME SCHEDULE

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Part – A Short Type (3 marks)	Part – B Essay Type (8 Marks)	Part – C Essay Type (10 Marks)
1	Steering System	12	14	02	01	
2	Braking System	10	14	02	01	
3	Suspension System	10	11	01	01	
4	Automobile Chassis and Body	10	11	01	01	
5	Body Design and Construction	10	11	01	01	
6	Air Conditioning System	8	9	03	00	
Part – C Question having 10 marks weight age from CO1 or CO2 or CO3			10			01
Total		60	80	10	05	01

Course Code : A-403	Course Title: Automobile Chassis and Body Engineering No. Of Periods : 60
Course Objectives	Upon completion of the course the student shall be able to 1. Familiarise with the knowledge of automobile chassis and its components. 2. Understand steering, braking and suspension system. 3. Understand the various aspects of vehicle body and its structures.

CO No.		Course Outcome
C01	**A-403.1**	Discuss the working of different steering systems and its components used in automobiles.
C02	**A-403.2**	Discuss the working of braking systems and its components used in automobiles.
C03	**A-403.3**	Analyse the working of suspension systems and its components used in automobiles.
C04	**A-403.4**	Explain the various vehicle body parts and their construction.
C05	**A-403.5**	Explain working of air conditioning system of an automobile.

Learning Outcomes:

1.0 Steering System

1.1 State any four functions and requirements of the steering system.
1.2 Explain Steering Linkage for rigid axle suspension system.
1.3 Explain Steering linkage for independent suspension system.
1.4 Explain 1. Rack and Pinion, 2. Worm and Roller, 3. Worm and Sector and 4. Re-circulating ball type Steering gear box
1.5 Analyse Ackermann steering gear mechanism and Davis steering gear mechanism.
1.6 Explain Integral power steering system and linkage type power steering system.
1.7 Explain the reversible and irreversible steering, Under-steering, over-steering and Turning radius.
1.8 Analyse various Steering geometry – 1.camber, 2. King-pin inclination, 3. Caster, 4. Toe-in, 5. Toe-out, 6. Combined inclination and 7. Scrub radius.
1.9 Explain Wheel alignment and adjustment of Toe-in and Toe out.
1.10 Explain 1. Collapsible steering column 2. Cornering force and 3. Self rightening torque.

2.0 Braking System:

2.1 State two functions and requirements of brakes
2.2 Classify brakes of an automobile.
2.3 Calculate the stopping time and distance – braking efficiency.
2.4 Explain the braking systems viz., mechanical and Hydraulic brakes with sketches.
2.5 Draw and explain the constructional details of master cylinder, wheel cylinder and Tandem master cylinder.
2.6 Explain the fixed calliper and swinging calliper type of disc brakes.
2.7 Compare advantages and disadvantages of disc brakes over drum brakes.
2.8 List advantages and disadvantages of Hydraulic braking system.
2.9 Describe self-energizing brakes.
2.10 Explain 1. Vacuum servo assisted brakes 2. Air brakes 3. Hand brakes 4.Parking brakes. 5. Wear Indicators and 6. Automatic Brake adjustment

3.0 Suspension system:

3.1 State the requirements and functions of a good suspension system.
3.2 Explain rigid axle front suspension system.
3.3 List types of independent suspension system.
3.4 Explain McPherson and double wish bone type of independent suspension system.
3.5 List types of leaf springs.
3.6 Describe Leaf and coil springs.

3.7 Explain the construction of leaf spring.
3.8 Explain 1. Torsion bars, 2. Telescopic type hydraulic shock absorber, and 3. Stabilizer bar.

4.0 Automobile Chassis and Body:

4.1 List types of chassis according to the fitting of engine and its main components.
4.2 Explain functions of the frames.
4.3 Describe car and truck frames.
4.4 Explain constructional features of chassis frames.
4.5 List loads acting on the frame.
4.6 Explain the requirement of vehicle body.
4.7 Explain the types of Automobile body of Trucks, cars and buses
4.8 Describe the requirements of a vehicle body.
4.9 Describe the various loads acting on body.
4.10 List materials commonly used for vehicle body

5.0 Body design and Construction

5.1 Explain the major dimensions of vehicle body.
5.2 Describe streamlining and aerodynamics of vehicle body.
5.3 Describe body components.
5.4 Describe interior finish of automobile body.
5.7 Describe power windows and Central locking system.
5.8 Describe body exterior finishing techniques.
5.9 Explain company painting method.

6.0 Air Conditioning System

6.1 Define Refrigeration and air conditioning.
6.2 Express unit of refrigeration in terms of ton of refrigeration.
6.3 Define coefficient of performance.
6.4 Identify commonly used refrigerants.
6.5 Explain Air conditioning as applicable to human comfort.
6.6 Define the terms 1. Humidity, 2. Relative humidity, 3.Due point, 4. DBT, 5. WBT, 6. Absolute humidity ratio, 7. Sensible heat and 8. Latent heat.
6.7 Explain the functions of various equipment such as 1. Fans, 2. Supply ducts, 3. Outlets,
4. Return ducts, 5. Filters and 6. Dust collectors.
6.8 Explain the necessity of Automobile Air-conditioning.
6.9 Locate the different components of Air conditioner in a car.
6.10 Explain the working of 1.Air conditioning system of Automobile 2. Automatic temperature control and 3. Compressor clutch.

COURSE CONTENTS:

1.0 Steering System:

Requirements and functions of the vehicle steering system – Steering gear layout for rigid axle and independent suspension system -Types of steering gears- rack and pinion, Worm and Roller, worm and sector and recalculating ball and nut– Steering gear mechanism - Ackermann & Davis steering gear - Power steering -Integral power steering and linkage type power steering – Reversible and irreversible steering, under steering and over steering-steering gear ratio-Turning radius- Steering geometry – camber, king-pin inclination, caster, Toe-in, Toe-out, combined inclination and scrub radius-Collapsible steering column – cornering force - self rightening torque, adjustment of Toe-in and Toe-out

2.0 Braking System:

Functions and requirements of automobile brakes -types of brakes- stopping time – stopping distance –braking efficiency – Mechanical and Hydraulic brakes – Layout of hydraulic braking systems – constructional details of internal shoe brakes (drum brakes) -master cylinder, wheel cylinder and Tandem master cylinder -self energizing brakes - Disc brakes – Types of disc brakes - advantages and limitations of hydraulic over mechanical brakes, advantages of disc brakes over drum brakes – power assisted brakes – vacuum servo assisted brakes – airbrakes – Hand brakes / parking brakes-Wear Indicators and Automatic Brake adjustment.

3.0 Suspension System:

Objectives of the suspension system – requirements and functions of a good suspension system – types of suspension system –rigid axle front suspension system and independent suspension system – Types of independent suspension system - types of springs –leaf spring and it types - coil springs – Torsion bar - Independent suspension types- McPherson strut and double wishbone type - Need of shock absorbers – construction and working of telescopic type shock absorber – stabilizer bar

4.0 Automobile Chassis and body:

Chassis frame –layout of the chassis and its main components-functions of the frame –types of chassis frames –brief description of their constructional features –various loads acting on the frame - Requirements of body - Types of body-Various car body types-truck body types – bus body types - framed construction, unitized construction-merits and demerits of unitized
Construction - Various loads acting body – materials used for body.

5.0 Body design and construction:

Major external dimensions of body – overall width, height, length, wheel track wheelbase and overhangs. major internal dimensions – like head room, leg room etc. body components – doors– types - windows- window regulating mechanism - seats – types of seats-seat adjustment mechanism -Other body components like, hood, boot lid, roof , firewall, spoilers, pillars etc. - Power

windows-Fabrication of body components- Interior finish – trimming, upholstery -Exterior – body painting –types –company painting method - central locking system.

6.0 Air Conditioning System

Introduction – Definition of refrigeration – unit of refrigeration – coefficient of performance – methods of refrigeration - Comfort Air conditioning – definition of terms human comfort, humidity, relative humidity, humidity ratio, DBT, WBT, sensible heat, latent heat. Fans - supply ducts – outlets – return ducts – filters and dust collectors –heating bar – cooling coils - Necessity – location of air conditioning components in a car – Automotive heaters –air conditioning system of automobile - Compressor clutch.

Reference Books:

1. The motor vehicle - Newton steeds. &Garret – KENNATH NEWTON
2. Automobile engineering - G.B.S.Narang – Khanna Publishers
3. Automobile engineering - Sethi.- Mc Graw Hill Education
4. Automotive Mechanics - William crouse. – Mc Graw Hill Education.

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A-403, Automobile Chassis and Body Engineering

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks wise Distribution of Weightage				Question wise Distribution of Weightage			
				R	U	Ap	An	R	U	Ap	An
1	Steering system	12	14	3	3	8	0	1	1	1	0
2	Braking system	10	14	3	3	8	0	1	1	1	0
3	Suspension system	10	11	3		8	0	1		1	0
4	Automobile chassis and body	10	11	3		8	0	1		1	0
5	Body design and construction	10	11	3		8	0	1		1	0
6	Introduction To Air Conditioning System	8	9	3	6	0	0	1	2	0	0
Part – C Question having 10 marks weightage from CO1 or CO2 or CO3			10				10				1
Total:		60	80	18	12	40	10	6	4	5	1

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.8
Unit Test – II	From 4.1 to 6.10

AUTOMOBILE SERVICING AND MAINTANANCE

Course Title	Course Code	Periods/Week	Periods/Semester
AUTOMOBILE SERVICING AND MAINTENANCE	A-404	04	60

TIME SCHEDULE

Sl. No	Major Topic	Periods Allocated	Weightage Of Marks	Part – A Short Type (3 marks)	Part – B Essay Type (8 Marks)	Part – C Essay Type (10 Marks)
1.	Introduction	04	06	2	0	
2.	Servicing Equipment	10	11	1	1	
3.	General Procedure for Servicing and Maintenance	12	14	2	1	
4.	Servicing and Maintenance of Two and Four Wheeler	14	14	2	1	
5.	Automobile Reconditioning Equipment	14	14	2	1	
6.	Reconditioning of Diesel Fuel Injection System	6	11	1	1	
	Part-C Question having 10 marks weightage from		10			1
	Total	60	80	10	5	1

Course Code:A-404	**COURSE TITLE: AUTOMOBILE SERVICING AND MAINTENANCE**
COURSE OBJECTIVES	**Upon completion of the course the student shall be able to** 1. Appreciate the importance of servicing and maintenance and the equipment used for servicing 2. Understand the procedure for servicing and maintenance of two and four wheelers 3. Know the automobile reconditioning equipment and its operation

CO No.		Course Outcome
C01	**A-404.1**	Describe the importance of automobile servicing and maintenance
C02	**A-404.2**	Describe the servicing equipment and procedure for servicing and maintenance
C03	**A-404.3**	Assess servicing and maintenance of two wheelers
C04	**A-404.4**	Assess servicing and maintenance of four wheelers
C05	**A-404.5**	Recommend automobile reconditioning equipment

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

1.0 Introduction

1.1 Draw the layout of the garage and explain about the activities
1.2 Draw and explain layout of service station
1.3 State the need for specialist repair shop
1.4 Name the tools used in the service station and state their functions
1.5 State various factors to be considered while locating a service station.
1.6 Differentiate between garage, service station and specialist service station

2.0 Servicing Equipment

2.1 Explain working of car washing equipment.
2.2 Explain working of vehicle hoist.
2.3 Explain working of Air Compressor and its applications
2.4 List different types of lubrication equipment and their function
2.5 Explain working of High-pressure lubrication equipment

3.0 General Procedure for Servicing and Maintenance

3.1 State the necessity and general procedure of servicing and maintenance of motor vehicle**.**
3.2 Enumerate the types of maintenance.
3.3 Explain periodic maintenance.
3.4 State preventive maintenance and its importance.
3.5 Enumerate the braked down maintenance and its necessity.
3.6 Explain operation maintenance and its purpose.
3.7 State servicing and its necessity.
3.8 Explain the cleaning procedure of motor vehicle components.
3.9 State the procedure of motor vehicle lubrication (greasing).
3.10 Explain the Method of lubrication of springs and Engine tune up.

4.0 Servicing and maintenance of two and four wheelers

4.1 Estimate general maintenance like periodic check-up and troubleshooting of motorcycle
4.2 Predict trouble shooting of 1. Cooling, 2. Lubrication, 3. Fuel & 4. Ignition system.
4.3 Assess trouble shooting of 1. Clutch, 2. Gearbox and 3. Differential.

5.0 Automobile reconditioning equipment

5.1 Explain working of degreasing plant.
5.2 Examine decarburizing methods
5.3 Explain the procedure of reboring and line boring.
5.4 Examine the necessity of valve seat cutting and grinding.
5.5 Judge the correct valve seating position and extent of grinding.
5.6 Assess the necessity of valve refacing.
5.7 Explain the procedure of valve lapping
5.8 Discuss servicing of valves.
5.9 Explain the procedure of crankshaft grinding & connecting rod reconditioning.
5.10 Explain working of Brake drum Lathe & Brake shoe riveting machine

6.0 Reconditioning of Diesel Fuel injection system

6.1 Examine Fuel injection pump Test Bench.
6.2 Discuss Phasing and Calibration of F.I.P.
6.3 Narrate various servicing and testing procedures of fuel injectors.
6.4 Assess Trouble shooting of fuel injection system.

COURSE CONTENT

1.0 Introduction

Garage- Service Station – Specialist repair Shop – Tools and equipment for a garage and service station – factors to be considered while locating service station – layout of a typical garage and service station

2.0 Servicing Equipment

Car Washing Equipment - Vehicle Hoist -Air Compressor - Lubrication equipment – Grease guns – High pressure lubrication

3.0 General Procedure for Servicing and Maintenance of Motor Vehicles

Types of maintenance–Periodic maintenance–Preventive maintenance – breakdown maintenance – Operation maintenance – Servicing and its necessity – Cleaning of the motor vehicle components - Greasing of motor vehicle – Lubrication of springs - Engine tune-up

4.0 Servicing & Maintenance of Two and Four Wheelers

General maintenance - periodic check-up and the trouble shooting of motorcycle (a)Engine systems: Fuel system–General diagnosis and fault rectification in fuel system (Carburetted system and fuel injection system) - Lubrication system - Diagnosis and fault rectification in cooling system – Ignition system – Diagnosis and fault rectification of Battery Ignition – Magneto system and Electronic Ignition system(b)Transmission system: Diagnosis and fault rectification in clutch, gearbox, differential

5.0 Automobile Reconditioning Equipment

Degreasing plant – Procedure of degreasing – De-carbonizing methods – working of reconditioning equipment–cylinder reboring machine - honing machine - line boring machine - valve seat cutting and grinding machine - valve refacing machine - valve lapping - crank shaft grinding machine - brake

drum lathe - brake shoe riveting machine – connecting rod reconditioning

6.0 Reconditioning of Diesel Fuel Injection System

Fuel injection pump test bench-Phasing and Calibration of F.I.P. -Servicing and Testing of Fuel injector - Trouble shooting of fuel injection system.

REFERENCE BOOKS

1. Automobile Engineering : G.B.S. Narang.-Khanna Publishers
2. Automobile Engineering Vol I & II : Dr. Kirpal Singh – Standard
3. Manual on Depot Maintenance : A.P.S.R.T.C Manuals
4. The Modern Motor Engineer Vol Arthen Judge-Caxton Publishing

Blueprint of Question Paper

A-404, AUTOMOBILE SERVICING & MAINTENANCE

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks wise Distribution of Weightage				Question wise Distribution of Weightage			
				R	U	Ap	An	R	U	Ap	An
1	Introduction	04	06	3	3	0	0	1	1	0	0
2	Servicing Equipment	10	11	0	3	8	0	0	1	1	0
3	General Procedure for Servicing and Maintenance of Motor Vehicle	12	14	3	3	8	0	1	1	1	0
4	Servicing and Maintenance of Two and four-wheelers	14	14	3	3	8	0	1	1	1	0
5	Automobile reconditioning equipment	14	14	3	3	8	0	1	1	1	0
6	Reconditioning of diesel fuel injection System	06	11	0	3	8	0	0	1	1	0
Part – C Question having 10 marks weightage from CO3 or CO4 or CO5			10				10				1
	Total:	60	80	12	18	40	10	4	6	5	1

- **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 3.10
Unit Test – II	From 4.1 to 6.10

SPECIAL PURPOSE VEHICLES

Course Title	Course Code	Periods/Week	Periods /Semester
Special Purpose Vehicles	A-405	04	60

TIME SCHEDULE

Sl. No.	Major Topic	Periods Allocated	Weightage of marks	Part – A Short Type (3 marks)	Part – B Essay Type (8 marks)	Part – C Essay Type (10 marks)
1	Introduction	06	6	2	0	
2	Farm Tractors	14	18	2	1	
3	Special Features in Tractors	14	14	2	1	
4	Earth Moving Vehicles	14	18	2	1 ½	
5	Automotive Emission and Control Systems	12	14	2	1	
Part C Question having 10 marks weight age from CO3 or CO4			10			01
TOTAL		**60**	**80**	**10**	**5**	**01**

Course Code: A – 405	**Title: Special Purpose Vehicles**	**Total No. of Periods: 60**
Course Objectives:	**Upon completion of the course the student shall be able to**	
	1.0 Know the types of special purpose vehicles and their use. 2.0 Understand the types of form tractors and special features in tractors 3.0 Know the working of earth moving vehicles and their applications 4.0 Understand the automobile emission and control strategies/ methods	

CO No.		Course Outcome
C01	**A-405.1**	List types of special purpose vehicles and tractors
C02	**A-405.2**	State the applications of special purpose vehicles and different types of tractors
C03	**A-405.3**	Discuss different systems tractors like PTO shaft, draw bar and hydraulic system
C04	**A-405.4**	Propose a suitable earth moving vehicle for given job.
C05	**A-405.5**	Explain automobile emission control methods/strategies

LEARNING OUTCOMES:

Upon completion of the course the student shall be able to

1.0 Introduction

1.1 State the meaning of Special Purpose Vehicle

1.2 List different types of Special Purpose Vehicles

1.3 State the applications of Special Purpose Vehicles

2.0 Farm Tractors

2.1 State the classification of tractors

2.2 Describe wheel type tractor

2.3 Describe the purposes of 1. Utility tractor, 2. Row crop tractor, 3. Orchard type tractor, 4. Industrial type tractor, 5. Garden tractor, 6. Rotary tiller, 7.Implement carrier, 8. Earth moving tractors.

2.4 List tractor manufacturing companies in India

2.5 Identify the elements in transmission system of a tractor

2.6 Explain the transmission system of tractors

2.7 Explain the differential assembly and describe the different types of Differential locks

2.8 Explain steering and braking system of tractors

3.0 Special Features in Tractors

3.1 Define P.T.O shaft

3.2 Compare the drive used for P.T.O. shafts

3.3 State safety precautions to be taken for various P.T.O shaft drives

3.4 Explain belt pulley drive and precautions to be taken while using belt pulley

3.5 Sketch the general layout of Hydraulic system of a tractor

3.6 Describe the lift mechanism in a tractor

3.7 Explain the trouble shooting of Hydraulic system of a tractor

3.8 Compare different types of Draw bars and hitches

3.9 Discuss the draft and depth control mechanisms

4.0 Earth Moving Vehicles

4.1 Explain the functions and specifications of different types of earth moving vehicles

4.2 Discuss the working and applications of Bulldozers

4.3 Describe the working and applications of Dumpers and tippers.

4.4 Describe the working and applications of Shovels

4.5 Discuss the working and applications of Excavators

4.6 Describe the working and applications of Graders

5.0 Automotive Emissions and Control system

5.1 List the sources of automotive pollutants

5.2 Explain the ill effects of pollutants

5.3 State the classification of S.I. Engine pollutants

5.4 Explain the control measures of automotive pollution
5.5 Describe the Exhaust Gas Recirculation (EGR) system
5.6 Describe the working of Catalytic Converter
5.7 Describe the ELCD and PCV method of automotive emission control
5.8 State the classification of C.I. Engine emissions
5.9 Explain the emission norms.

COURSE CONTENT

1. **Introduction**
   Special purpose vehicles – types – applications
2. **Farm Tractors**
   Classification of tractors – Wheel type and Track type – Types of drives – types of tractors – their purpose – Tractor manufacturing companies in India – Transmission system –Differential – Differential lock – types – Steering and braking system of tractors
3. **Special Features in Tractors**
   P.T.O. shaft – Types of drive for P.T.O. shafts – Belt pulley drive – Precautions to be taken while using belt pulley and P.T.O. shaft – General layout of hydraulic system of a tractor – Hydraulic Lift mechanism in a tractor – Trouble shooting of hydraulic system – Draw bar – Types (two point linkage & three point linkage) – Types of hitches - Draft and Depth control mechanism
4. **Earth Moving Vehicles**
   Types of Earthmovers – Dumpers – Bull Dozers – Shovels – Excavators – Tippers and graders – their working and applications
5. **Automotive emission and control**
   Sources of automotive pollutants – effects of pollutants on human and environment – S.I Engine emissions – CO, NO_X, HC – automotive emission Control measures – Exhaust Gas Recirculation (EGR) system – Catalytic Convertor – Evaporative Loss Control device (ELCD), Positive Crankcase Ventilation (PCV) – C.I Engine Emissions – particulate emissions – smoke – control measures – particulate traps – Emission norms – BS (Bharat) – Euro

REFERENCE BOOKS

1. Farm Machines & Equipments by C. P. Nakra – Dhanpat Rai Publishing Company
2. Automobile Engineering by K.K. Ramalingam -Scitech
3. Truck Cranes by A. Astakhov - (MIR)
4. Motor Graders by E. G. Ronioson - (MIR)
5. Construction equipment by Y. Pokras & Tushnyakov –(MIR)

Blueprint of Question Paper
A – 405, Special Purpose Vehicles

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks wise Distribution of Weightage				Question wise Distribution of Weightage			
				R	U	Ap	An	R	U	Ap	An
1	Introduction	06	6	3	3			1	1		
2	Farm Tractors	14	18	3	3	12		1	1	1 1/2	
3	Special Features in Tractors	14	14	3	3	8		1	1	1	
4	Earth Moving Vehicles	14	18	3	3	12		1	1	1 1/2	
5	Automotive Emission and Control Systems	12	14	3	3	8		1	1	1	
Part – C Question having 10 marks weightage from CO3 or CO4			10				10				1
Total		**60**	**80**	**15**	**15**	**40**	**10**	**5**	**5**	**5**	**1**

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	1.1 to 3.9
Unit Test – II	4.1 to 5.9

MOTOR TRANSPORT ORGANISATION

Course Title	Course Code	Periods/Week	Periods/ Semester
Motor Transport Organisation	A-406	04	60

TIME SCHEDULE

Sl. No.	Major Topic	Periods Allocated	Weightage of marks	Part – A Short Type (3 marks)	Part – B Essay Type (8 marks)	Part – C Essay Type (10 marks)
1.	Organisational structure	10	14	2	1	
2.	Operations	12	14	2	1	
3.	Bus and Crew Scheduling	08	11	1	1	
4.	Transport Economics	08	6	2	-	
5.	Traffic and Fares	10	11	1	1	
6.	Legal aspects of Motor Transport	12	14	2	1	
Part – C Question having 10 marks weightage from CO1 or CO4 or CO5			10	-	-	1
	Total:	**60**	**80**	**10**	**5**	**1**

Course Code : A-406	**Course Title : Motor Transport Organisation**	**No of Periods : 60**
Course Objectives	Upon completion of the course the student shall be able to 1. Understand the organisational structure and operations in a road transport corporation. 2. Comprehend the bus and crew scheduling, transport economics and fares in a road transport corporation. 3. Appreciate the legal aspects and loss assessment of motor transport.	

CO No.		Course Outcome
C01	**A-406.1**	Discuss organisational structure in a Motor transport organisation.
C02	**A-406.2**	Distinguish among various operations carried out in a Motor transport organisation.
C03	**A-406.3**	Explain Use of computer in bus and crew scheduling in a Motor

		transport organisation.
C04	**A-406.4**	Discuss transport economics in a Motor transport organisation and explain traffic and fares in a Motor transport organisation.
C05	**A-406.5**	Analyse the legal aspects and loss assessment of motor transport.

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

1.0 Organisational Structure

1.1 State the importance of Motor Transport organisation.
1.2 Classify the Motor Transport organisation.
1.3 Differentiate between passenger transport and goods transport, public transport and private transport.
1.4 Explain the different types of ownership of motor transport organisation.
1.5 Give the functional wings of a transport system.
1.6 State the need of training Programmes for various staff.

2.0 Operations

2.1 State the types of operation.
2.2 Distinguish city and moffussil operations.
2.3 State inter-city operations.
2.4 State the operating characteristics of a vehicle.
2.5 State the factors such as 1. Utility, 2. Capacity, 3. Dependability, 4. Safety, 5.Distance, 6. Flexibility, 7. Speed, 8. Road condition, 8. Fuel economy, 9. Traffic interference.
2.6 Explain the term trip generation and factors to be considered for trip generation.
2.7 Explain about traffic data – published data.
2.8 Explain the terms 1. Duty roasters, 2. Trip sheet, way bill and log book.

3.0 Bus and Crew Scheduling

3.1 State the factors to be considered in bus scheduling.
3.2 Calculate number of buses required and vehicle utilisation.
3.3 State the factors to be considered in crew scheduling..
3.4 Use of computers in scheduling.

4.0 Transport Economics

4.1 Discuss different types of costs involved in a transport organisation.
4.2 Explain the components of vehicle operational cost.
4.3 Compute the total cost for specific type of operation.

5.0 Traffic and Fares

5.1 Explain traffic investigation.
5.2 Explain peak hour demand.
5.3 Explain types of services.
5.4 State fare and fare structure.
5.5 State the requirement of good fare system
5.6 Explain different fares for hilly areas.
5.7 State different fare methods.

5.8 Explain 1. Straight line method, 2. Taper scale method, 3. Flat fare method, 4. Concessional Fare and 5. Luggage fare.
5.9 State the types of ticketing system
5.10 Explain hand written ticket, card ticket, pre-printed denomination ticket, Advance booking and reservation voucher and ticketing machine.

6.0 Legal aspect of Motor Transport

6.1 Explain traffic signs and signals.
6.2 Explain registration procedure for the vehicle.
6.3 Explain the necessity of permit and meaning of fitness certificate.
6.4 Explain the procedure for obtaining driving license and conductor license.
6.5 Explain insurance coverage and types of insurance coverage.
6.6 Explain the motor claim settlement procedure.

COURSE CONTENT

1. Organisational Structure

Importance of motor transport in present day transport system – types of motor transport – Passenger transport and Goods transport – public transport and private transport – Types of ownership – state, municipality , public and private undertaking, functional wings of motor transport - administrative, traffic, secretarial and engineering function, Training Programmes for management, supervisors, workshop staff , drivers and conductors.

2. Operations

Types of operations – city operation – moffussil operation – inter-city (short distance and long distance) operation-operating characteristics – utility – capacity , Dependability – safety, distance, speed – road condition- fuel economy, Traffic interference, flexibility – Trip generation- factors to be considered in trip generation – traffic data – published data – duty roasters –Trip sheet – way bill – log book.

3. Bus and Crew Scheduling

Basic factors to be considered in bus scheduling – Traffic demand, running time, Stand time, maintenance time-no. of busses required – vehicle utilization - Basic factors to be considered in crew scheduling – hours of work – Daily and weekly intervals of rest – spread over, spell of duty, overtime allowance – handing over and taking over time –use of computer in scheduling.

4. Transport Economics

Costs – Capital costs – Maintenance costs- miscellaneous costs – components of vehicle operational costs – fuel, lubricants, tyres, license- operational staff –vehicle taxes – depreciation –total cost for specific type of operation.

5. Traffic and Fares.

Elementary treatment of traffic investigation to improve services – peak hour demand –types of services – fare and fare structure – requirements of good fare system – different fares for hilly areas – Fare methods – Straight line method, taper scale method, flat rate, concessional fare, luggage fare – ticketing system types – hand written ticket, card ticket, pre-printed denomination ticket, advance and reservation booking ticket – ticket machine.

6. Legal aspects of Motor Transport

Traffic signs and signals – procedure for registering of a vehicle- necessity of permits –fitness certificate – procedure for issue of driving license and conductor license – Motor insurance – basic principle – scope and coverage of different policies – claim settlements.

Reference Books

1. Motor vehicle act of state and central Govt.
2. Traffic Engineering and Transport Planning- L.R. Kadiyali Khanna
3. Motor vehicle workshop ORGANISATION and administration - Bernard Chandler Oxford
4. Bus Operation and Bus Crew Scheduling - CIRT. (Pune)
5. An introduction to Transport Engineering - Wilton W Hey W W.
6. Elements of Transport - R.J. Eatan CIRT. (Pune)

Blueprint of Question Paper
A-406, MOTOR TRANSPORT ORGANISATION

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks wise Distribution of Weightage				Question wise Distribution of Weightage			
				R	U	Ap	An	R	U	Ap	An
1	Organisational structure	10	14	3	3	8	0	1	1	1	0
2	Operations	12	14	3	3	8	0	1	1	1	0
3	Bus and crew scheduling	8	11	0	3	8	0	0	1	1	0
4	Transport economics	8	06	3	3	0	0	1	1	0	0
5	Traffic and fares	10	11	3	0	8	0	1	0	1	0
6	Legal aspects of motor transport	12	14	3	3	8	0	1	1	1	0
Part – C Question having 10 marks weightage from CO1 or CO4 or CO5			10	-	-	-	10	-	-	-	1
Total:		**60**	**80**	**15**	**15**	**40**	**10**	**5**	**5**	**5**	**1**

- **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 3.4
Unit Test – II	From 4.1 to 6.6

AUTOMOBILE ENGINEERING DRAWING

Course Title	Course Code	Periods / Week	Periods / Semester
Automobile Engineering Drawing	A–407	06	90

TIME SCHEDULE

Sl. No	Major Topics	Periods	Weightage of marks	Part - A	Part - B	Total Marks	
1	Automobile Engine Components	24	15	2	1	10	10
2	Chassis and Transmission	24	15	2		10	
3	Cams and Cam profiles	12	10	0	1	10	
4	Automobile Parts assembly drawings	30	20	0	1	20	
	Total	**90**	**60**	**4**	**3**	**60**	

Course Code : A-407	Course Title : Automobile Engineering Drawing No. of Periods : 90
Course Objectives	Upon completion of the course the student shall be able to visualise and draw various views of the given automobile components.

CO No.		Course Outcome
C01	**A-407.1**	Apply the drawing methods to various automobile engine components
C02	**A-407.2**	Able to Visualise and draw various views of a chassis and transmission system components.
C03	**A-407.3**	Able to draw cam profile for a given follower motion.
C04	**A-407.4**	Acquire the knowledge and draw assembly of different engineering components.

Learning Outcomes:

1.0 Draw to scale various views like front view, side view, top view and Sectional Views of
Automobile Engine Components

1.1 Pistons for diesel and petrol.
1.2 Connecting rods for diesel and petrol engines.

1.3 Cylinder Head for 2 stroke petrol engine.
1.4 Crank shaft.
1.5 Cam shaft.
1.6 Valves.
1.7 Rocker Arms.
1.8 Spark plugs.

2.0 Draw to scale various views like front view, side view, top view and Sectional Views of Chassis and transmission components

2.1 Linkage Bracket
2.2 Chassis Bracket
2.3 Gear box selector fork
2.4 Engine Mount
2.5 Bell crank lever

3.0 Cams and followers

3.1 Draw types of cams.
3.2 Draw the cam profile for the following motion of the follower
(i) Uniform velocity
(ii) Uniform Acceleration and retardation
(iii) Simple harmonic motion.
3.3 Draw cam profiles in above three cases for a knife edge follower, roller follower and flat follower. (inline cams)

4.0 Draw the automobile parts of the assembly drawing.

4.1 Screw Jack
4.2 Master Cylinder
4.3 Wheel cylinder

COURSE CONTENT

1.0 Draw to scale various views like front view, side view, top view and Sectional Views of
Automobile Engine Components

1.1 Pistons for diesel and petrol.
1.2 Connecting rods for diesel and petrol engines.
1.3 Cylinder Head for 2 stroke petrol engine.
1.4 Crank shaft.
1.5 Cam shaft.
1.6Valves.
1.7 Rocker Arms.
1.8 Spark plugs.

2.0 Draw to scale various views like front view, side view, top view and Sectional Views of
Chassis and transmission components

2.1 Linkage Bracket
2.2 Chassis Bracket
2.3 Gear box selector fork
2.4 Engine Mount
2.5 Bell crank lever

3.0 Cams and followers

3.1 Draw types of cams.

3.2 Draw the cam profile for the following motion of the follower

(i) Uniform velocity

(ii) Uniform Acceleration and retardation

(iii) Simple harmonic motion.

3.3 Draw cam profiles in above three cases for a knife edge follower, roller follower and flat follower. (inline cams)

4.0 Draw the automobile parts of the assembly drawing.

4.1 Screw Jack

4.2 Master Cylinder

4.3 Wheel cylinder

REFERENCE BOOKS:

1. Automobile Engineering Drawing by R.B Guptha -Satya Prakash Publications
2. Machine Drawing by N.D Bhat –Charotar Publishing House Pvt Ltd.

Communication Skills

Course Code	Course Title	No. of Periods/Week	Total No. of Periods	Marks for FA	Marks for SA
A-408	Communication Skills	3	45	40	60

S. No.	Unit Title	No of Periods	COs Mapped
1	**Listening Skills**	6	CO1
2	**Introducing Oneself**	3	CO1, CO2, CO3
3	**Short Presentation (JAM)**	6	CO1, CO2, CO3
4	**Group Discussion**	6	CO1, CO2, CO3
5	**Preparing Resume with Cover Letter**	3	CO3
6	**Interview Skills**	9	CO1, CO2, CO3
7	**Presentation Skills**	9	CO1, CO2
8	**Work place Etiquette**	3	CO1, CO2
Total Periods		**45**	

Course Objectives	To comprehend the features of communication needed for professional success and display the use of these competently
	To present ideas, opinions in group discussions and presentations on topics of general and technical interest
	To prepare for job selection processes

CO No.	Course Outcomes
CO1	Interacts in academic and social situations by comprehending what is listened to when others speak.
CO2	Demonstrates effective English communication skills while presenting ideas, opinions in group discussions and presentations on topics of general and technical interest.
CO3	Exhibits workplace etiquette relevant in classroom situations for easy adaptation in professional setting in the future.

Mapping Course Outcomes with Program Outcomes:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1					✓	✓	✓
CO 2					✓	✓	✓
CO3					✓	✓	✓

Blue Print for evaluation based on Course Outcomes for SA:

Note: Every Question based on CO has to be given marks for the following parameters of communication in the rubric.

- Fluency and Coherence
- Lexical Resource (Vocabulary)
- Grammatical Range and Accuracy

***Rubric Descriptors 'Good/ Competent / Fair /Poor' for Communication**

LEVEL OF COMPETENCE	Fluency and Coherence	Lexical Resource (Vocabulary)	Grammatical Range and Accuracy
GOOD (9-10*)	Speaks at length without noticeable effort or loss of coherence. May demonstrate language-related hesitation at times, or some repetition and/or self-correction.	Uses vocabulary resources flexibly during discussion. Uses paraphrase effectively.	Uses a range of complex structures with some flexibility.
	Uses a range of connectives and discourse markers with some flexibility. **Articulates and adapts to near naturalization.**	Uses some less common vocabulary and shows some awareness of style and collocation	Mostly produces error-free sentences.
COMPETENT (6-8)	Is willing to speak at length, though may lose coherence at times due to occasional repetition, self-correction or hesitation.	Has enough vocabulary to discuss topics and make meaning clear in spite of inappropriacies.	Uses a mix of simple and complex structures, but with limited flexibility.
	Uses a range of connectives and discourse markers but not always appropriately.	Generally paraphrases successfully	May make mistakes with complex structures though these rarely cause comprehension

			problems.
FAIR (3-5)	Tries to maintain a flow of speech but t uses repetition, self correction and/or slow speech to keep going.	Manages to talk about familiar and unfamiliar topics but uses vocabulary with limited flexibility.	Produces only basic sentence forms, however, errors persist.
	Produces simple speech fluently, but more complex communication causes fluency problems.	Attempts to use paraphrase but with mixed success.	Uses a limited range of more complex structures, but these usually contain errors and may cause some comprehension problems
POOR (0 *-2)	Speaks with long pauses. Pauses lengthy before most words. **Merely imitates**	Uses simple vocabulary to convey personal information	Attempts basic sentence forms but with limited success, or relies on apparently memorized utterances
	Has limited ability to link simple sentences	Has insufficient vocabulary for less familiar topics	Makes numerous errors except in memorized expressions
	Gives only simple responses and is frequently unable to convey basic message	Only produces isolated words or memorized utterances	Struggles to produce basic sentence forms

s*10 marks to be awarded only if competence level shows flawless expertise in English.

***0 marks to be awarded when student shows incoherence and gives irrelevant responses.**

Blue Print for evaluation based on Course Outcomes for SA of each student:
Note: Marks are awarded for each student as per the Rubric descriptors.

S. No.	Questions based on Course Outcomes	Periods Allocated for practical work	Marks Wise Distribution of Weightage	Marks allotment for each Student in the Rubric*				Mapping of COs
				Poor 0-2	Fair 3-5	Competent 6-8	Good 9-10	
1	Describe the given object in a minute	6	10					CO 2
2	Exchange ideas/ views in a group discussion on _____ issue (academic, technical or social)	6	10					CO1, CO 2
3	Present your ideas /opinions on the given issue/ topic (individual to an audience)	9	10					CO1, CO2, CO 3
4	Role play an imaginary work-place situation	6	10					CO1, CO2, CO 3
5	Individual interaction with the Examiner duly submitting Resume (Facing the Interview) – Introducing oneself and answering questions	12	10					CO1, CO2, CO 3
6	*Listen to and comprehend any audio communication/ content	6	10					CO1, CO2, CO 3
TOTAL		**45**	**60**					

***Listen to and comprehend the given audio content**: Giving the Students time to read the questions (Fill in the Blanks, Select from Alternatives, True or False, Table fill, etc.) in chunks before listening to audio inputs also played in chunks.

Blue Print for evaluation based on Course Outcomes for Formative Assessment:

Note: Every Question based on CO has to be given marks for the following parameters in the rubric.

- Fluency and Coherence
- Lexical Resource
- Grammatical Range and Accuracy

S. No.	Questions based on Course Outcomes	Periods Allocated for practical work	Marks Wise Distribution of Weightage	Marks allotment for each Student in the Rubric*				Mapping of COs
				Poor 0-2	Fair 3-5	Competent 6-8	Good 9-10	
Formative Assessment – 1								
1	Describe the given object in a minute	3	10					CO 2
2	Exchange ideas/ views in a group discussion on _____ issue (academic, technical or social)	6	10					CO1, CO 2
3	Present your ideas /opinions on the given issue/ topic (individual to an audience)	6	10					CO1, CO2, CO 3
4	*Listen to and comprehend any audio communication/ content	3	10					CO1, CO2, CO 3
Total		**18**	**40**					
Formative Assessment -2								
1	Present your ideas /opinions on the given issue/ topic	3	10					

	(individual to an audience)							
2	Role play an imaginary work-place situation	6	10					CO1, CO2, CO 3
3	Individual interaction with the Examiner duly submitting Resume (Facing the Interview) – Introducing oneself and answering questions	15	10					CO1, CO2, CO 3
4	*Listen to and comprehend any audio communication/ content	3	10					CO1, CO2, CO 3
TOTAL		**27**	**40**					

Learning Outcomes

1. **Listening Skills:**
   - 1.1 Listen to audio content (dialogues, interactions, speeches, short presentations) and answer questions based on them
   - 1.2 Infer meanings of words / phrases / sentences / after listening to audio content as mentioned above
2. **Introducing Oneself:**
   - 2.1 Prepare a grid different aspects for presentation about a person / oneself
   - 2.2 Present a 1 or 2 minute introduction of oneself for an audience
3. **Short Presentation:**
   - 3.1 Define an object
   - 3.2 Describe an object, phenomenon, event, people
   - 3.3 Speak on a topic randomly chosen
4. **Group Discussion:**
   - 4.1 Practice Group Discussion. Techniques
   - 4.2 Participate in group discussions
5. **Resume Writing and Cover Letter:**
   - 5.1 Prepare resumes of different sorts – one's own and others.
   - 5.2 Write an effective cover letter that goes with a resume
6. **Interview Skills:**

6.1 Prepare a good Curriculum Vitae

6.2 Exhibit acceptable (Greeting, Thanking, Answering questions with confidence)

7. Presentation Skills:

7.1 Prepare Posters, Charts, PPT's on issue of general and technical interest

7.2 Present one's ideas before an audience with confidence using audio visual aids and answer questions that are raised.

8. Workplace Etiquette:

8.1 Show positive attitude & adaptability / appropriate body language to suit the work place

8.2 Display basic of etiquette like politeness, good manners.

AUTOMOBILE SERVICING AND MAINTENANCE LABORATORY

Course Title	Course Code	Periods / Week	Periods / Semester
Automobile Servicing and Re-conditioning Laboratory	A – 409	06	90

TIME SCHEDULE

SL.NO.	MAJOR TOPIC	PERIODS
1	Servicing and Maintenance of various systems of an Automobile	45
2	Re-conditioning:	45
3	Demonstration of driving skills ***(One batch will go for Four Wheeler driving practice and another batch will do the experiment)***	
	TOTAL	90

Course Code: A – 409 **COURSE: AUTOMOBILE SERVICING AND RE-CONDITIONING LABORATORY**	
COURSE OBJECTIVES	**Upon completion of the course the student shall able to** 1. Understand servicing and maintenance of various systems of an automobile 2. Know the procedure of reconditioning of various vehicle 3. Know the procedure of washing of a vehicle

CO No.		Course Outcome
C01	**A-409.1**	Perform the servicing of a give engine and Troubleshoot and rectify the problems in fuel supply system, braking system, suspension system, steering system, cooling and lubrication system of an engine
C02	**A-409.2**	Perform the greasing of rear axle hubs and decarbonising operation to a given engine
C03	**A-409.3**	Perform cylinder reboring, cylinder honing, valve refacing, valve seat cutting, grinding, lapping, line boring, crankshaft grinding, brake drum turning and brake shoe riveting on a given engine
C04	**A-409.4**	Perform phasing and calibration operation to a given fuel injection pump and perform the servicing and testing of Petrol and diesel fuel Injectors.
C05	**A-409.5**	Perform water washing of a given vehicle and Demonstrate driving skills on four wheeler vehicle

LIST OF EXPERIMENTS

Servicing and Maintenance of various systems of an Automobile:

1. Engine
2. Fuel system of Petrol engine
3. Fuel system of Diesel engine
4. Braking system
5. Suspension system
6. Steering system
7. Cooling system
8. Lubrication system
9. Rear axle hubs

Re-conditioning:

1. Decarburising
2. Cylinder Re-boring
3. Cylinder Honing.
4 Valve seat cutting, grinding, re-facing and lapping.
5. Line boring
6. Crank shaft grinding
7. Brake drum turning
8. Brake shoe riveting
9. Fuel injection pump testing - phasing and calibration
10. Fuel injector - servicing and testing both Petrol and Diesel
11. Water washing practice
12. Driving practice on Motor vehicle

Competencies and key competencies to be achieved by the student

Sl. No	Title of the Experiment	Key competencies expected	Competencies expected
1	Petrol Engine Servicing	**Engine Tuning:** • Adjustment of Carburettor • Adjustment of MPFI using computer assistance • Fuel consumption test • Fault finding and rectification of different troubles	• Understand and doing idling adjustment • Understand and doing the timing adjustment

2	Diesel Engine Servicing	**Engine Tuning:** • Adjustment of FIP and Governor • Adjustment of CRDI using computer assistance • Fuel consumption test • Fault finding and rectification of different troubles	• Understand and doing idling adjustment • Understand and doing the timing adjustment
3	Automobile steering systems	• Identify the tools and gauges required • dismantling& assembling • Fault finding and rectification of different troubles • Servicing & adjustments.	• Understand the construction and working • Understand the steering systems used in different types of vehicles • Understand the grades of oils used in automobile steering systems.
S.No.	**Name Of The Experiment**	**Key Competencies**	**Competencies**
4	Braking systems of automobiles	• Identify the tools and gauges required • dismantling and assembling • Fault finding and rectification of different troubles • Servicing & adjustments • Brake bleeding.	• Understand the construction and working of braking system • Understand the braking systems used in different types of vehicles • Understand the grades of oils used in automobile braking systems
5	Independent suspension systems of automobiles	• identify the tools and Gauges required • dismantling and assembling • Fault finding and rectification of different troubles • Servicing and adjustments	• Understand the construction and working • Understand the independent suspension systems • Used in different types of vehicles.
6	Rigid axle suspension system of automobiles	• Identify the tools and gauges required	• Understand the construction and working

		• dismantling and assembling • Fault finding and rectification of different troubles • Servicing & adjustments	• Understand the rigid axle suspension systems used in different types of vehicles.

S.No.	Name Of The Experiment	Key Competencies	Competencies
1	Decarburising	• Scrape Engine components with hand scraper	• State various decarbonising methods. • Identify suitable tools • Wet the components with kerosene / diesel • Scrape Engine components with hand scraper • Use hand scraper unidirectionally • Wipe the components with cotton cloth
2	Cylinder Re-boring	• Measure ovality and taper using dial bore gauge • Align the cylinder block with cylinder reboring machine. • Check roundness of cylinder .	• Identify the tools required for dismantling Engine. • Measure ovality and taper using dial bore gauge • Calculate depth of cut. • Align the cylinder block with cylinder reboring machine. • Select suitable speed , feed and depth of cut
3	Cylinder Honing	• Align the cylinder block with honing machine. • Obtain smooth and criss-cross hatch pattern.	• Identify the tools required. • Select the required hone. • Select suitable speed , feed and depth of cut • Align the cylinder block with honing machine. • Obtain smooth and criss-cross hatch pattern.
4	Valve seat cutting, grinding,	• Check the condition of valve face and seat.	• State different grades of emery paste.

	refacing and lapping	• Align valve with grinding wheel. • Check concentricity for valve face and seat.	• Check the condition of valve face and seat. • Apply lapping compound on valve seat and valve face. • Align valve with grinding wheel. • Check concentricity for valve face and seat.

S.No.	Name Of The Experiment	Key Competencies	Competencies
5	Line - boring	• Align Main journal with line boring machine. • Check for correctness of bearing journals.	• Measure diameter of journal using micrometre. • Align Main journal with line boring machine. • Select suitable speed , feed and depth of cut • Check for correctness of bearing journals.
6	Crank shaft grinding	• Align crank pin with grinding wheel. • Check roundness of crank pin	• Measure diameter of crank pin using micrometre • Calculate depth of cut. • Align crank pin with grinding wheel. • Select suitable speed , feed and depth of cut • Check correctness.
7	Brake drum turning	• Check ovality and taper. • Mount brake drum with suitable cones. • Check roundness of brake drum	• Identify tools required for removing brake drum. • Measure diameter of brake drum for ovality and taper • Calculate depth of cut. • Mount brake drum with suitable cones • Select suitable speed , feed and depth of cut
8	Brake shoe riveting	• Align new brake liner on brake shoe • Fix brake liner to brake shoe using rivets • Check the thickness of liner.	• Identify the tools required for removing lining from brake shoe &remove the old rivets • Align new brake liner on brake shoe

			• Fix brake liner to brake shoe using rivets
9	Fuel injection pump testing - phasing and calibration.	• Mount F.I.P. on test bench. • Adjust controls of test bench. • Compare fuel output with manufacturer specifications. • Check fuel injection timing	• State various specialized tools required. • Identify controls of F.I.P. test bench. • Mount F.I.P. on test bench. • Adjust controls of test bench. • Compare fuel output with manufacturer specifications. • Check fuel injection timing
S.No.	**Name Of The Experiment**	**Key Competencies**	**Competencies**
10	Fuel injector - servicing and testing (Petrol & Diesel)	• Check injector opening pressure, fuel leak-off and spray pattern.	• Identify components of injector testing equipment. • check injector opening pressure • Adjust the injector opening pressure as per manufacturers' specification. • Check for fuel leak-off and spray pattern.
11	Water washing practice	• Operate hydraulic hoist for lifting the vehicle.	• Identify the components of washing equipment. • Set suitable water pressure. • Clean with suitable liquid. • Blow high pressure air.
12	Driving practice on light motor vehicle	• Foot controls • Driving controls • Operate all controls simultaneously.	• Identify foot controls of a four wheeler. • State the purpose of foot controls. • Operate foot controls efficiently. • Operate steering controls. • Operate gear shift lever. • Identify various accessories. • Operate all controls simultaneously.

HYDRAULIC AND PNEUMATIC CONTROLS LABORATORY

Course Title	Course Code	Periods / Week	Periods / Semester
Hydraulic and Pneumatic Controls Laboratory	A – 410	03	45

TIME SCHEDULE

S.No	Experiment Name	Periods allocated
1	Venturimeter	12
2	Orifice meter	12
3	Identification of Oil Power Hydraulic controls.	09
4	Identification of Pneumatic Power controls.	12
Total		**45**

Course Title : HYDRAULIC AND PNEUMATIC CONTROLS LABORATORY	
Course Objectives	1.0 Determination of coefficient of discharge by using 1. Orifice meter 2. Venturi meter 2.0 Familiarise with the experimental setup for hydraulic and pneumatic actuators and motors 3.0 Familiarise with the experimental setup for hydraulic and pneumatic flow control valve, pressure control valve and direction control valve.

CO No.		Course Outcome
C01	**A-410.1**	Determination of coefficient of discharge by using 1. Orifice metre 2. Venturi metre
C02	**A-410.2**	Operate the experimental setup for the hydraulic and pneumatic actuators and take required observations
C03	**A-410.3**	Operate the experimental setup for the hydraulic and pneumatic motors and take required observations
C04	**A-410.4**	Operate the experimental setup for the hydraulic and pneumatic direction control valve and take required observations
C05	**A-410.5**	Operate the experimental setup for the hydraulic and pneumatic flow control valve and pressure control valve by taking required observations

Learning outcomes

1.0 Practice the determination of C_d of Venturimeter

1.1 State the practical applications of venturimeter.

1.2 Record the manometric head readings from U-tube manometer

1.3 Record the time taken for collecting discharge by varying the discharge

1.4 Calculate the areas of the pipe and throat of the given venturimeter

1.4 Calculate coefficient of discharge of venturimeter.

2.0 Practice the determination of C_d of Orificemeter

2.1 State the practical applications of Orificemeter.

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 Orificemeter

2.5 Calculate coefficient of discharge of Orificemeter.

3.0 Identification of Oil Power Hydraulic controls

3.1 Identify the principal components of oilpower hydraulic circuits.

3.2 Understand the principle of working of hydraulic actuator.

3.3 Understand the principle of working of hydraulic motor.

3.4 Understand the principle of working of direction control valve.

3.5 Understand the principle of working of flow control valve.

3.6 Understand the principle of working of pressure control valve.

4.0 Identification of Pneumatic Power controls

4.1 Identify the principal components of pneumatic power circuits.

4.2 Understand the principle of working of pneumatic actuator.

4.3 Understand the principle of working of pneumatic motor.

4.4 Understand the principle of working of direction control valve.

4.5 Understand the principle of working of flow control valve.

4.6 Understand the principle of working of pressure control valve.

COURSE CONTENT

1. Determination of Coefficient of discharge of Venturi meter.
2. Determination of Coefficient of discharge of Orifice meter
3. Hands on experience on oil power hydraulic trainer.
4. Hands on experience on pneumatic power trainer.

V SEMESTER

DIPLOMA IN AUTOMOBILE ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
V Semester

Subject Code	Name of the Subject	Instruction period / week		Total Periods	Scheme of Examination			
		Theory	Practical/Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
A-501	Industrial Management	5	-	75	3	20	80	100
A-502	Design of Machine Elements	5	-	75	3	20	80	100
A-503	Production Technology	5	-	75	3	20	80	100
A-504	Modern Trends in Automobile Engineering	5	-	75	3	20	80	100
A-505	Electric Vehicles	4	-	60	3	20	80	100
PRACTICALS:								
A-506	CAD Practice	-	6	90	3	40	60	100
A-507	IC Engine Testing and Vehicle Diagnosing Lab	-	6	90	3	40	60	100
A-508	Life Skills	-	3	45	3	40	60	100
A-509	Project Work	-	3	45	3	40	60	100
TOTAL		24	18	360+270	-	260	640	900

INDUSTRIAL MANAGEMENT

Subject Title	Subject Code	Periods/Week	Period/Semester
Industrial Management	A-501	5	75

TIME SCHEDULE

Sl. No.	Major Topic	Periods Allocated	Weightage of marks	Part – A Short Type (3 marks)	Part – B Essay Type (8 marks)	Part – C Essay Type (10 marks)
1.	Principles and functions of Industrial Management	10	6	2	-	
2.	Organisation structure & Organisational behaviour	16	14	2	1	
3.	Production Management	10	11	1	1	
4.	Materials Management, Maintenance management & Industrial Safety	16	14	2	1	
5	Entrepreneurship Development	12	14	2	1	
6	Trends in Management	11	11	1	1	
Part – C Question having 10 marks weightage from CO3 or CO5			10	-	-	1
	Total:	**75**	**80**	**10**	**5**	**1**

Course Code : A-501		Course Title : Industrial Management	No of Periods : 75
Course Objectives		Upon completion of the course the student shall be able to 1. Understand the principles and functions of industrial management, organisation structure and organisational behaviour. 2. Understand the production management, materials management, maintenance management and industrial safety. 3. Understand the entrepreneurship development and trends in management.	
CO No.		**Course Outcome**	
C01	**A-501.1**	Explain principles and functions of industrial management.	
C02	**A-501.2**	Explain organisation structure and organisational behaviour.	
C03	**A-501.3**	Solve problems on CPM and PERT techniques in production management.	
C04	**A-501.4**	Explain 1. Materials management, 2. Maintenance management and 3. Industrial safety.	
C05	**A-501.5**	Discuss 1. Entrepreneurship, 2. Demand and market survey 3. Feasibility study report and 4. Trends in management.	

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

1.0 Principles and functions of Industrial Management

1.1 Define industry, commerce (Trade) and business.
1.2 State the need for management.
1.3 Explain functions of Management.
1.4 Explain the principles of scientific management.
1.5 Differentiate between management and administration.
1.6 Explain the nature of management as a profession
1.7 Differentiate between supervisory, middle and Top level management
1.8 Explain the importance of managerial skills (1. Technical, 2. Human and 3. Conceptual)

2.0 Organisation Structure & organisational behaviour

2.1 Explain the philosophy and organisation structure of an industry.
2.2 Discuss the 1. Line, 2. Staff and 3. Functional organisations
2.3 List the differences between Delegation and decentralization
2.4 Describe the communication process
2.5 State motivational theories and Maslow's Hierarchy of needs.
2.6 List different leadership models.
2.7 Explain the process of 1. Recruitment, 2. Selection, 3. Training and 4. development

2.8 Explain types of business ownerships
2.9 State the objectives of Employee participation
2.10 Explain the meaning of corporate social responsibilities

3.0 Production management

3.1 State the factors of Plant Location
3.2 List the objectives of plant Layout
3.3 State the principles of plant Layouts
3.4 Explain the types of plant Layouts
3.5 State different types of production.
3.6 Explain the stages of Production, planning and control.
3.7 List the basic methods forecasting
3.8 Explain 1. Routing methods, 2. Scheduling methods and 3. Dispatching.
3.9 Explain Break Even Analysis and project scheduling.
3.10 Solve problems on CPM and PERT networks.

4.0 Materials Management, Maintenance management & Industrial Safety

4.1 Explain functions of materials management in Industry and an expression for inventory control.
4.2 Explain 1. ABC analysis 2. Safety stock and 3. reorder level
4.3 State an expression for economic ordering quantity and functions of Stores Management.
4.4 List out 1. Stores equipment, 2. Stores records and3. Purchase records.
4.5 Explain 1. types of store layouts 2. general purchasing procedures, 3. tendering, 3. E-tendering and 4. E-procurement procedures
4.6 Explain the 1. Bin card, 2. Cardex method and 3. applications of RFID
4.7 Explain maintenance management, preventive maintenance and scheduled maintenance in industry.
4.8 Differentiate between scheduled and preventive maintenance
4.9 Explain the importance of safety at Work place and important provisions related to safety.
4.10 Explain hazard and accident in the Industry and causes of accidents (direct and indirect causes of accidents).

5.0 Entrepreneurship Development.

5.1 Define the word entrepreneur.
5.2 Explain the requirements of an entrepreneur.
5.3 Explain the role of entrepreneurs in promoting Small Scale Industries.
5.4 Describe the details of self-employment schemes.
5.5 List the financial assistance programmes and organisations that help an entrepreneur
5.6 Explain the concept of 1. Make in India, 2. Zero defect and 3. Zero effect
5.7 State the importance for start-ups
5.8 Explain the demand surveys and market survey
5.9 Prepare feasibility study report.

6.0 Trends in Management:

6.1 Explain the concept of quality
6.2 List the quality systems and elements of quality systems.
6.3 State the principles of quality Assurance.
6.4 Explain 1. Management information system (MIS), 2. basic concepts of TQM and 3. Pillars of TQM.
6.5 List the evolution of ISO standards and beneficiaries of ISO 9000.
6.6 Explain 1. ISO standards, 2. ISO 9000 series of quality systems 3. Concepts of ISO 14000 and 4. overview of PDCA cycle
6.7 State the 1. principles of 5S for good housekeeping 2. Kaizen strategy 3. IoT 4. key features of IoT, 5. components of IoT and 6. advantages and disadvantages of IoT. 7. IoT Applications
6.8 Explain 1. Smart Energy, 2. Smart Transportation, 3. Mobility, 4. Smart Factory and 5. Smart Manufacturing

Course Content

1. **Principles and Functions of Industrial Management**
   Introduction: Industry, Commerce and Business; Definition of management; Functions of management - Principles of scientific management by F.W.Taylor, Principles of Management by Henry Fayol; Administration and management; levels of management; managerial skills;

2. **Organisation Structure and Organisational Behaviour**
   Organizing - Process of Organizing; Line, Staff and functional Organizations, Decentralization and Delegation, Communication, Motivational Theories; Leadership Models; Human resources development; recruitment selection training and development, Forms of Business ownerships: Types – Sole proprietorship, Partnership, Joint Stock Companies, Cooperative Organization; objectives of employee participation, Corporate Social responsibility;

3. **Production Management**
   Definition and importance; objectives and principles of plant layout, Plant location and types of layout; Types of production -job, batch and mass; production Planning and Control: basic methods of forecasting, routing, scheduling, dispatching and follow up; Break even analysis; Project scheduling; Application of CPM and PERT techniques; simple numerical problems;

4. **Materials Management, Maintenance Management & Industrial Safety**
   Materials in industry, Importance and functions of materials management, Basic inventory control model, ABC Analysis, Safety stock, re-order level, Economic ordering quantity, Stores Management: Stores layout, stores equipment, Stores records, purchasing procedures, tendering, e-tendering, e-procurement; purchase records, Bin card, Cardex, RFID Applications in materials

management, Objectives and importance of maintenance management, Different types of maintenance, Schedules of preventive maintenance, scheduled maintenance Advantages of preventive maintenance, Advantages of scheduled maintenance, Importance of Safety at work places; industrial hazards; Causes of accidents

5. Entrepreneurship Development.

Definition of Entrepreneur; Requirements of entrepreneur, Role of Entrepreneur; Entrepreneurial Development, Details of self-employment scheme, financial assistant programmes, organisations that help entrepreneurs (SSI, MSME, DIC, Banks) Concept of Make In India, ZERO defect, Zero Effect, Concept of Start-up Company, Demand survey and Market survey; Preparation of Feasibility study reports

6. Trends in Management:

Concept of quality, quality systems and its terms, principles of quality assurance, Introduction to Management Information System (MIS); Total Quality Management (TQM), ISO 9000 series , ISO-14000, Deming's PDCA Cycle (Plan, Do, Check and Action). 5S Principles, Kaizen Strategy (continuous improvement), Overview of IoT - Define IoT, key features of IoT, components of IoT : hardware, software, technology and protocols, advantages and disadvantages of IoT - IoT Applications - Smart Energy, Smart Transportation and Mobility, Smart Factory and Smart Manufacturing.

REFERENCE BOOKS

1. Industrial Engineering and Management O.P Khanna Dhanpat rai -2019
2. Production Management Buffa. Abe books
3. Engineering Economics and Management Science T.R. Banga & S.C. Sharma Khanna Publishers
4. Production and Operations Management S.N. Chary Tata McGraw Hill 5th Edition

Blueprint of Question Paper
A-501, INDUSTRIAL MANAGEMENT

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks wise Distribution of Weightage				Question wise Distribution of Weightage			
				R	U	Ap	An	R	U	Ap	An
1.	Principles and functions of Industrial Management	10	6	3	3	0	0	1	1	0	0
2.	Organisation structure & Organisational behaviour	16	14	3	3	8	0	1	1	1	0
3.	Production Management	10	11	0	3	8	0	0	1	1	0
4.	Materials Management, Maintenance management & Industrial Safety	16	14	3	3	8	0	1	1	1	0
5	Entrepreneurship Development	12	14	3	3	8	0	1	1	1	0
6	Trends in Management	11	11	0	3	8	0	0	1	1	0
Part – C Question having 10 marks weightage from CO3 or CO5			10	-	-	-	10	-	-	-	1
	Total:	75	80	12	18	40	10	4	6	5	1

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	1.1 to 3.10
Unit Test – II	4.1 to 6.8

DESIGN OF MACHINE ELEMENTS

Course Title	Course Code	Periods / Week	Periods / Semester
Design of Machine Elements	A-502	05	75

TIME SCHEDULE

Sl. No.	Major Topic	Periods Allocated	Weightage of marks	Part – A Short Type (3 marks)	Part – B Essay Type (8 marks)	Part – C Essay Type (10 marks)
1	Bolts and Nuts	8	6	2	0	
2	Shafts	15	14	2	1	
3	Keys and Couplings	12	11	1	1	
4	Balancing and Vibrations	8	6	2	0	
5	Governors and	14	14	2	1	
6	Design of Automobile Components	18	19	1	2	
Part C Question having 10 marks weightage from CO3 or CO5			10			01
TOTAL		**75**	**80**	**10**	**5**	**01**

Course Code: A – 502	**Title: Design of Machine Elements**	**Total No. of Periods: 75**
Course Objectives:	**Upon completion of the course the student shall be able to**	
	1. Know the functions of bolts, nuts, shafts, keys, couplings and automobile components 2. Understand the design of bolts, nuts, shafts, keys, couplings and automobile components 3. Understand the concept of balancing and vibrations 4. Solve problems on design of above components	

CO No.		Course Outcome
C01	**A-502.1**	Explain functions of 1. Bolts and nuts, 2. Shafts, 3. Keys and couplings
C02	**A-502.2**	Describe the concept of balancing and vibrations
C03	**A-502.3**	Design 1. Bolts, 2. Nuts, 3. Shafts, 4. Keys and couplings with given parameters.
C04	**A-502.4**	Design governors and flywheel with the given data.
C05	**A-502.5**	Design automobile components with given parameters.

LEARNING OUTCOMES:

Upon completion of the course the student shall be able to

1.0 Bolts and Nuts

1.1 List design factors considered while designing a machine component

1.2 Describe the terminology used in bolts and nuts – its proportions

1.3 State the effect of forces involved when the nut is tightened and the maximum load that a set of bolt and nut can take up before its failure

1.4 Calculate the dimensions of bolt and nut by using empirical formula

2.0 Shafts

2.1 Explain the concept of torsion and torque equation

2.2 State the assumptions made in pure torsion

2.3 Describe the functions of a shaft and various materials used in the manufacture of shaft with respect to its adaptability

2.4 Calculate the diameters of hollow and solid shafts

2.5 Calculate the diameters of hollow & solids shafts considering both strength & stiffness

3.0 Keys and Couplings

3.1 State the function of keys and splines with the help of neat sketches and material used for them

3.2 Explain the types of keys

3.3 Design rectangular sunk key considering its failure against shear and crushing using empirical proportions

3.4 Describe the proportions of a spline for various applications

3.5 State the function of a coupling

3.6 Calculate the proportions of muff coupling and flange coupling

3.7 Calculate the proportions of muff coupling, C.I. flange coupling considering the failure of the bolts against shear for a given torque by using the empirical formula

4.0 Balancing and Vibrations

4.1 State the types of balancing

4.2 Explain the balancing of masses

4.3 Solve problems on balancing of masses

4.3 Describe vibrations

4.4 Describe types of vibrations

5.0 Governors and Flywheel

5.1 State the types of Governors and their applications

5.2 Describe the working of Porter Governor

5.3 Solve problems on design of porter governor

5.4 State the purpose and applications of flywheel

5.5 Differentiate between the governor and flywheel.

5.6 Explain the turning moment diagram

5.7 Solve problems on design of flywheel

6.0 Design of Automobile components

6.1 Design of Engine Cylinder
6.2 Design of Piston
6.3 Design of Connecting Rod
6.4 Design of Crankshaft
6.5 Design of Engine Valve
6.6 Design of Clutch
6.7 Design of Brake
6.8 Design of Universal coupling

COURSE CONTENT

1. Bolts and Nuts

Definition of terms: pitch, lead, lead angle, thread angle, nominal diameter, crest , root, depth of thread etc, related to bolts and nuts – classification of bolts – loads acting on the bolts and the consequent failures – calculation of various dimensions of a bolt and nut for a given diameter using empirical proportions

2. Shafts

Theory of pure torsion – Torque (torsion) equation (No Derivation) – assumptions made in pure torsion - Function of shafts – materials used – Power transmitted by solid and hollow circular shafts – Design of solid and hollow shafts subjected to (i) shear stress and angle of twist and (ii) shear stress and bending stress

3. Keys and couplings

Functions of keys and splines - materials used - nature of failure of a key - Types of keys -saddle, flat round and sunk keys - Design of a rectangular sunk key – proportions of splines - Functions of coupling – classification of couplings – problems on design of muff coupling and flange coupling

4. Balancing and Vibrations

Necessity of balancing - types of balancing - balancing of single revolving mass – balancing of number of rotating masses – balancing of reciprocating masses – simple problems on balancing of masses – Vibrations – types of vibrations

5. Governors and Fly wheels

Function of Governor – types – applications - working of porter Governor - simple problems on design of Porter Governor - Function of Flywheel - types – purpose and applications - Comparison between governors and flywheels - turning moment diagram - design of flywheel –problems on design of flywheel

6. Design of Automobile Components

Design Engine Cylinder – Piston - Connecting Rod – Crankshaft - Engine Valve – Clutch – Brake - Universal coupling

REFERENCE BOOKS

1. Auto Design R.B Guptha 2016 Satya Prakash publications
2. Machine Design R.S Khurmi 2005 S. Chand publications

Blueprint of Question Paper
A – 502, Design of Machine Elements

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks wise Distribution of Weightage				Question wise Distribution of Weightage			
				R	U	Ap	An	R	U	Ap	An
1	Bolts and Nuts	8	6	3	3			1	1		
2	Shafts	15	14	3			11	1			2
3	Keys and Couplings	12	11	3			8	1			1
4	Balancing and Vibrations	8	6	3	3			1			1
5	Governors and Flywheels	14	14	3	3		8	1	1		1
6	Design of Automobile Components	18	19		3		16		1		2
Part – C Question having 10 marks weightage from any of the above chapters			10				10				1
Total		**75**	**80**	**15**	**12**		**53**	**5**	**3**		**8**

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	1.1 to 3.7
Unit Test – II	4.1 to 6.8

PRODUCTION TECHNOLOGY

Course Title	Course Code	Periods / Week	Periods / Semester
PRODUCTION TECHNOLOGY	A–503	5	75

TIME SCHEDULE

Sl. No.	Major Topic	Periods Allocated	Weightage of marks	Part – A Short Type (3 marks)	Part – B Essay Type (8	Part – C Essay Type (10
1.	Milling	9	11	1	1	
2.	Gear Making	08	06	2	0	
3.	Grinding	16	11	1	1	
4.	Surface Finishing Process	06	06	2	0	
5.	Jigs and Fixtures	08	08	0	1	
6.	Processing of Plastics	08	11	1	1	
7.	Modern Machining process	12	11	1	1	
8.	Flexible Manufacturing System and Robotics	08	06	2	0	
Part-C Question having 10 marks weightage from CO3 or CO5			10	-		1
	Total:	**75**	**80**	**10**	**5**	**1**

Course Cod: A–503 COURSE TITLE : PRODUCTION TECHNOLOGY No. of Periods : 75	
COURSE OBJECTIVES	**Upon completion of the course the student shall be able to** 1. Know the milling , gear making and grinding procedure 2. Understand surface finishing process, jigs and fixtures and processing of plastics 3. Appreciate modern machining process and flexible manufacturing process

CO No.		Course Outcome
C01	**A-503.1**	Describe 1. Milling machine, 2. Gear making and 3. Surface finishing process
C02	**A-503.2**	Explain jigs and fixtures
C03	**A-503.3**	Discuss various types of grinding machines
C04	**A-503.4**	Describe processing of plastics
C05	**A-503.5**	Discuss 1. Modern machining process, 2.Flexible manufacturing systems and 3. Robotics

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

1.0 Milling

1.1 Explain the working of milling machine
1.2 Describe milling machines
1.3 Explain the constructional details and functions of each part of milling machine
1.4 State the specifications of milling machine
1.5 Describe the milling operations
1.6 List indexing methods
1.7 Explain simple and direct indexing methods

2.0 Gear Making

2.1 State methods of gear making.
2.2 Describe gear shaping and gear hobbing.
2.3 Explain different gear finishing methods

3.0 Grinding

3.1 List types of abrasives
3.2 Describe the abrasive bonds and bonding process
3.3 Describe the designation /marking system of grinding wheel
3.4 State the factors for selection of grinding wheel
3.5 List methods of grinding
3.6 State the specifications and classification of grinding machines
3.7 Describe the construction and working of grinding machines

4.0 Surface Finishing Process

4.1 List different types of surface finishing process
4.2 Describe the principle of Electroplating with a sketch
4.3 Explain the principle of 1. Hot dipping processes, 2. Galvanizing, 3. Tin coating 4. Parkerizing and 5. Anodizing

5.0 Jigs and Fixtures

5.1 State the advantages of jigs and fixtures
5.2 Differentiate between jigs and fixtures
5.3 Describe different types of drill jigs
5.4 Describe welding and milling fixtures

6.0 Processing of Plastics

6.1 State the advantages and limitations of plastics as engineering materials
6.2 Differentiate between thermoplastics and thermosetting plastics
6.3 Describe the principle of making plastic products by 1. Compression moulding, 2. Transfer moulding, 3. Blow moulding and 4. Injection moulding
6.4 Explain the principle of extruding and calendaring

7.0 Modern Machining Process

7.1 Differentiate between conventional and non –conventional machining
7.2 State the relative advantages and limitations of non-conventional Machining
7.3 Explain the principle of USM with a neat sketch
7.4 Describe Electric Discharge Machining with a neat sketch
7.5 Explain the principle of open loop NC machine and closed loop NC Machine
7.6 State elements of NC machine and the advantages and limitations of

NC machining system over the Conventional machining system

7.7 Explain the NC system 1. Point to point positioning control system, 2. Straight cut positioning system and 3. Continuous path system

7.8 Explain the principle of computerized numerical control (CNC) machining

7.9 Differentiate between NC and CNC machines

7.10 Explain direct numerical control (DNC) system

8.0 Flexible Manufacturing System (FMS) and Robotics

8.1 Define FMS

8.2 Describe the major elements and features of FMS.

8.3 List components of FMS

8.4 State the advantages and limitations of FMS

8.5 State the concept of 'Robot'

8.6 Describe the basic elements common to all robots

8.7 State typical applications of Robots in Industry

8.8 List the advantages and applications of Robots in production and Manufacturing

COURSE CONTENT

1.0 Milling

Types of milling machines-plain, universal, vertical milling machines – constructional details – specifications - Milling operations – Indexing – direct and simple indexing

2.0 Gear Making

Methods of manufacture of Gears: Casting, moulding, stamping, coining, extruding, rolling - Gear shaping – description of Gear shaper – Gear hobbing –description of Gear hob – Gear finishing processes

3.0 Grinding

Types of Abrasives – natural &artificial - types of bonds for making grinding wheel – vitrified, silicate, Shellac, rubber, Bakelite - Factors effecting the selection of grinding wheel – kind of abrasives: Grain size, grade, strength, bond, structure of grain spacing-bond materials - Standard marking systems - letters and numbers – sequence of marking system, grades of letters. Classification of Grinding machines - constructional details and working principles of cylindrical, surface, tool & cutter and center-less grinding machines – advantages and limitations – balancing, dressing and truing of grinding wheels

4.0 Surface Finishing Process

Electroplating–basic principles – Plating metals – applications - Hot dipping: Galvanizing, Tin coating, Parkerizing and Anodizing - Metal spraying: Wire process –powder process - Types of Organic coatings: oil base paints, lacquer base points, varnish, enamels, bituminous paints and Rubber base coatings

5.0 Jigs and Fixtures

Advantages of using jigs and fixtures in mass production, Work location – types of locators and clamps - Drill jig - welding and milling fixtures

6.0 Processing of Plastics

Advantages and limitations of plastics over other engineering Materials - differences between thermoplastics and thermosetting plastics - Processing of plastics: (a) Compression moulding (b) Transfer moulding (c) Extruding (d) Blow moulding (e) Injection moulding (f) calendaring

7.0 Modern Machining Process

Introduction – differences between conventional/traditional machining and non-conventional or non-traditional or modern machining processes - Ultrasonic machining (USM): Principles, Description of equipment – applications – advantages and limitations - Electrical discharge machining (EDM): Principle, description of equipment, application – advantages and limitations - Chemical machining - Basic concepts of NC machines – comparison with operator controlled Machine - Types of NC system – open loop and closed loop - Classification of NC systems – Point to point positioning control system, straight cut positioning system, continuous path or contouring system - Programming for NC machines – absolute programming, incremental programming – Advantages and limitations of NC system over the conventional system - Basic concept of CNC and DNC systems.

8.0 Flexible Manufacturing System (FMS) and Robotics

Introduction, definition of FMS-Features of FMS–Advantages and limitations of FMS-

Concept of Robot – Basic elements: Manipulator, controller, end – effectors, sensors, energy source and their functions - Basic construction of Robot and types of Robots.

REFERENCE BOOKS

1. A Course on workshop Technology (Vol. II) – Raghuvamshi 2015 Dhanpath Rai & Co.
2. Elements of workshop Technology (vol. II)-HazraChowdhary 2010 MP Publishers
3. Production Technology -R. K. Jain and S. C. Gupta 2016 Khanna Publishers
4. Work shop Technology (Vol. III)-Chapman 2001 CBS publishers
5. Manufacturing Process -B. M. L. Begeman 1969 John Willy and Sons
6. Workshop Technology (Vol. II)-Gupta and Kaushisk
7. Production Technology -H.M.T. 2017 Mc Hill Publishers
8. Automation production system and-Michel P Groover 2016 Pearson Publishers
9. CAD / CAM – Michel P. Groover 2010 Pearson Publishers

Blueprint of Question Paper
A-503, PRODUCTION TECHNOLOGY

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks wise Distribution of Weightage				Question wise Distribution of Weightage			
				R	U	Ap	An	R	U	Ap	An
1	Milling	09	11	3	0	8	0	1	0	1	0
2	Gear Making	08	06	0	3	3	0	0	1	1	0
3	Grinding	16	11	3	0	8	0	1	0	1	0
4	Surface Finishing Process	06	06	3	3	0	0	1	1	0	0
5	Jigs and fixtures	08	08	0	0	8	0	0	0	1	0
6	Processing of Plastics	08	11	3	0	8	0	1	0	1	0
7	Modern machining process	12	11	3	0	8	0	1	0	1	0
8	Flexible manufacturing system & Robotics	08	06	3	3	0	0	1	1	0	0
Part – C Question having 10 marks weightage from CO3 and CO5			10				10				1
Total:		75	80	18	9	43	10	6	3	6	1

- **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 4.3
Unit Test – II	From 5.1 to 8.8

MODERN TRENDS IN AUTOMOBILE ENGINEERING

Subject Title	Subject Code	No of periods/week	Total periods /Semester
MODERN TRENDS IN AUTOMOBILE ENGINEERING	A-504	05	75

TIME SCHEDULE

Sl. No.	Major topic	Periods Allocated	Weightage of marks	Part – A Short Type (3 marks)	Part – B Essay Type (8 Marks)	Part – C Essay Type (10 Marks)
1	Alternate Fuels	10	9	03	00	
2	Automotive sensors and actuators	12	14	02	01	
3	I C Engine Air and Fuel	12	11	01	01	
4	Modern Transmission, Steering, Braking and	18	14	02	01	
5	Automotive Safety and Computer Control Systems	12	11	01	01	
6	Automobile Assembly Line and Testing	11	11	01	01	
Part – C Question having 10 marks weightage from CO2 or			10			01
	Total	75	80	10	5	01

Course Code: A-504	Title: Modern Trends in Automobile Engineering	Total No. Of Periods: 75
Course Objectives	Upon completion of the course the student shall be able to	
	1.0 Understand the concepts of alternate fuels used in Automobiles 2.0 Comprehend the modern technologies in Automobiles.	

CO No.		Course Outcome
C01	A-504.1	Explain the need to develop alternate fuels and their usage in Automobile
C02	A-504.2	Discuss sensors and actuators used in automotive vehicles.
C03	A-504.3	Discuss modern air and fuel flow systems used in IC engines.
C04	A-504.4	Discuss the modern technologies related to transmission, steering,

		braking, and suspension systems of automobiles.
C05	**A-504.5**	Explain the 1. Automobile Assembly Line, 2. Testing and 3. Safety aspects.

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

1.0 Alternate Fuels

1.1 Define a fuel and an alternative fuel.

1.2 State the necessity of alternate fuels and properties of alternate fuels.

1.3 List the types of alternate fuels that can be used for propulsion of automobile.

1.4 State the types of alternative energy sources.

1.5 List alcohols that can be used as fuel in automobiles

1.6 Explain the 1. Effects of Alcohol Fuels used directly in S.I engines and CI Engines, 2. Effects of blending of methanol or ethanol with gasoline and diesel and 3. Emission characteristics of these blends.

1.7 List advantages and Limitations of Alcohol blends as automobile fuels.

1.8 Define a Biodiesel and Gaseous fuel.

1.9 List 1. Advantages and Limitations of gaseous fuels as automobile fuels, 2. Types of Gaseous fuels and 3. Gaseous fuels used in an automobile.

1.10 Explain the modifications required in the fuel system of the SI Engine and CI engine to make use of gaseous fuels

2.0 Automotive Sensors and Actuators

2.1 State the functions of different sensors used in automobiles 1. Voltage generating sensors, 2. Resistive sensors 3. Switch sensors.

2.2 Explain the sensors used in automobiles 1. Catalyst and oxygen sensor, 2. Throttle Position sensor, 3. Mass Air flow (MAF) sensor, 4.Manifold Absolute Pressure (MAP) sensor, 5. Engine speed and piston position sensor, 6. Coolant temperature sensor, 7.Idle speed control sensor 8. Wheel speed sensor, 9.Yaw sensor,10. Crash sensor, 11.Steering wheel position sensor, 12.Knock sensor, 13.Cam shaft sensor.

2.3 Classify the Actuators

2.4 List four types of electrical actuators.

2.5 State the applications of electrical Actuators.

2.6 Explain Actuator Mechanism and operation

3.0 IC Engine Air and Fuel Systems

3.1 Explain the Method of Super Charging and Turbo Charging

3.2 Explain the working Principle of fixed Geometry Turbo Charger (FGT) and Variable Geometry Turbo Charger (VGT)

3.3 Explain the Principle of Turbo Stratified Injection System.

3.4 Explain the Principle of Turbo Charger with Inter cooling System and Waste gate Turbocharger

3.5 State the Modifications required for the Turbo Charged Engine.

3.6 Describe the working of fuel system to use CNG and LPG in Petrol and diesel engines with block diagram

3.7 Describe the basic components of electronically controlled unit (ECU)

3.8 Explain the working principle of 1. Multi point fuel Injection System (MPFI), 2. Direct Petrol Injection System, 3. Modern common Rail Diesel Injection System (CRDI) and 4. Electronic Unit Injection System (EUI)

3.9 List the advantages & disadvantages of MPFI System

3.10 Compare MPFI System with carburetted System

4.0 Modern Transmission, Steering, Braking and Suspension Systems

4.1 Explain the working of 1. Dual shift gear box, 2. Continuously variable transmission system and 3. Intelligent Manual Transmission.

4.2 Explain the working of ECU Controlled Power Assisted Steering.

4.3 Explain the working of Electronic Power Assisted Steering.

4.4 Explain the working of Four Wheel Steering.

4.5 Explain 1. Antilock Braking System (ABS), 2. Equal Braking Distribution System (EBD), 3. Traction Control System (TC), 4. Electronic Stability Control System (ESC) and 5. Multi-collision Braking System

4.6 Explain Hydrolastic suspension, Hydro gas suspension and Adaptive Suspension Systems.

4.7 Explain the working of a) solenoid valve actuated damper and b) Magnetorheological damper used in adaptive suspension system.

5.0 Automotive Safety and Computer Control Systems

5.1 State the types of safety systems in Automobiles.

5.2 Explain the Supplementary restraint systems (SRS) – Air bags- seat belt, Pre-tensionless

5.3 Explain the Pedestrian Safety system

5.4 Explain the Blind Spot collision warning system Lane following assist.

5.5 Explain the Automatic Cruise control system.

5.6 Explain Vehicle condition monitoring (VCM)

5.7 List the fault codes of control systems.

5.8 Explain about fault codes – Onboard Diagnostics.

5.9 Explain about 1. Computer Control Operation, 2. Input Sensors, and 3. Actuator Mechanism & Operation.

6.0 Automobile Assembly Line and Testing

6.1 Comprehend the Assembly line for two wheelers and four wheelers

6.2 List the applications of robots in assembly line

6.3 Explain the testing procedure of 1.Chassis Dynamometer, 2.Crash Test, 3.Rollover test

6.4 State about the Bio-fidelity Dummies.

COURSE CONTENT

1.0 Alternate Fuels

Definition of fuel, alternative fuel – necessity for developing alternative fuels– definition of renewable and non-renewable fuels – existing alternative fuels like Alcohols, vegetable oils, Bio diesel, LPG, CNG, LNG, Hydrogen, that can be used in automobiles – merits and demerits of these alternative fuels - types of alcohols – alcohols that can be used in automobiles – effects of using alcohols as fuel in SI and CI engines– Blending of methanol or ethanol with gasoline and diesel – emission characteristics of these blends – advantages and limitations of alcohol blends as automobile fuels -Definition of Bio diesel – Definition of Gaseous fuels – types of gaseous fuels – short listing of gaseous fuels used in automobiles - modifications required in the fuel system of the SI and CI engine to make use of gaseous fuels – working of fuel system to use CNG and LPG in Petrol and diesel engines with a block diagram – advantages and limitations of gaseous fuels as automobile fuels

2.0 Automotive Sensors and Actuators

Classification of sensors – Voltage generating sensors – resistive sensors – switch sensors-Catalyst and oxygen sensor- Throttle position sensor- Mass Air flow (MAF) sensor -Manifold Absolute Pressure (MAP) sensor -engine speed and piston position sensor-coolant temperature sensor- idle speed control – wheel speed sensor- yaw sensor – crash sensor – steering wheel position sensor – knock sensor – cam shaft sensor.

Classification of Actuators – Mechanical – Hydraulic – Pneumatic- Electric Actuators – Types-Viz., Solenoids, DC Motors, Stepper Motors, Piezo Actuators –Applications of Actuators. Explain Actuator Mechanism and operation

3.0 IC Engine Air and Fuel Systems

Super Charging method - Turbo Charger- Fixed Geometry Turbo (FGT) – Waste gate Turbocharger - Variable Geometry Turbocharger (VGT)- Turbo Stratified Injection (TSI) – TC with inter cooling systems- turbo charged engine modifications.

Introduction to Electronic Fuel injection system (EFI) - Electronically Controlled Unit (ECU) – Basic components of ECU - Multi point fuel Injection System (MPFI)- Advantages and comparison with Carburetor and MPFI System- Direct petrol Injection-Modern Common Rail Diesel Injection System(CRDI)- Electronic unit Injector(EUI)

4.0 Modern Transmission, Steering, Braking and Suspension Systems

Transmission

Dual shift gear box - Continuously variable transmission system - Intelligent Manual Transmission.

Steering

ECU Controlled Power assisted steering – Electric power assisted steering-four wheel steering

Brakes

Antilock Braking system (ABS)- Equal braking distribution system(EBD)- Traction control (TC)- Electronic stability control(ESC) –MCB (Multi Collision Braking)

Suspension: Hydro (lastic) Suspension- Hydro gas suspension – Hydro Pneumatic suspension – Adaptive Suspension System

5.0 Automotive Safety and Computer Control Systems

Active Safety – Passive Safety - Supplementary restraint systems (SRS) – Air bags- seat belt Pretensioners-Pedestrian Safety- Blind Spot collision warning-Lane following assist-Automatic Cruise control. Vehicle condition monitoring (VCM) - fault codes - Onboard Diagonostics - Computer Control Operation-Input Sensors - types– Actuators – types – Actuator Mechanism & Operation.

6.0 Automobile Assembly Line and Testing

Assembly line for two wheelers and four wheelers- Trim assembly, chassis line and final Assembly-application of robots in assembly

Testing –Chassis Dynamometer – Crash Test –Rollover test- Bio-fidelity Dummies.

Reference Books:

1. Trends in Automobile Engineering - A S Rangwala 2006 (New Age International Publishers)
2. A Practical Approach to Motor Vehicle Engineering and Maintenance – Allan Bonnick, Derek New bold 2005 (Routledge Publishers)
3. Automobile Engineering – Vol –I Engine System – Anil Chhikara 2017 (Satya Prakashan Publishers)
4. The automotive body manufacturing systems and processes – Mohammad A omar
5. Automobile Manufacturing process – P D Kulkarni
6. Euroncap website

Blueprint of Question Paper
A-504, Modern Trends in Automobile Engineering

Sl. No	Chapter Name	Periods Allocated	Weight age Allocated	Marks wise Distribution of Weight age				Question wise Distribution of Weight age			
				R	U	Ap	An	R	U	Ap	An
1	Alternate Fuels	12	9	3	3	3	0	1	1	1	0
2	Automotive sensors and actuators	12	14	3	3	8	0	1	1	1	0
3	I C Engine Air and Fuel Systems	12	11	3	0	8	0	1	0	1	0
4	Modern Transmission, Steering, Braking and Suspension Systems	16	14	3	3	8	0	1	1	1	0
5	Automotive Safety and Computer Control Systems	12	11	3	0	8	0	1	0	1	0
6	Automobile Assembly Line and Testing	11	11	3	0	8	0	1	0	1	0
Part – C Question having 10 marks weightage from CO2 or CO3 or CO4			10				10				1
Total:		**75**	**80**	**15**	**12**	**43**	**10**	**6**	**4**	**5**	**1**

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	1.1 to 3.10
Unit Test – II	4.1 to 6.4

ELECTRIC AND ELECTRIC HYBRID VEHICLES

Subject Title	Subject Code	Periods/Week	Periods per Semester
ELECTRIC AND ELECTRIC HYBRID VEHICLES	A-505	04	60

TIME SCHEDULE

Sl. No	Major topic	Periods Allocated	Weightage of marks	Part – A Short Type (3 marks)	Part – B Essay Type (8 Marks)	Part – C Essay Type (10 Marks)
1	Introduction to Electric and Electric hybrid vehicles	10	14	2	1	
2	Energy Storage	16	14	2	1	
3	Design of Drive train	12	14	2	1	
4	Electric Propulsion	12	14	2	1	
5	Regenerative Braking	10	14	2	1	
Part – C Question having 10 marks weightage from CO3 or CO4 or CO5			10	-	-	1
	Total	**60**	**80**	**10**	**5**	**1**

Course Code : A-505	**Course Name: Electric And Electric Hybrid Vehicles No. Of periods : 60**
Course Objectives	Upon completion of the course student shall be able to 1. Study the concepts and drive train configurations of Electric and Electric hybrid vehicles. 2. Comprehend Electric propulsions systems and energy storage devices. 3. Appreciate regenerative braking systems.

CO No.		Course Outcome
C01	**A-505.1**	Explain the concepts and configurations of Electric and Electric Hybrid Vehicles
C02	**A-505.2**	Explain the concepts and principles of Energy storage systems used for Electric and Electric Hybrid Vehicles
C03	**A-505.3**	Design hybrid electric drive trains used for Electric and Electric Hybrid Vehicles
C04	**A-**	Discuss the principle and working of electric propulsions used for

	505.4	Electric and Electric Hybrid Vehicles
C05	**A-505.5**	Discuss the principle and working of regenerative braking systems used for Electric and Electric Hybrid Vehicles

Learning Out comes: Upon completion of the course student shall be able to

1.0 Introduction to Electric and Electric Hybrid Vehicles

1.1 Describe the history of electric and electric hybrid vehicles.
1.2 Describe the Social and environmental importance of Electric and Electric Hybrid vehicles.
1.3 Explain basic components of Electric and Electric Hybrid vehicles.
1.4 Explain fuel cell vehicles.
1.5 Explain the principle of solar power vehicles.
1.6 List the advantages of Electric and Electric Hybrid vehicles.

2.0 Energy Storage

2.1 List the requirements of energy storage.
2.2 Explain the working principle of Nickel and Lithium based batteries.
2.3 List the types of fuel cells.
2.4 State the characteristics of fuel cells.
2.5 State the applications of fuel cells.
2.6 Explain principle and operation of proton exchange membrane and alkaline fuel cells.
2.7 Describe ultra-capacitors.
2.8 Explain basic principle of ultra-capacitor.
2.9 Explain Hybridisation of Energy storage and battery management and safety.
2.10 Explain selection of batteries and battery charging methods.

3.0 Design of Drive train

3.1 List out four hybrid electric drive trains.
3.2 Explain Series hybrid, parallel hybrid, series parallel and complex drive trains.
3.3 Explain torque coupling parallel and speed coupling parallel hybrid electric drive.
3.4 List out advantages of parallel hybrid drive train.
3.5 Describe control strategy of parallel hybrid drive train.
3.6 Describe plug in hybrid electric drive.
3.7 Describe transmission system used in EV/EHV.

4.0 Electric Propulsion

4.1 Explain the principle and operation of permanent magnet brushless dc motor drive.
4.2 Explain the principle and operation of switch reluctant motor drive.
4.3 Describe sizing and selection of motors.
4.4 Explain methods of control of motors.
4.5 Explain configuration of drives.

5.0 Regenerative Braking

5.1 Describe regenerative braking.
5.2 Explain the braking power and energy on front and rear wheels.

5.3 Describe energy consumption in regenerative braking.
5.4 Explain components of braking system of EV and EHV.
5.5 Explain optimal feel series brake.
5.6 Explain optimal energy recovery series brake.
5.7 Explain parallel braking system used in EV/EHV.
5.8 Explain ABS system used in EV/EHV.

Course Content:

1. **Introduction to Electric and Electric hybrid vehicles :**
   History of Electric and Electric Hybrid vehicles – Social and environmental importance – basic components of Electric and Electric Hybrid vehicles - Fuel cell vehicles – solar power vehicles
2. **Energy Storage:**
   Requirement of Energy storage – battery technologies – Nickel based (Nickel-iron, Nickel-cadmium, Nickel Metal hybrid) and lithium based (Lithium-polymer, Lithium-ion) batteries – types, characteristics and applications of fuel cells – principle and operation of fuel cells (proton exchange membrane and alkaline fuel cells)– ultra capacitors : basic principle of ultra capacitors - Hybridisation of energy storage – battery management – battery safety – monitoring cells – thermal management – selection of batteries - battery charging methods.
3. **Design of Drive train :**
   Hybrid Electric drive train – a) Series hybrid b) parallel hybrid c) series – parallel d) complex drive train – torque coupling parallel hybrid electric drive – speed coupling parallel hybrid electric drive - advantages of parallel hybrid drive train – control strategy of parallel hybrid drive train – plug in hybrid electric drive – transmission for EV/EHV.
4. **Electric Propulsion:**
   DC motor drives – permanent magnet brushless dc motor drive (principle and operation) – switch reluctant motor drive(SRM) – sizing and selection of motors – control of motor and configuration of drives.
5. **Regenerative Braking:**
   Energy consumption – braking power and energy on front and back wheels – braking system of EV and EHV – Optimal feel series brake – optimal energy recovery series brake – parallel brake – ABS for EV/EHV.

Reference books:

1. Vehicular Electric Power Systems – Mehrdad Ehsani, Yimin Gao CRC Press 2003
2. Electric and Hybrid Vehicles – I. Husain CRC Press 2003

Blueprint of Question Paper
A-505, ELECTRIC AND ELECTRIC HYBRID VEHICLES

Sl. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks wise Distribution of Weightage				Question wise Distribution of Weightage			
				R	U	Ap	An	R	U	Ap	An
1	Introduction to Electric and Electric hybrid vehicles	10	14	3	3	8	0	1	1	1	0
2	Energy Storage	16	14	3	3	8	0	1	1	1	0
3	Design of Drive train	12	14	3	3	8	0	1	1	1	0
4	Electric Propulsion	12	14	3	3	8	0	1	1	1	0
5	Regenerative Braking	10	14	3	3	8	0	1	1	1	0
Part – C Question having 10 marks weightage from CO3 or CO4 or CO5			10				10				1
Total		**60**	**80**	**15**	**15**	**40**	**10**	**5**	**5**	**5**	**1**

- **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 2.10
Unit Test – II	From 3.1 to 5.8

CAD PRACTICE

Course Title	Course Code	Periods per week	Period per semester
CAD Practice	A–506	06	90

TIME SCHEDULE

Sl No.	Major Topics	No. of periods
1.	Introduction to Computer Aided Drafting	3
2.	Computer Aided Drafting Interface	16
3.	Computer Aided Drafting – 2D	24
4.	Practice 2D drawings, Isometric View drawings and Plotting	28
5	Practice 3D Drawings	19
TOTAL		**90**

Course Code: A-506	**Course Name: CAD Practice** **No. Of Periods: 90**
Course Objectives	Upon completion of the course the student shall be able to 1. Understand basics of computer aided drafting. 2. Understand working in CAD environment. 3. Prepare drawings of standard components using CAD software both in 2D and 3D.

CO No.		**Course Outcome**
C01	**A-506.1**	Explain Computer Aided Drafting and its importance.
C02	**A-506.2**	Practice usage of Computer Aided Drafting Interface and its various tools
C03	**A-506.3**	Practice 1. Creating objects commands, 2. Modify or editing commands, 3. Coordinate system, 4. Text and dimensioning.
C04	**A-506.4**	Create 2Ddrawings using CAD software
C05	**A-506.5**	Create 3D drawings using CAD Software.

Learning Outcome

1.0 Introduction to Computer Aided Drafting

1.1 Define Computer Aided Drafting

1.2 List the Advantages of CAD

1.3 List the CAD software's used for drafting.

1.4 Explain the importance of CAD software

1.5 Explain the features of Graphic Work station

1.6 State the system requirements of CAD software.

2.0 Computer Aided Drafting Interface

2.1 Explain CAD Environment 1. Screen, 2. Various tool bars, 3. Command line, 4. Drop down menus, 5. Ribbon tabs and 6. Icons

2.2 Practice repeating a commands, undoing and redoing action

2.3 Practice mouse functions

2.4 Practice the Creating drawing, Opening, existing Files and saving the drawing

2.5 Practice the setting limits and drawing unit, Standard workspace settings

2.6 Practice selection methods – crossing and window, drawing accuracy methods – Ortho, Osnap, Snap and grid and use of grips

2.7 Practice the use of Zoom, Scroll bar, pan command, and rotating view to move around within drawing

2.8 Practice the displaying of multiple views, changing line-weight.

3.0 Computer Aided Drafting – 2D

3.1 Draw the lines, circles, arcs, ellipses, elliptical arcs, rays and infinite lines and shapes like rectangles, polygons, polylines, Splines, adding of hatch pattern

3.2 Practice how the coordinate system work, Two dimensional coordinates such as Absolute Cartesian, Relative Cartesian and Polar coordinates, use of right- hand rule and Practice the how to enter into x, y, z – coordinates, defining user coordinate system

3.3 Calculate the areas, distance and angle and display the information about the entities and drawing status

3.4 Practice the entity selection and deselect ion methods, Deletion, Copying of entities within a drawing and between drawings and making of parallel copies, Mirroring entities and Arraying entities

3.5 Practice the Rearranging of entities by Moving, Rotating and Reordering and Resizing of entities by Stretching, Scaling, Extending,Trimming, Editing the length, Braking and joining of entities

3.6 Practice the creating, modifying the groups and ungrouping of Entities and Exploding of entities, Chamfering and Filleting of entities

3.7 Practice the setting a current layer, layers color, line type, line weight, print Style, locking and unlocking of layers and setting of current line type

3.8 Explain the purpose of a block, creating, inserting, redefining and exploding a block

3.9 Practice the creating of linear, Angular, Diameter, Radial, Ordinate Dimensions and creating leaders and annotations, dimensions oblique, Edit the dimension text, Controlling of dimension arrows and format.

3.10 Practice the creating, naming and modifying the text fonts, Creation of line text, paragraph text, Setting of line text style and its alignment and Practice the Setting of Paragraph text style and its alignment

4.0 Practice 2D drawings, Isometric and Plotting

4.1 Create 2D drawings of standard mechanical components
4.2 Create Isometric views of simple objects
4.3 Understand the layouts, viewing of drawings in paper and model space
4.4 Display the model and layout tabs, new layout, layout view ports
4.5 Set the paper size and orientation
4.6 Select a printer or a plotter

5.0 Practice 3D Drawings

5.0 Explain the concept of 3D
5.1 Create 3D solids using solid tool bar options
5.2 Create 3D Drawings of Standard Mechanical Components

COURSE CONTENT

S.No	Experiment Title	Key Competency
1.	Introduction to Computer Aided Drafting	• Computer Aided Drafting, Advantages of CAD, CAD software's • Importance of CAD, system requirements of CAD software.
2.	Computer Aided Drafting Interface	• CAD Environment: Screen, Various tool bars, command line, drop down menus, ribbon tabs and icons, repeating a commands, undoing and redoing action, mouse functions • Creating the drawing, Opening existing Files, saving the drawing - setting limits and drawing unit, Standard workspace settings • Selection methods – crossing and window, • Using Drawing accuracy methods –Ortho, Osnap, Snap and grid and use of grips • Practice viewing commands.
S.No	**Experiment Title**	**Key Competency**
3.	Computer Aided Drafting – 2D	• Practice Draw commands • Practice how the coordinate system work, Two dimensional coordinates such as Absolute Cartesian, Relative Cartesian and Polar coordinates, use of right-hand rule, how to enter into x, y, z – coordinates, defining user coordinate

		system • Practice Inquiry commands • Practice Modify / Edit commands • Practice layers and block commands. • Practice Dimensioning commands. • Practice text and Mtext • Draw simple geometrical shapes like circles, rectangles etc.,
4.	Practice 2D drawings, Isometric drawings and Plotting	• Create 2D drawings of standard mechanical components • Create Isometric views of simple objects • Practice layouts, paper size and orientation and plotting
5.	Practice 3D Drawings	• Explain the concept of 3D • Create 3D solids using solid tool bar options • Create 3D Drawings of Standard Mechanical Components

REFERENCE BOOKS

1. Mastering AutoCAD 2017 by George omura, Brain C. Benton
2. Up and Running with AutoCAD 2017 2D and 3D by Elliot J.Gindis

I.C. ENGINE TESTING AND VEHICLE DIAGNOISING LAB

Course Title	Course Code	Periods/Week	Periods/Semester
IC ENGINE TESTING AND VEHICLE DIAGNOISING LAB	A-507	06	90

TIME SCHEDULE

Sl No.	Major Topics	No. of periods
1.	IC Engine Testing	45
2.	Vehicle Diagnosing	45
3	Demonstration of driving skills **(One batch will go for driving practice and another batch will do the experiment)**	
TOTAL		**90**

Course Code: A-507 COURSE: IC ENGINE TESTING AND VEHICLE DIAGNOISING LAB Total No. of Periods: 90	
COURSE OBJECTIVES	**Upon completion of the course the student shall able to** 1. Practice load test, morse test on given petrol and diesel engines and draw the performance curves and heat balance sheet 2. Practice wheel balancing, wheel alignment, engine analysing, exhaust gas analysing and spark plug testing 3. Practice driving on four wheelers

CO No.		Course Outcome
C01	**A-507.1**	Draw performance curves by conducting load test on a given petrol and diesel engine
C02	**A-507.2**	Find mechanical efficiency by conducting morse test on a given I.C engine and draw the heat balance sheet.
C03	**A-507.3**	Perform 1. Wheel balancing, 2. Wheel alignment, 3. Exhaust gas analyser, 4. OBD scanner and 5. Spark plug cleaning and testing.
C04	**A-507.4**	Troubleshoot the engine using engine analyser
C05	**A-507.5**	Demonstrate driving skills on four wheelers

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

IC ENGINE TESTING

1. Load tests and performance curves on the available diesel engine
2. Load tests and performance curves on the available petrol engine
3. Morse Test
4. Drawing of heat balance sheet of an IC engine

VEHICLE DIAGNOISING

1. Wheel Balancing
2. Wheel Alignment
3. Engine Analyzer
4. On-Board Diagnosis Scanning
5. Exhaust gas Analyzer for Petrol Engines
6. Exhaust Gas Analyzer for Diesel Engine
7. Spark Plug Cleaing and Testing

IC ENGINE TESTING

The competencies and key competencies to be achieved by the student

Sl. No	Name of the Experiment	Key Competencies	Competencies
1	Valve timing diagrams	• Identify the dead centres • Use of spirit level and metal tape and feeler gauge • Identify the opening and closing of valves during different strokes • Measure the circumferential gaps for the valve opening and closing and convert them into degrees	• State different strokes of an I.C.Engine • State the parts of an I.C. Engine • Identify the dead Centre • Use of spirit level and metal tape and feeler gauge • Identify the opening and closing of valves during different strokes • Measure the circumferential gaps for the valve opening and closing and convert them into degrees
2	Heat Balance Sheet	• Identify the locations of cooling water inlet and outlet • Allow cooling water to enter the cylinder jacket. • Cranking the engine and operating the decompression lever • Adjust the load	• State various parameters to be measured • Identify the locations of cooling water inlet and outlet • Allow cooling water to enter the cylinder jacket • Cranking the engine and operating the decompression lever

		• Record the load and speed • Record the reading of cooling water temperature at inlet and outlet • Record time taken for 10c.c fuel consumption • Record exhaust gas temperature	• Adjust the load • Record the load and speed • Record the reading of cooling water temperature at inlet and outlet • Record time taken for 10c.c fuel consumption • Record exhaust gas temperature
3	Morse test	• Cranking the engine and operating the decompression lever • Varying the load • Maintaining constant speed • Disconnecting engine cylinders one by one by operating the lever • Record the readings in spring balance without parallax error	• Define I.P. ,B.P. and F.P. • Write down the formulae for I.P. ,B.P. and F.P. • Cranking the engine and operating the decompression lever • Varying the load • Maintaining constant speed • Disconnecting engine cylinders one by one by operating the lever • Record the readings in spring balance without parallax error

VEHICLE DIAGNOISING

The competencies and key competencies to be achieved by the student

Sl.No.	Name of the Experiment	Key Competencies	Competencies
1	Wheel Balancing	• Check Static Balancing • Check Dynamic Balancing	• Identify tools required for removing wheel • Determination of Wheel diameter and width • Entering all the parameters in computerized wheel balancer • Add weights if necessary • Run the same procedure until the balancing is perfect
2	Wheel Alignment	• Check Toe-in • Check Toe-out	• Place the vehicle on rotating plates. • Determine the central axis • Adjust toe-in and Toe-out

3	Engine Analyzer	• Check Engine r.p.m ., dwell, ignition timing and resistance of primary winding.	• Identify various tests to be conducted . • Connect various probes • check Engine r.p.m ., dwell, timing.
4	Exhaust gas Analyzer for Petrol & Diesel Engines	• Note readings of pollutant levels • Compare with standards.	• State pollutants in exhaust emissions. • Connect the probe to the exhaust tail pipe • Note readings of pollutant levels • Compare with standards
5	Spark Plug Testing by Using Spark Plug Cleaning & testing Machine	• Check intensity of spark	• Check spark plug condition and electrode gap • Clean spark plug using machine • Check intensity of spark
6	Driving practice on light motor vehicle	• Foot controls • Driving controls • Operate all controls simultaneously.	• Identify foot controls of a four wheeler. • State the purpose of foot controls. • Operate foot controls efficiently. • Operate steering controls. • Operate gear shift lever. • Identify various accessories. • Operate all controls simultaneously.

NOTE:

1. Sessional Marks will be 20 in each laboratory
2. The End Examination will be conducted separately in two laboratories each (30 + 30)
3. Internal assessment marks will be awarded based on the performance of the candidate in each laboratory (20 + 20)
4. Both labs has to be appeared at a time. If a candidate did not appear for any one of the labs, it will be treated as Absent for the entire subject.
5. A candidate is declared passed, if he gets required percentage of marks to pass a practical subject by adding all the marks obtained in both the labs i.e., 50 % in the Practical end examination and combined minimum of 50 % of both sessional and practical end examination marks put together.
6. If a student fails in the subject, he has to appear for both the practicals in the subsequent examinations.

LIFE SKILLS

Course Code	Course Title	No. of Periods/Week	Total No. of Periods	Marks for FA	Marks for SA
A-508	Life Skills	3	45	40	60

S. No.	Unit Title	No of Periods	COs Mapped
1	Attitude	4	CO1
2	Adaptability	4	CO1, CO2
3	Goal Setting	4	CO1, CO2, CO3
4	Motivation	4	CO1, CO2, CO3
5	Time Management	4	CO2
6	Critical thinking	4	CO3
7	Creativity	4	CO3
8	Problem Solving	5	CO3
9	Team Work	4	CO4
10	Leadership	4	CO4
11	Stress Management	4	CO4
Total Periods		**45**	

Course Objectives	To understand the importance of Life skills for acceptable, sustainable and ethical behaviour in academic, professional and social settings
	To exhibit language competence appropriate to acceptable social and professional behaviour.
	To demonstrate time management, stress management, team skills, problem solving ability to manage oneself in academic, professional and social settings.

CO No.	Course Outcomes
CO1	Demonstrates positive attitude and be able to adapt to people and events
CO2	Fixes personal and professional goals and manages time to meet targets
CO3	Exhibits critical and lateral thinking skills for problem solving.
CO4	Shows aptitude for working in teams in a stress free manner and sometimes/ very often/ mostly display leadership traits.

Blue Print for evaluation based on Course Outcomes for SA:

Note: Every Activity based Question that focuses on COs and responses as exhibited through communication has to be given marks for the following parameters

- Clarity of Thinking as Exhibited through Content
- Features of Etiquette

***Rubric Descriptors 'Outstanding/ Very Good/ Good/ Satisfactory/ Poor' levels of Competence**

Level of Competence	Parameters of Assessment	
	Clarity of thinking as exhibited through content	**Features of etiquette**
Outstanding 10	**Thinking** is **extremely logical** and suggested course of action is **feasibile** Shows **creativity and uniqueness** Exhibits **expert use of expression** (organizational devices and discourse markers) that denote clarity in thought.	Exhibits **courtesy to all most appropriately** with **confidence**
Very Good 8/9	**Thinking** is **clear and logical** Suggested **course of action is feasible** Shows **traces of creativity** Exhibits **good expression** (organizational devices and discourse markers) that denote clarity in thought.	Exhibits **courtesy to all to a considerable level.**
Good 6/7	**Thinking is clear and logical most of the time**. Lacks creativity or out of the box thinking as expressed through content.	Exhibits **courtesy / politeness to an acceptable level.**
Satisfactory 4/5	**Thinking is logical**; However **expressing content is disjointed and disorganized.**	Has courtesy but often fumbles with language.
Poor 3 or less than 3	**Thoughts** as expressed through content are **incoherent.Language skills are very limited.**	Fails to show courtesy to others.

Blue Print for evaluation based on Course Outcomes for SA of each student:
Note: Marks are awarded for each student as per the Rubric descriptors.

S No.	Questions based on Course Outcomes	Periods Allocated for practical work	Max Marks	Poor >3	Satisfactory 4 /5	Good 6/7	Very Good 8/9	Outstanding 10
1	Short presentation on GOALS with Timeline and Action Plan	12	10					
2	State what you will do in the given situation (Assesses adaptability and critical thinking skills, leadership, team skills)	12	10					
3	In how many different and creative way can you use _____ (Object) other than its primary use	8	10					
4	What solutions can you think of for _____ problem.	13	10					
	Total	**45**	**60**					

Note: The marks that are awarded for the student for 40 to be increased proportionally for 60.

Learning Outcomes

1. **Attitude Matters :**

   1.1 Understand the importance of positive attitude and the consequences of negative attitude.

   1.2 Demonstrate positive attitude in dealing with work-related issues and in personal life.

2. **Adaptability….makes life easy :**

   2.1 Understand the significance of adaptability.

   2.1 Show adaptability whenever needed, both at place of work and on personal front.

3. **Goal Setting … life without a Goal is a rudderless boat!**

3.1 Understand the SMART features of goal-setting.

3.2 State one's short-term and long-term goals and spell out plans to achieve them.

4. Motivation … triggers success!

4.1 Comprehend the need for motivation in order to achieve success in life.

4.2 State how one is motivated in life.

4.3 Show the impact of motivation on one's life.

5. Time Management… the need of the Hour!

5.1 Understand the value of time management and prioritizing in life

5.2 Demonstrate the effect of time management on one's professional work.

6. Critical Thinking … logic is the key!

6.1 Distinguish between facts and assumptions

6.2 Use logical thinking in dealing with professional matters

7. Creativity … the essential you!

7.1 Understand the importance of thinking out of the box in dealing with critical issues

7.2 Solve problems using creativity / imagination

8. Problem Solving … there is always a way out!

8.1 Understand the need for and importance of problem solving.

8.2 Use logic or creativity to solve a problem at workplace or home.

9. Team Work… together we are better!

9.1 Understand the need for team skills / team building

9.2 Demonstrate one's skills as a team player

10. Leadership… the meaning of a leading!

10.1 Understand the need for team skills / team building

10.2 Demonstrate one's skills as a team player

11. Stress Management… live life to the full!

11.1 Understand what causes stress and how to cope with stress at workplace.

11.2 Demonstrate how stress can be overcome in a healthy way.

PROJECT WORK

Course Title	Course Code	Periods per week	Periods per semester
Project Work	A-509	3	45

Course Code: A-509 COURSE: PROJECT WORK Total No. of Periods: 45	
COURSE OBJECTIVES	**Upon completion of the course the student shall able to** 1. Provide with the opportunity to synthesize knowledge from various areas of learning 2. Identify the problems in a given automobile and modify the design or structure of a given automobile to enhance the performance 3. Critically and creatively apply it to real life situations 4. Prepare proposal for a new design or modify and to prepare a feasibility report for the same

CO No.		**Course Outcome**
C01	**A-509.1**	To build the strength, teamwork spirit and self-confidence
C02	**A-509.2**	To Improve independent learning
C03	**A-509.3**	To Apply theory to practical work situations
C04	**A-509.4**	To gain knowledge in writing report in technical projects

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 Automobile 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.

4.2. Analyze the appropriate actions.

4.3. Compares merits and demerits

4.4. Analyze the activities for sustainability.

4.5 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 Automobile 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

INDUSTRIAL TRAINING

Course Title	Course Code	DURATION
INDUSTRIAL TRAINING	A-601	6 MONTHS

Time schedule

S.NO	Code	TOPICS	Duration
1	A-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 Equipment's List of Processes: Skills Acquired, Conclusions and References	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, and supervising in the engineering fields. 4. Install 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-CO 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) Technical Skills*(*Manufacturing/Service/Diagnosing the trouble /Maintenance)
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) Customer relationship and recording Skills

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 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***

Weightage of marks for Assessment of Skill sets during first and second assessment.

Skill Set Sl.No	***SKILL SET***	***Max Marks Allotted For each parameter***
1	Technical Skills *(*Manufacturing/Service/Diagnosing the trouble /Maintenance etc)	*25*
2	Reading drawings and analysing Specifications	*20*

3	Recognize and Practice safety Measures	*15*
4	Handling Tools/Instruments/Materials/Machines	*25*
5	Assess and Control of quality parameters	*15*
6	Customer relationship and recording Skills	*20*
	Total	*120*

During assessment the performance of the students shall be assessed in those skills in which the student has been trained and be awarded the marks as per the weightage assigned as above. In case the student has undergone training in a few skill sets then the total marks obtained shall be raised to 120 marks for the given assessment i.e. either assessment 1 or 2. However the performance of the student shall be assessed at the most skill sets listed above but not less than three skill sets.

ILLUSTRATION

If the student has undergone training in only 4 skill sets (namely S.No. 1,3,4 and 5), and marks awarded during assessment is 50 out of 80, then the marks of 50 shall be enhanced to 120 proportionately as 50/80X120 = 75.

GUIDELINES FOR INDUSTRIAL TRAINING OF DIPLOMA IN AUTOMOBILE ENGINEERING PROGRAMME

1. Duration of the training: 6 months (24 Weeks)
2. Eligibility: The As per SBTET norms
3. Training Area: Students may be trained in the fields Fabrication/Manufacturing/Service/Diagnosing the trouble /Maintenance etc.
4. The candidate shall put a minimum of 90% attendance, during industrial training.
5. If the student fails to secure 90% attendance during industrial training, the student shall reappear for 6 months industrial training.
6. Formative assessment at industry level shall be carried out by the Mentor from the industry, where the student is undergoing training and the in faculty incharge (Guide) from the concerned section in the institution.
7. The Industrial training shall carry a weightage of 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.
8. 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.
9. Final summative assessment at institution level is done by a committee including1. Head of the section (**of concerned discipline ONLY**), 2.External examiner from an industry and 3. Faculty member who assessed the student during Industrial Training as members. Final

Guidelines and Responsibilities of the faculty members who are assessing the students 'performance during industrial training:

1. The faculty member shall guide the students in all aspects regarding training.
2. Shall create awareness regarding safety measures to be followed in the industry during the training period, and shall check it is followed scrupulously.
3. Shall check the logbook of the students during the time of their visit for the assessment.
4. Shall monitor progress at regular intervals and make appropriate suggestions for improvement.
5. Shall visit the industry and make first and second assessments as per stipulated schedule.
6. Shall assess the skill sets acquired by the students during their assessment.
7. Shall award the marks for each skill set as per the marks allotted for that skill set during final assessment at institution.
8. Shall voluntarily supplement students learning through appropriate materials like photographs, articles, videos etc.
9. Shall act as co-examiner along with external examiner.
10. Shall act as liaison between the student and mentor.
11. Shall maintain a dairy indicating his observation with respect to the progress of students learning in all three domains (Cognitive, Psychomotor and Affective)

Guidelines to the training mentor in the industry:

- Shall train the students in all the skill sets as far as possible.
- Shall assess and award the marks in both the assessments along with the faculty member.
- Shall check and approve the log books of the students.
- Shall approve the attendance of each student at the end of the training period.
- Shall report to the guide about student's progress, personality development or any misbehaviour as the case may be.
- ✓ **Every Teacher (including HoD if not holding any FAC) shall be assigned a batch of students of 10 to 15 for industrial training irrespective of student's placements for training.**

Rubrics for Industrial Training Assessment

Department of Technical Education

Name of the Institution/ College:

PIN: **Name of the student:**

Skill Set Sl.No	***SKILL SET***	**Max Marks Allotted For each parameter**	**Precisely completes the task**	**Completes the task, mistakes are absent, but not Precise**	**Completes the task, Mistakes are a few**	**Makes attempt, Mistakes are many**
1	***Technical Skills (15 M)***					
	(i) Analytical Thinking	5	5	*3*	*2*	*1*
	(ii) Creativity.	5	5	*3*	*2*	*1*
	(iii) Problem-solving.	5	5	*3*	*2*	*1*
2	***Reading Drawings and Analysing Specifications (20 M)***					
	(i) 2 D and 3D (Computer Aided Design) CAD/Drawings.	*10*	*10*	*7*	*6*	*3*
	(ii) Knowledge of specifying the machine member/Automobile Components	*10*	*10*	*7*	*6*	*3*
3	***Handling Tools / Instruments / Safety Practices (15)***	*5*	*5*	*3*	*2*	*1*
	(i) Identification of tools and instruments.	*5*	*5*	*3*	*2*	*1*
	(ii) Measuring the parameter	*5*	*5*	*3*	*2*	*1*
	(iii) Aware of safety Management					
4	***Trouble Shooting / Dismantling & Assembling and of the Unit (30)***	*5*	*5*	*3*	*2*	*1*
	(i) Fault-Finding					
	(ii) Dismantling the given Machine/ Equipment / Engine /Automobile components	*10*	*10*	*7*	*6*	*3*
	(iii) Repair or Replacement with spare parts	*5*	*5*	*3*	*2*	*1*
		10	*10*	*7*	*6*	*3*

	(iv) Assembling of the given Machine/ Equipment / Engine /Automobile components after testing for working condition.					
5	***Quality Assessment and Control (15 M)*** *(i) Use of various Inspection and Quality Control Tools* *(OBD CODES)* *(ii) Identification of Proper Testing Method and Tool for the manufactured or Serviced or repaired Components* *(iii) Analyze Test Results*	*5* *5* *5*	*5* *5* *5*	*4* *4* *4*	*3* *3* *3*	*2* *2* *2*
6	***Soft skills and Recording skills(25)*** *(i)Communication Skills (oral/writing skills)* *(ii) Human relations.* *(iii) Supervisory abilities.* *(iv) Recording technical issues* *(v) Proper Maintenance of records in the industry.*	*5* *5* *5* *5* *5*	*5* *5* *5* *5* *5*	*4* *4* *4* *4* *4*	*3* *3* *3* *3* *3*	*2* *2* *2* *2* *2*

*Mistakes are with reference to Technique, Procedure & Precautions, while precision refers to Technique, Procedure, Precautions, Time & Result

Total Marks: 120

Marks Awarded: _____

(Marks awarded in words:)

Signature of the Training In-charge (Mentor)
Name
Designation

Signature of the faculty in-charge (Guide)
Name
Designation