GOVERNMENT OF ANDHRA PRADESH

STATE BOARD OF TECHNICAL EDUCATION AND TRAINING
Andhra Pradesh :: Amaravathi

Globally Competetive
CURRICULUM (C-16)
For Polytechnic Diploma Courses
In Andhra Pradesh

INTERNET of THINGS

DIPLOMA IN AUTOMOBILE ENGINEERING

Front Cover Page

Objective of the New Curriculum (C-16)

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

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

Highlights of the Curriculum (C-16)

❖ 6 months /1 year industrial training in all the Diploma Courses.

❖ 1 year industrial training in collaboration with BOAT (Board of Apprenticeship & Training (SR), Chennai).

❖ Virtual labs for ECE & Computer Branches & Strengthening of Skill Development Centers to provide industrial training to students.

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

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

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

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

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

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

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

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

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Journal (JPAP)

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

JOURNAL OF POLYTECHNICS IN ANDHRA PRADESH

Volume - 1, Issue - 1, Jan - Jun, 2017

CISCO

CISCO ACADEMIES IN POLYTECHNICS

- ◆ 70 Government Polytechnics chosen to have Cisco Academies
- ◆ Course Content of CISCO has been incorporated into the ECE and Computer Diploma Courses
- ◆ CISCO to train Staff of Polytechnics in two phases to enable them to run the courses effectively
- ◆ Students to get 'Certificate from CISCO' along with Diploma Certificate.

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CURRICULUM-2016
(C-16)

FOR DIPLOMA COURSES IN ANDHRA PRADESH

PREAMBLE

The State Board of Technical Education and Training, Andhra Pradesh under the aegis of the Department of Technical Education, Andhra Pradesh generally reviews the Curricula once in every five years. However, recognizing the needs of the industries and enhancing the employability skills of Polytechnic students, the Government of Andhra Pradesh constituted a committee vide G.O.Rt.No:95 of Higher Education (TE) Dept dated: 29-4-2016 and G.O.Rt.No:98 of Higher Education (TE) Dept dated: 4-5-2016 for updation of polytechnic curriculum under the chairmanship of Sri. S. Balasubrahmanyam, IAS (Retd.,). The committee submitted a report on 31-5-2016 making certain recommendations and suggesting new initiatives to be incorporated in the curriculum. An Industry Institute Interaction Meet was organized with Industry experts and subject experts on 26-12-2016 and the suggestions from Industrialists have also been incorporated in the curriculum. The new Curricula for the different diploma courses have been designed with the active participation of the members of the faculty teaching in the Polytechnics of Andhra Pradesh, besides reviewed by Expert Committee constituted with eminent academicians.

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

The revised New Curriculum i.e., Curriculum–2016 (C-16) is approved by BoG of SBTET for its implementation with effect from 2016-17.

Salient Features:

1. Duration of course is either 3 years / 3½ years duration of Regular Academic Instruction.
2. The Curriculum is prepared in Semester Pattern. However, First Year is maintained as Year-wise pattern.
3. 6 Months/ 1 year Industrial Training is introduced for all the Diploma courses.
4. Fundamentals of Internet of Things (IOT) is introduced for all the Diploma courses in the subject.
5. Modern subjects relevant to the industry are introduced in all the Diploma courses.
6. CISCO course content has been incorporated into the ECE and CME courses to get certification from CISCO along with Diploma.

7. The policy decisions taken at the State and Central level with regard to environmental science are implemented by including relevant topics in Chemistry. This is also in accordance with the Supreme Court guidelines issued in Sri Mehta's case.

8. Keeping in view the increased need of communication skills which is playing a major role in the success of Diploma Level students in the Industries, emphasis is given for learning and acquiring listening, speaking, reading and writing skills in English. Further as emphasized in the meetings, Communication Skills lab and Life Skills lab are introduced for all the branches.

9. Modern topics relevant to the needs of the industry and global scenario suitable to be taught at Diploma level are also incorporated in the curriculum.

10. AutoCAD specific to the branch has been given more emphasis in the curriculum. Preparing drawings using CAD software has been given more importance.

11. Every student is exposed to the computer lab at the 1st year itself in order to familiarize himself with skills required for keyboard/mouse operation, internet usage and e-mailing.

12. Upon reviewing the existing C-14 curriculum, it is found that the theory content is found to have more weightage than the Practical content. In the revised C-16 curriculum, more emphasis is given to the practical content of Laboratories and Workshops, thus strengthening the practical skills.

13. With increased emphasis for the student to acquire Practical skills, the course content in all the subjects is thoroughly reviewed and structured as outcome based than the conventional procedure based.

14. Curricula of Laboratory and Workshops have been thoroughly revised based on the suggestions received from the industry and faculty, for better utilization of the equipment available at the Polytechnics. The experiments /exercises that are chosen for the practical sessions are identified to conform to the field requirements of industry.

15. The Members of the working group are grateful to Sri G.S. Panda Das, I.A.S., Special Commissioner of Technical Education & Chairman of SBTET, AP. and Sri. Adityanath Das, I.A.S., Principal Secretary of Higher Education for their guidance and valuable inputs in revising, modifying and updating the curriculum.

16. The Members acknowledge with thanks the cooperation and guidance provided by Sri. A.Nirmal Kumar Priya, Secretary, SBTET, Andhra Pradesh and other officials of Directorate of Technical Education and the State Board of Technical Education, Andhra Pradesh, experts from industry, academia from the universities and higher learning institutions and all teaching fraternity from the Polytechnics who are directly or indirectly involved in preparation of the curricula.

RULES AND REGULATIONS

1 DURATION AND PATTERN OF THE COURSES

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

All the Diploma courses are run on year wise pattern in the first year, and the remaining two or two & half years are run in the semester pattern. In respect of few courses like Diploma in BM course, the

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

2   PROCEDURE FOR ADMISSION INTO THE DIPLOMA COURSES:

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

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

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

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

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

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

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

3   MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

4   PERMANENT IDENTIFICATION NUMBER (PIN)

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

5   NUMBER OF WORKING DAYS PER SEMESTER / YEAR:

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

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

c).   There shall be 7 periods of 50 minutes duration on all working days.

d).   The minimum number of working days for each semester / year shall be 90 / 180 days excluding examination days. If this prescribed minimum is not achieved due to any reason, special arrangements shall be made to conduct classes to cover the syllabus.

6   ELIGIBILITY OF ATTENDANCE TO APPEAR FOR THE END EXAMINATION

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

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

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

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

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

7   READMISSION

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

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

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

2.   Within 30 days after commencement of class works in any year (including   D. Pharmacy course or first year course in Engineering and Non Engineering Diploma streams).

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

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

8   SCHEME OF EXAMINATION

a) First Year

THEORY EXAMINATION: Each Subject carries 80% marks with examination of 3 hours duration, along with 20% marks for internal evaluation. (Sessional marks). However, there are no minimum marks prescribed for sessionals.

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

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

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

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

9   INTERNAL ASSESSMENT SCHEME

a)   Theory Subjects: Theory Subjects carry 20% sessional marks, Internal examinations will be conducted for awarding sessional marks on the dates specified. **Three unit tests will be conducted for I year students and two Unit Tests for semesters.** Average of marks obtained in all the prescribed tests will be considered for awarding the sessional marks.

b)   Practical Subjects: Student's performance in Laboratories / Workshop shall be assessed during the year/ semester of study for 40% marks in each practical subject. Allotment of marks should be discrete taking into consideration of the students' skills, accuracy, recording and performance of the task assigned to him / her. Each student has to write a record / log book for assessment purpose. In the subject of Drawing, which is also considered as a practical paper, the same rules hold good. Drawing exercises are to be filed in seriatum.

c)   Internal assessment in Labs / workshops / Survey field work etc., during the course of study shall be done and sessional marks shall be awarded by the concerned Lecturer / Senior Lecturer / Workshop superintendent as the case may be.

d)   For practical examinations, except in drawing, there shall be two examiners. External examiner shall be appointed by the Principal in consultation with respective Head of Section preferably choosing a qualified person from any local Industry/ nearby Government Polytechnic/ Local Government Organization. Internal examiner shall be the person concerned with internal assessment as in (c) above. The end examination shall be held along with all theory papers in respect of drawing.

e)   Question Paper for Practicals: Question paper should cover all the experiments / exercise prescribed.

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

g)   **In case of Diploma courses *having* Industrial Training**, the training assessment shall be done and the marks are to be awarded in the following manner.

Industrial assessment	:	200 marks (in two spells of 100 marks each)
Maintenance of log book	:	30 marks
Record Work	:	30 marks

Seminar / viva-voce	:	40 marks

TOTAL	:	300 marks

The assessment at the institution level (Seminar/Viva-voce)shall be done by three members, viz., Internal Faculty member, External Examiner and Head of Section and be averaged.

10   MINIMUM PASS MARKS

THEORY EXAMINATION:

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

PRACTICAL EXAMINATION:

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

11.   PROVISION FOR IMPROVEMENT

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

2.   Improvement is allowed in any 4 (Four) subjects of the Diploma.

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

4.   No improvement is allowed in Practical / Lab subjects or Project work or   Industrial Training assessment. However, improvement in drawing subject(s) is allowed.

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

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

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

8.   All the candidates who wish to appear for improvement of performance   shall deposit the original Marks Memos of all the years / Semesters and also original Diploma Certificate to the Board. If there is

improvement in performance of the current examination, the revised Memorandum of marks and Original Diploma Certificate will be issued, else the submitted originals will be returned.

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

a) For Diploma Courses of 3 Years duration

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

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

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

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

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

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

For IVC & ITI Lateral Entry Students:

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

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

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

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

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

For IVC& ITI Lateral Entry students:

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

ii) Should not have failed in more than Four backlog subjects of 3rd Semester

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

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

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

     Training

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

   For IVC & ITI Lateral Entry students:

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

   Important Note:

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

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

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

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

For IVC & ITI Lateral Entry students:

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

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

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

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

For IVC & ITI Lateral Entry students:

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

OTHER DETAILS

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

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

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

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

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

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

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

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

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

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

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

For IVC & ITI Lateral Entry Students:

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

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

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

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

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

For IVC & ITI Lateral Entry students:

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

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

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

A candidate is eligible to appear for 6th semester examination

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

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

For IVC & ITI Lateral Entry students:

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

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

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

(Seminar/Viva-voce) if he/she

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

For IVC & ITI Lateral Entry students:

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

Important Note:

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

OTHER DETAILS

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

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

13. STUDENTS PERFORMANCE EVALUATION

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

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

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

3. Second Class shall be awarded to candidates who secure a pass with an overall aggregate of below 60%.

   The Weightage of marks for various year/Semesters which are taken for computing overall aggregate shall be 25% of I year marks + 100% of 3rd and subsequent Semesters.

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

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

14. EXAMINATION FEE SCHEDULE:

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

15. STRUCTURE OF END EXAMINATION QUESTION PAPER:

The question paper for theory examination is patterned in such a manner that the Weightage of periods/marks allotted for each of the topics for a particular subject be considered Examination paper is of 3/6/9 hours duration.

a) Each theory paper consists of Section 'A' and Section 'B'. Section 'A' contains 10 short answer questions. All questions are to be answered and each carries 3 marks Max. Marks: 10 x 3 = 30. Section B contains 8 essay type questions including Numerical questions, out of which 5 questions each carrying 10 marks are to be answered.

   Max.Marks: 5 x 10 = 50.

   Total Maximum Marks: 80.

b) For Engineering Drawing Subject (107) consist of section 'A' and section 'B'. Section 'A' contains four (4) questions. All questions in section 'A' are to be answered and each carries 5 marks. Max. Marks: 4 x 5=20. Section 'B' contains six (6) questions. Out of which four (4) questions to be answered and each question carries 10 Marks. Max. Marks 4 x 10 = 40.

c) Practical Examinations

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

Max. Marks for an experiment / exercise : 50%

Max. Marks for VIVA-VOCE : 10%

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

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

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

16. ISSUE OF MEMORONDUM OF MARKS

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

17. MAXIMUM PERIOD FOR COMPLETION OF DIPLOMA COURSES:

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

18. ELIGIBILITY FOR AWARD OF DIPLOMA

A candidate is eligible for award of Diploma Certificate if he / she fulfils the

following academic regulations.

i.   He / She pursued a course of study for not less than 3 / 3 ½ academic years & not more than 6 / 7 academic years.

ii.   He / she has completed all the subjects.

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

For IVC & ITI Lateral Entry students:

i.   He / She pursued a course of study for not less than 2 / 2 ½ academic years & not more than 4 / 5 academic years.

ii. He / she has completed all the subjects.

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

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

A) FOR ISSUE OF PHOTO COPIES OF VALUED ANSWER SCRIPTS

1. A candidate desirous of applying for Photo copy of valued answer script/ scripts should apply within prescribed date from the date of the declaration of the result.

2. Photo copies of valued answer scripts will be issued to all theory subjects and Drawing subject(s).

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

4. No application can be entertained from third parties.

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

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

2. Re-verification of valued answer script shall be done for all theory subjects and Drawing subject(s).

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

I) RE-COUNTING

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

2) RE-VERIFICATION

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

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

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

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

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

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

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

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

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

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

4. No request for Photo copies/ Recounting /Re-verification of valued answer script would

be entertained from a candidate who is reported to have resorted to Malpractice in that

examination.

20.   MAL PRACTICE CASES:

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

21.   DISCREPANCIES/ PLEAS:

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

22.   ISSUE OF DUPLICATE DIPLOMA

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

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

23.   ISSUE OF MIGRATION CERTIFICATE AND TRANSCRIPTS:

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

24.   GENERAL

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

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

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

DIPLOMA IN AUTOMOBILE ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
(FIRST YEAR)

Subject Code	Name of the Subject	Instruction period / week		Total Period / year	Scheme of Examination			
		Theory	Practical /Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
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 Work shop practice	-	6	180	3	40	60	100
A-109	Physics Laboratory	-	3	90	3	20	30	50
A-110	Chemistry Laboratory				3	20	30	50
A-111	Computer fundamentals Laboratory	-	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 periods / week		Total Periods per semester	Scheme of Examination			
		Theory	Practical /Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
A-301	Engineering Mathematics-II	5	-	75	3	20	80	100
A-302	Automobile power plants	5	-	75	3	20	80	100
A-303	Automobile Transmission Systems	4	-	60	3	20	80	100
A-304	Engineering materials and Manufacturing processes	5	-	75	3	20	80	100
A-305	Thermal Engineering	5	-	75	3	20	80	100
PRACTICAL:								
A-306	Machine Drawing	-	6	90	3	40	60	100
A-307	Automobile Laboratory	-	6	90	3	40	60	100
A-308	Workshop Practice- II	-	6	90	3	40	60	100
TOTAL		**24**	**18**	**630**		**220**	**580**	**800**

DIPLOMA IN AUTOMOBILE ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
IV Semester

Subject Code	Name of the Subject	Instruction period / week		Total Period / Semester	Scheme of Examination			
		Theory	Practical /Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
A-401	Automobile Electrical and Electronics systems	4	-	60	3	20	80	100
A-402	Strength of materials and Fluid mechanics	6	-	90	3	20	80	100
A-403	Automobile Chassis and Body Engineering	5	-	75	3	20	80	100
A-404	Automobile Servicing and Maintenance	5	-	75	3	20	80	100
A-405	Special Purpose Vehicles	4	-	60	3	20	80	100
PRACTICAL:								
A-406	Automobile Engineering Drawing	-	6	90	3	40	60	100
A-407	Automobile Servicing and Reconditioning Laboratory	-	6	90	3	40	60	100
A-408	Communication Skills	-	3	45	3	40	60	100
A-409	Strength of Materials Lab & Fluid Mechanics Lab	-	3	45	3	20+20	30+30	100
	TOTAL	24	18	630		-	-	900

DIPLOMA IN AUTOMOBILE ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
V Semester

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-501	Industrial Management & Smart Technologies	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	Motor Transport Organization	4	-	60	3	20	80	100
PRACTICAL:								
A-506	CAD Practice	-	6	90	3	40	60	100
A-507	I.C. Engines Testing and Vehicle Diagnosing Laboratory	-	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	630	-	260	640	900

DIPLOMA IN AUTOMOBILE ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS

VI SEMESTER

A - 601 INDUSTRIAL TRAINING

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

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

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

FIRST YEAR

DIPLOMA IN AUTOMOBILE ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
(FIRST YEAR)

Subject Code	Name of the Subject	Instruction period / week		Total Period / year	Scheme of Examination			
		Theory	Practical /Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
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 Work shop practice	-	6	180	3	40	60	100
A-109	Physics Laboratory	-	3	90	3	20	30	50
A-110	Chemistry Laboratory				3	20	30	50
A-111	Computer fundamentals Laboratory	-	3	90	3	40	60	100
	TOTAL	24	18	1260		280	720	1000

Subject Title : ENGLISH

Subject Code : Common - 101

Periods per Week : 3

Periods per Year : 90

Time Schedule& Weightage

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

Rationale and Scope

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

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

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

1.0   Extend their vocabulary in the direction of their future needs
1.1   Locate words, learn spellings, understand meanings
1.2   Pronounce words intelligibly
1.3   Find synonyms and antonyms
1.4   Use affixation
1.5   Comprehend meanings of words by understanding meanings of roots

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

3.0   Read and comprehend English
3.1   Identify the main ideas

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

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

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

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

Reference Books
1. Essential English Grammar (Intermediate Level)   Raymond Murphy
2. Learn English (A Fun Book of Functional Language, Grammar and Vocabulary) Santanu Sinha Chaudhuri
3. Grammar Builder (Entire Series)   Oxford University Press
4. High School English Grammar (Revised Edition)   Wren and Martin
5. Sentence skills with Readings (fourth Edition, Tata McGraw Hill)

Engineering Mathematics - I

(Common to all Branches)

Subject Title : **Engineering Mathematics - I**

Subject Code : **Common- 102**

Periods per Week : **5**

Periods per Year : **150**

Time Schedule

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

S. No	Major Topic	Theory	Practice	Weightage of Marks	R	U	App	R	U	App
	Unit III : Co-ordinate Geometry									
13	Straight Lines	5	3	6	1	1	0	0	0	0
14	Circle	4	2	5	0	0	0	0	1/2	0
15	Conic Sections	4	3	5	0	0	0	0	1/2	0
	Unit – IV : Differential Calculus									
16	Limits and Continuity	4	2	3	0	1	0	0	0	0
17	Differentiation	18	10	23	1	0	0	1	1	0

S. No	Major Topic	No of Periods		Weightage of Marks	Short Type			Essay Type		
	Unit - V : Applications of Differentiation	Theory	Practice		R	U	App	R	U	App
18	Geometrical Applications	3	2	5	0	0	0	0	0	1/2
19	Physical Applications	2	2	5	0	0	0	0	0	1/2
20	Maxima and Minima	3	4	5	0	0	0	0	0	1/2
21	Errors and Approximations	2	0	5	0	0	0	0	0	1/2
	Total	92	58	110	6	4	0	2	2 1/2	3 1/2
				Marks	18	12	0	20	25	35

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

COMMON TO ALL BRANCHES – 102

Objectives

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

UNIT – I

Algebra

1.0   Use Logarithms in engineering calculations

    1.1   Define logarithm and list its properties.

    1.2   Distinguish natural logarithms and common logarithms.

    1.3   Explain the meaning of e and exponential function.

    1.4   State logarithm as a function and its graphical representation.

    1.5   Use the logarithms in engineering calculations.

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

    2.1   Define the following fractions of polynomials:

        1.   Rational,

        2.   Proper and

        3.   Improper

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

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

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

3.0   Use Matrices for solving engineering problems

    3.1   Define a matrix and order of a matrix.

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

    3.3   Compute sum, scalar multiplication and product of matrices.

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

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

3.6   Define symmetric and skew-symmetric matrices.

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

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

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

3.10   Distinguish singular and non-singular matrices.

3.11   State properties of determinants with simple examples.

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

3.13   Compute adjoint and multiplicative inverse of a square matrix.

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

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

3.16   Solve system of linear equations by matrix inversion method

3.17   State elementary row operations.

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

UNIT – II

Trigonometry :

4.0   Understand Trigonometric Ratios

4.1   Define trigonometric ratios of any angle.

4.2   List the values of trigonometric ratios at specified values.

4.3   Draw graphs of trigonometric functions

4.4   Explain periodicity of trigonometric functions.

5.0   Solve simple problems on Compound Angles

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

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

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

5.4   Solve simple problems on compound angles.

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

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

6.2   Derive useful allied formulas like sinA= (1- cos2A)/2 etc.,

6.3   Solve simple problems using the above formulae

7.0   Apply Transformations for solving the problems in Trigonometry

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

8.0   Use Inverse Trigonometric Functions for solving engineering problems

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

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

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

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

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

9.0   Solve Trigonometric Equations in engineering applications

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

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

10.0   Appreciate Properties of triangles and their solutions

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

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

10.3   List various formulae for the area of a triangle.

10.4   Solve problems using the above formulae.

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

11.0   Represent the Hyperbolic Functions in terms of logarithm functions

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

11.2   Represent inverse hyperbolic functions in terms of logarithms.

12.0   Represent Complex numbers in various forms

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

12.2   Define the operations on complex numbers with examples.

12.3   Define amplitude of a complex number

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

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

UNIT - III

Coordinate Geometry

13.0   Solve the problems on Straight lines

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

13.2   Solve simple problems on the above forms

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

14.0   Solve the problems on Circles

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

14.2   Find the equation of a circle given

(i)   Center and radius

(ii)   Two ends of a diameter

(iii)   Centre and a point on the circumference

(iv)   Three non collinear points

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

15.0   Appreciate the properties of Conics in engineering applications

15.1   Define a conic section.

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

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

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

UNIT - IV

Differential Calculus

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

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

16.2   Mention the Standard limits $\lim_{x \to a} \dfrac{x^n - a^n}{x - a}$, $\lim_{x \to 0} \dfrac{\sin x}{x}$, $\lim_{x \to 0} \dfrac{\tan x}{x}$, $\lim_{x \to 0} \dfrac{a^x - 1}{x}$,

$\lim_{x \to 0} \dfrac{e^x - 1}{x}$, $\lim_{x \to 0} (1 + x)^{\frac{1}{x}}$, $\lim_{x \to \infty} \left(1 + \dfrac{1}{x}\right)^x$ (All without proof).

16.3   Solve the problems using the above standard limits

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

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

17.0   Appreciate Differentiation and its meaning in engineering situations

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

$\lim_{h \to 0} \dfrac{f(x + h) - f(x)}{h}$ and also provide standard notations to denote the derivative

of a function.

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

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

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

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

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

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

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

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

17.9   Find the derivatives of hyperbolic functions.

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

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

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

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

17.14 Explain the definition of Homogenous function of degree n

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

UNIT - V

Applications of the Differentiation

18.0   Understand the Geometrical Applications of Derivatives

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

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

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

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

19.0   Understand the Physical Applications of Derivatives

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

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

20.0   Use Derivatives to find extreme values of functions

20.1   Define the concept of increasing and decreasing functions.

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

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

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

21.0   Use Derivatives to find Errors and Approximations

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

COURSE CONTENT

Unit-I

Algebra

1. Logarithms :

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

2. Partial Fractions :

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

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

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

Matrices:

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

Unit-II

Trigonometry :

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

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

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

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

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

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

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

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

10. Properties and solutions of triangles: relation between sides and angles of a triangle- sine rule, cosine rule, tangent rule and projection rule-area of a triangle- solving a triangle-problems.

11. Hyperbolic functions: Definitions of hyperbolic functions, identities of hyperbolic functions, inverse hyperbolic functions and expression of inverse hyperbolic functions in terms of logarithms.

12. Complex Numbers: Definition of a complex number, Modulus and conjugate of a complex number, Arithmetic operations on complex numbers, Modulus- Amplitude (polar) form, Exponential form (Euler) form of a complex number- Problems. DeMoivre's Theorem and its applications in complex numbers- Simple problems.

UNIT-III

Coordinate geometry

13. Straight lines: various forms of straight lines, angle between lines, perpendicular distance from a point, distance between parallel lines-examples.

14. Circle: locus of a point, Circle definition-Circle equation given (i) center and radius, (ii) two ends of a diameter (iii) centre and a point on the circumference (iv) three non collinear points - general equation of a circle - finding center, radius.

15. Definition of a conic section, equation of a conic when focus directrix and eccentricity are given. Properties of parabola, ellipse and hyperbola, standard forms.

UNIT-IV

Differential Calculus

16. Concept of Limit- Definition- Properties of Limits and Standard Limits -Simple Problems- Continuity of a function at a point- Simple Examples only.

17. Concept of derivative- definition (first principle) - different notations-derivatives of elementary functions - problems. Derivatives of sum, product, quotient, scalar multiplication of functions - problems. Chain rule, derivatives of inverse trigonometric functions, derivative of a function with respect to another function, derivative of parametric functions, derivative of hyperbolic, implicit functions, logarithmic differentiation – problems in each case. Higher order derivatives - examples – functions of several variables – partial differentiation, Euler's theorem-simple problems.

UNIT-V

Applications of Derivatives:

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

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

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

21. Applications of derivative in finding errors and approximations of functions and simple problems.

Reference Books :

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

ENGINEERING PHYSICS
(Common to all Branches)

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

TIME SCHEDULE

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

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

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

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

3.0 Understand the concept of Kinematics
3.1 Write the equations of motion in a straight line
3.2 Explain the acceleration due to gravity
3.3 Derive expressions for vertical motion
a) Maximum Height, b) time of ascent, c) time of descent, and d) time of flight
3.4 Derive height of a tower when a body projected vertically upwards from the top of

a tower.
3.5 Explain projectile motion with examples
3.6 Explain Horizontal projection
3.7 Derive an expression for the path of a projectile in horizontal projection
3.8 Explain oblique projection
3.9 Derive an expression for the path of projectile in oblique projection
3.10 Derive formulae for projectile in oblique projection
a) Maximum Height, b) time of ascent, c) time of descent, and d) time of flight
e) Horizontal Range, f) Maximum range
3.11 Solve the related numerical problems

4.0 Understand the concept of Friction
4.1 Define friction
4.2 Classify the types of friction and define
4.3 Explain the concept of Normal reaction
4.4 State the laws of friction
4.5 Define coefficients of friction
4.6 Explain the Angle of friction
4.7 Derive an expression for acceleration of a body on a rough horizontal surface
4.8 Derive an expression for the displacement and time taken to come to rest over

a
rough horizontal surface
4.9 Define Angle of repose
4.10 Derive expressions for acceleration of a body on a smooth inclined plane (up and down)
4.11 Derive expressions for acceleration of a body on a rough inclined plane (up

and down)

        4.12 List the Advantages and Disadvantages of friction
        4.13 Mention the methods of minimizing friction
        4.14 Solve the related numerical problems

5.0   Understand the concepts of Work, Power, and Energy

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

6.0   Understand the concept of Simple harmonic motion

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

7.0   Understand the concept of Heat and thermodynamics

        7.1   Explain the concept of expansion of gases
        7.2   State and explain Boyle's law and also express it in terms of density
        7.3   Define absolute zero temperature
        7.4   Explain absolute scale of temperature
        7.5   State Charles laws in terms of absolute temperature and explain
        7.6   Define ideal gas and distinguish from real gas
        7.7   Derive Ideal gas equation
        7.8   Define Specific gas constant and Universal gas constant
        7.9   Explain why universal gas constant is same for all gases
        7.10 State SI unit and dimensional formula of universal gas constant
        7.11 Calculate the value of universal gas constant
        7.12 State the gas equation in different forms (as a function of density and mass)
        7.13 Distinguish between r and R
        7.14 State and Explain Isothermal process
        7.15 State and Explain adiabatic process
        7.16 Distinguish between isothermal and adiabatic processes

7.17 State first and second laws of thermodynamics and state applications
7.18 Define specific heats & molar specific heats of a gas and differentiate them
7.19 Derive the relation $C_p - C_v = R$ (Mayer's Equation)
7.20 Solve the relevant numerical problems

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

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

10.0   Understand the concept of Electricity and Magnetism
10.1   Explain the concept of Electricity
10.2   State Ohm's law and write the formula
10.3   Explain Ohm's law
10.4   Define specific resistance, conductance and state their units

10.5 State Kirchoff's laws
10.6 Explain Kirchoff's laws
10.7 Describe Wheatstone's bridge with legible sketch
10.8 Derive an expression for balancing condition of Wheatstone's bridge
10.9 Describe Meter Bridge experiment for the determination of resistivity with a neat circuit diagram
10.10 Write the formula in Meter Bridge to determine specific resistance
10.11 Explain the concept of magnetism
10.12 State the Coulomb's inverse square law of magnetism
10.13 Define magnetic field and magnetic lines of force and write the properties of magnetic lines of force
10.14 State the Magnetic induction field strength and mention its units and dimensionsal formula
10.15 Derive an expression for the moment of couple on a bar magnet placed in a uniform magnetic field
10.16 Derive Magnetic induction field strength at a point on the axial line
10.17 Derive Magnetic induction field strength at a point on the equatorial line
10.18 Solve the related numerical problems

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

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

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

3. Kinematics

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

4. Friction:

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

5. Work, Power and Energy:

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

6. Simple Harmonic Motion:

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

7. Heat and Thermodynamics:

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

8. Sound:

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

9. Properties of matter

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

10. Electricity & Magnetism:

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

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

REFERENCE BOOKS

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

Blue Print for setting question paper at different levels

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

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

Subject Title   **: Engineering Chemistry & Environmental Studies**
Subject Code   **: Common-104**
Periods per week   **: 04**
Total periods per year   **: 120**
Scheme of instruction and examination Time Schedule

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

OBJECTIVES

Upon completion of the course the student shall be able to

A.ENGINEERINGCHEMISTRY

1.0 Understand the concept of Atomic structure

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

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

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

1.4   Explain the significance of four Quantum numbers.

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

1.6   Define Orbital in an atom.

1.7   Draw the shapes of s, p and d - Orbitals .

1.8   Distinguish between Orbit and Orbital

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

1.10   Explain the significance of chemical bonding

1.11   Explain the Postulates of Electronic theory of valency

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

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

1.14   Explain bond formation in NaCl and MgO.

1.15   List Properties of Ionic compounds

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

1.17   List Properties of Covalent compounds

1.18   Distinguish between properties of ionic compounds and covalent compounds.

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

1.20   Structures of Unit cells of NaCl and CsCl.

1.21   Define the term. Oxidation number.

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

       a)K$\underline{Mn}$O$_4$ b) K$_2$$\underline{Cr}_2O_7$ c) H$\underline{N}$O$_3$ d) H$_2$$\underline{S}O_4$ e) $\underline{Cl}$O$_4^-$ f) $\underline{N}$H$_4^+$

1.23   Differentiate between Oxidation Number and Valency

2.0   Calculate Molarity and Normality of given Solution

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

2.2   Classify solutions based on physical state and solubility

2.3   Define mole

2.4   Problems on 'Mole concept'

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

2.6   Calculate Molecular weight and Equivalent weight of given
       Acids,(HCl,H$_2$SO$_4$HNO$_3$)Bases (NaOH, KOH, Ca(OH)$_2$) and Salts (NaCl, Na$_2$CO$_3$, CaCO$_3$)

2.7   Define 1.Molarity, 2.Normality of solutions

2.8   Solve Numerical problem son Molarity and Normality

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

       given

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

given

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

3.0   Understand the concepts of Acids and bases

3.1   Explain Arrhenius theory of Acids and Bases
3.2   State the limitations of Arrhenius theory of Acids and Bases
3.3   Explain Bronsted – Lowry theory of acids bases
3.4   State the limitations of Bronsted – Lowry theory of acids bases
3.5   Explain Lewis theory of acids and bases
3.6   State the limitations of Lewis theory of acids and bases
3.7   Explain the Ionic product of water
3.8   Define pH and explain Sorens on scale
3.9   Solve the Numerical problems on pH(Strong Acids and Bases)
3.10   Define Buffer solution
3.11   Give atleast three examples for Buffer solutions
3.12   State the applications of Buffer solution

4.0   Understand the Principles of Metallurgy

4.1   List at least eight Characteristics of Metals
4.2   Distinguish between Metals and Non Metals
4.3   Define the terms 1.Mineral, 2.Ore, 3. Gangue, 4.Fluxand 5.Slag
4.4   Describe the methods of concentration of Ore; 1.Handpicking,2.Levigation, 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 Metals by Electrolytic Refining
4.7   Define an Alloy
4.8   Write the Composition of the following alloys:1.Brass, 2.Germansilver, 3 Nichrome
4.9   List the uses of the following Alloys: 1. Brass, 2.Germansilver, 3.Nichrome

5.0   Understand the concepts of Electrochemistry
5.1   Define the terms1. Conductor, 2. Insulator, 3.Electrolyte 4.Non–electrolyte
5.2   Distinguish between metallic conduction and Electrolytic conduction
5.3   Explain electrolysis by taking example fused NaCl
5.4   Explain Faraday's laws of electrolysis
5.5   Define 1.Chemical equivalent (E) 2.Electrochemicalequivalent (e) and their relation.
5.6   Solve the Numerical problems based on Faraday's laws of electrolysis
5.7   Define Galvanic cell

5.8   Explain the construction and working of Galvanic cell

5.9   Distinguish between electrolytic cell and galvanic cell

5.10 Explain the electrode potentials and standard electrode potentials

5.11 Explain the electro chemical series and its significance

5.12 Explain the emf of a cell.

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

6.0   Understand the concept of Corrosion

6.1   Define the term corrosion

6.2   state the Factors influencing the rate of corrosion

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

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

6.5   Explain the methods of prevention of corrosion:

a)Protective coatings (anodic and cathodic coatings)

      b) Cathodic protection(Sacrificial anode process and

Impressed–voltage process)

7. 0   Understand the concept of Water Technology

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

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

7.3   Define the term hardness of water

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

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

7.6   State the disadvantages of using hard water in industries

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

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

7.9   Concept of Osmosis and Reverse Osmosis with examples .

7.10 State the applications of Reverse Osmosis.

7.11 State essential qualities of drinking water.

8.0   Understand the concepts of Polymers

8.1 Explain the concept of polymerization

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

8.3 Define the term plastic

8.4 Classify the plastics with examples

8.5 Distinguish between thermo and thermo setting plastics

8.6 List the Characteristics of plastics

8.7 State the advantages of plastics over traditional materials

8.8 State the disadvantages of using plastics.

8.9 Explain the methods of preparation of the following plastics:

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

8.10 Explain the uses of the following plastics:

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

8.11 Define the term natural rubber

8.12 write the structural formula of Natural rubber

8.13 Explain the processing of Natural rubber from latex

8.14 List the Characteristics of natural rubber

8.15 Explain the process of Vulcanization

8.16 List the Characteristics of Vulcanized rubber

8.17 Define the term Elastomer

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

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

9.0 Understand the concepts of Fuels

9.1 Define the term fuel

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

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

9.4 List the characteristics of good fuel

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

B. ENVIRONMENTALSTUDIES

1.1 Define the term environment

1.2 Explain the scope and importance of environmental studies

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

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

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

1.6   Define the terms:

   1).Producers, 2).Consumers and 3).Decomposers with examples.

1.7   Explain bio diversity and threats to biodiversity

1.8   Define air pollution

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

1.10   Explain the causes of Air pollution.

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

1.12   State the uses of forest resources.

1.13   State the deforestation and its causes and effects.

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

1.15   Explain the methods of control of Air pollution

1.16   Define Water pollution

1.17   Explain the causes of Water pollution

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

1.19   Explain the methods of control of Water pollution.

COURSE CONTENT

A.   ENGINEERINGCHEMISTRY

1.   Fundamentals of Chemistry

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

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

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

2.   Solutions

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

3.   Acids and Bases

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

4.   Principles of Metallurgy

Characteristics of Metals and distinction between Metals and Non Metals, Metallurgy, ore, Gangue, Flux, Slag - Concentration of Ore –Hand picking, Levigation, Froth

floatation – Methods of Extraction of crude Metal – Roasting, Calcination, Smelting – Alloys – Composition and uses of Brass, German silver and Nichrome

5. Electrochemistry

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

6. Water technology

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

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

8. Polymers

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

9. Fuels

Definition and classification of fuels–characteristicsofgoodfuel- compositionandusesofgaseousfuels.

B. ENVIRONMENTALSTUDIES

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

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

REFERENCEBOOKS

1. Intermediate chemistry Vol 1&2   Telugu Academy

2. Intermediate chemistry Vol 1&2   Vikram Publishers

3. Intermediate chemistry Vol 1&2   Vignan Publishers &Deepthi Publishers

4. Engineering Chemistry   Jain & Jain

5. Engineering Chemistry   O.P. Agarwal, Hi-Tech.

6. Engineering Chemistry   Sharma

7. Engineering Chemistry   A.K. De

ENGINEERING MECHANICS

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

TIME SCHEDULE

S No.	Major Topics	No. of Periods	Weightage of Marks	Short Answer Questions	Essay Type Questions
1	Statics	16	16	02	01
2	Friction	16	16	02	01
3	Dynamics	14	13	01	01
4	Simple machines	20	23	01	02
5	Basic Link Mechanisms	16	16	02	01
6	Transmission of power	28	26	02	02
	Total	**120**	**110**	**10**	**08**

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

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

2.0 Understand the concept of Friction
    2.1   Explain the concept of friction
    2.2   State the laws of friction

2.3	Identify the machine members in which friction exists and desirable
2.4	Resolve the forces acting on bodies moving on horizontal plane.
2.5	Resolve the forces acting on bodies moving along the inclined planes.
2.6	Solve the related numerical problems

3.0   Understand the concept of Dynamics
- 3.1   Define the terms Kinematics and Kinetics
- 3.2   Classify the motion types
- 3.3   Define the terms displacement, velocity and acceleration
- 3.4   Solve the problems related to the rectilinear motion of a particle
- 3.5   Explain the Motion of projectile
- 3.6   Solve the numerical problems
- 3.7   State the D'Alembert's principle
- 3.8   Define the Law of conservation of energy
- 3.9   Explain the Work-Energy principle
- 3.10   Define the Law of conservation of momentum
- 3.11   Explain the Impulse –Momentum equation
- 3.12   Solve the problems using the above principles
- 3.13   Explain the Rotary motion of particle
- 3.14   Define Centripetal force.
- 3.15   Define Centrifugal force.
- 3.16   Differentiate Centripetal and Centrifugal forces

4.0   Comprehend the Principles involved in Simple Machines
- 4.1   Define the important terms of simple machines
       a) Machine, b) Mechanical Advantage, c) Velocity Ratio, d) Efficiency.
- 4.2   Illustrate the use of three classes of simple lever.
- 4.3   Show that an inclined plane is a simple machine to reduce the effort in lifting loads.
- 4.4   Derive expression for Velocity Ratio in cases of Wheel & Axle, Weston Differential pulley blocks, Pulleys, Worm & Worm wheel, Winch crabs, Screw jack, Rack & Pinion.
- 4.5   Compute the efficiency of a given machine.
- 4.6   Compute effort required to raise or lower the load under given conditions.
- 4.7   Interpret the law of machine.
- 4.8   State the conditions for self-locking and reversibility.
- 4.9   Calculate effort lost in friction and load equivalent of friction.
- 4.10   Evaluate the conditions for maximum Mechanical Advantage & Maximum efficiency.

5.0   Understand the concept of Basic Link mechanism
- 5.1   Define important terms of basic link mechanism
       a) Link, b) Kinematics pair, c) Kinematic chain, d) Mechanism & e) Machine
- 5.2   Explain kinematic pair and kinematic chain with the help of legible sketch
- 5.2   List examples for Lower and Higher pairs.
- 5.3   List examples of inversion.

6.0   Understand the concept of transmission of power in Engineering.
- 6.1   Identify various power transmitting media like belt, chain, rope, gears.
- 6.2   Select suitable material for belt.
- 6.3   Explain the belt fasteners

6.4   Derive the expression for velocity ratio of a belt drive.
6.5   Explain the term slip in belt and its effect on velocity ratio.
6.6   Explain the combined effect of belt thickness and slip on velocity ratio.
6.7   Explain the use of jockey pulley.
6.8   Distinguish between open belt drive and cross belt drive.
6.9   Explain the tensions in tight and slack sides of a belt.
6.10   Calculate velocity ratio and power in belt drive.
6.11   Explain the rope drive state the advantages and limitations.
6.12   Explain the chain drive state the advantages and limitations.
6.13   Explain the types of chain.
6.14   Explain the principle of gear drive state the advantages and limitations.
6.15   Classify the gears.
6.16   Explain nomenclature of gear
6.17   Discuss the simple and compound gear train.
6.18   Explain the applications of the above drives in engineering.
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COURSE CONTENT
1.0   Statics
1.1   The meaning of word mechanics.
1.2   Application of Mechanics in Engineering.
1.3   System of Units.
1.4   Definition and specification of force
1.5   System of forces
1.6   Resolution of force
1.7   Equilibrium and Equilibrant.
1.8   Statement of Parallelogram law of forces, Triangle law of forces, Polygon law of forces and Lami's theorem
1.9   Drawing the free body diagram
1.10   Numerical problems related to concurrent coplanar forces
1.11   Couple and moment of a couple
1.12   Condition for equilibrium of a rigid body subjected to number of coplanar non-concurrent forces.
1.13   Related numerical problems

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

3.0   Dynamics
3.1   Definition of Kinematics and Kinetics
3.2   Classification of motion
3.3   Definition of displacement, velocity and acceleration

3.4   Laws of motion (without derivation)
3.5   Solving the problems related to the rectilinear motion of a particle
3.6   Motion of projectile and solving the numerical problems
3.7   Newton's laws of motion.
3.8   D'Alembert's principle
3.9   Definition Law of conservation of energy
3.10   Work - Energy principle
3.11   Law of conservation of momentum
3.12   Impulse – Momentum equation
3.13   Solving the kinetic problems using the above principles
3.14   Rotary motion of particle and laws of rotary motion
3.15   Definition and Differentiate Centripetal and Centrifugal forces.
3.16   Simple Harmonic Motion (SHM).
3.17   Definition of the terms frequency, time period, amplitude and circular frequency
3.18   SHM equation, natural frequency
3.19   Simple problems on SHM

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

5.0   Basic Link Mechanism
5.1   Definition of terms: Link, Kinematic pair, Kinematic chain,
        Mechanism, Structure and Machine.
5.2   Quadric cycle chain and its inversions.
5.3   Slider Crank chain and its inversion.

6.0   Transmission of power:
6.1   Belt drive, Materials for the belt drive and belt fasteners.
6.2   (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.
      (b) Open belt and Cross belt drive.
      (c) Effective tension $(T_1 – T_2)$.
      (d) Velocity of the belt and Power transmitted by belt
      (e) Problems –Velocity ratio, Slip and Power transmitted in a belt drive.
6.3   Rope drive – Advantages and limitations over a belt drive.
6.4   Chain drive – Advantages and limitations over a belt drive.
6.5   Types of chains.
6.6   Gears and Gear trains
      a) Nomenclature of gear
      b) Types of gears – spur, helical, bevel, and spiral.

c) Simple and compound gear trains.
d) Velocity ratio in gear drive processes and problems.
e) Advantages and limitations 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

WORKSHOP TECHNOLOGY

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

TIME SCHEDULE

S. No.	Major Topics	No. of Periods	Weightage of Marks	Short Answer Questions	Essay type Questions
1	Basic Workshop tools & operations				
	(1) Carpentry	20	16	2	1
	(2) Fitting	25	26	2	2
	(3) Forging	15	13	1	1
	(4) Sheet metal	12	13	1	1
2	Drilling	08	13	1	1
3	Foundry	22	16	2	1
4	Mechanical working of metals	18	13	1	1
	Total	120	110	10	08

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

1.0 Comprehend the use of Basic workshop tools and its operation
a. State the importance of workshop processes.
b. List the various workshop processes and explain briefly about each.

1.1 Carpentry
a. Identify various carpentry tools.
.
b. List work holding devices.
c. Explain wood working processes viz., sawing, chiseling 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   Understand the concept of drilling
2.1 State the working principle of drilling.
2.2 List out different types of drilling machines.
2.3 Draw the line diagrams of the sensitive and radial drilling machines.
2.4 Identify the parts of 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   Understand the concept of Foundry
3.1 Acquaint with foundry as a manufacturing process.
3.2 State the advantages of casting over other process.
3.3 State the limitations of the process.
3.4 List the various hand moulding tools.
3.5 State the properties of good moulding sand.
3.6 State the types of moulding sands.
3.7 List the ingredients in foundry sand.
3.8 List the various types of patterns.
3.9 State the sequence of pattern making operations.
3.10 List the various moulding processes.
3.11 State the need and types of cores.
3.12 Describe the casting processes.
3.13 Identify the defects in casting.
3.14 Describe special casting processes.

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**
     1.1.1 Marking & measuring tools: scales, rules, fourfold wooden rule, flexible measuring rule (tape), straight edge, try square, bevel square, combination square, marking knife, marking gauge, mortise gauge, wing compass, trammel, divider, spirit level
     1.1.2 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,

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

     1.1.4 Holding devices
          Bench vice, bench stop, sash cramp (bar cramp) G- cramp,.
     1.1.5 Miscellaneous tools
          Rasps and files, scraper, oilstone, glass paper, pincer, screw driver
     .
     1.1.6 Carpentry Processes
          Marking, measuring, sawing, chiselling, planning, boring, grooving
          .

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

     1.1.8 Wood working machines
          Wood working lathe (wood turning lathe), circular saw, band saw, wood planer, sanding machine, belt sander
1.2   **Fitting**

1.2.1 **Cutting tools**
Chisels: Flat chisel, cross cut chisel, half round chisel, diamond point chisel, side chisel, specifications and uses.
Files: Different parts of a file –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.

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

1.2.3 **Holding Devices**
Vices: Bench vice, hand vice, pin vice, tool makers vice, pipe vice, specifications and uses.

1.2.4 **Marking Tools**
Surface plate, V-block, angle plate, scriber, punch - prick punch, centre punch, number punch, letter punch, specifications and uses.

1.2.5 **Miscellaneous Tools**

Screwdrivers, spanners,cuttingpliers,nosepliers,allenkeys.

1.2.6 **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, micrometer - outside & inside, - specifications and uses.

1.2.7 **Fitting Operations :**
Marking, sawing, chipping, filing, scrapping,drilling, reaming,grinding, tapping and dieing.

1.3 **Forging**

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

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

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

1.3.4 **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.

1.3.5 **Forging defects:** Types and remedies.

1.4 **Sheet Metal Work**

1.4.1 Metals used for sheet metal work.

1.4.2 **Sheet metal hand tools**:
Measuring tools - steel rule, circumference rule, thickness gauge, sheet metal gauge, straight edge, 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.

1.4.3 **Sheet Metal Operations**
Shearing: Cutting off, parting, blanking, punching, piercing, notching, slitting, lancing, nibbling and trimming.
Bending: Single bend, double bend, straight flange, edge hem, Embossing, beading, planishing, flanging.
Drawing: Deep drawing, shallow or box drawing.
Squeezing: Sizing, coining, hobbing, ironing, riveting.

1.4.4 **Sheet Metal Joints**
Hem Joint: single hem, double hem & wired edge, **seam joint** -lap seam, grooved seam, single seam, double seam, dovetail seam, burred bottom seam or flanged seam.
Notches – straight notch , sqare notch and slant notch

1.4.5 **Fastening Methods**
Riveting, soldering, brazing & spot welding.

2 **Drilling**

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

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

3 **Foundry.**

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

3.2 **Foundry equipment:**

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

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

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

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

3.6 **Cores:** Need of cores, types of cores.

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

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

4 **Mechanical working of metals**

4.1 **Introduction:** Hot working and cold working

4.2 **Hot working processes:** rolling - types of rolling, two high mill, three high mills, four high mills, piercing or seamless tubing, drawing or cupping, spinning, extrusion - direct or forward extrusion, indirect or backward extrusion, tube extrusion, Impact extrusion.

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

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

4.5 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 (Mc Graw Hill)
3. Workshop Technology Vol I & II   by   Raghuvamshi

ENGINEERING DRAWING

Subject Title	:	**Engineering Drawing**	
Subject Code	:	**107 (Common to all Branches)**	
Periods/Week	:	**06**	
Periods Per Year	:	**180**	

Time Schedule

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

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

OBJECTIVES

Upon completion of the subject the student shall be able to

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

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

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

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

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

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

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

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

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

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

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

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

COURSE CONTENT

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

1) The importance of Engineering Drawing

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

2) Engineering drawing Instruments

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

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

3) Free hand lettering & numbering

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

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

4) Dimensioning practice

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

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

5) Geometric Constructions

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

Construction of ellipse by concentric circles method - Construction of parabola by rectangle method - Construction of rectangular hyperbola - General Curves: Involute, Cycloid and Helix, explanations as locus of a moving point, their engineering applications, viz, Gear tooth profile, screw threads, springs etc. - their construction.

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

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

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

6) Projection of points, lines, planes & solids

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

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

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

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

7) Auxiliary views

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

Drawing plate 10: Consisting of four exercises on auxiliary views

8) Sectional views

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

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

9) Orthographic Projections

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

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

10) Pictorial Drawings

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

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

11) Development of Surfaces

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

Drawing plate 14: Consisting of 5 exercises on development problems

REFERENCE BOOKS

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

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

Engineering Drawing　　　　　by　　　N.D.Bhatt.

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

SP-46-1998 – Bureau of Indian Standards.

BASIC WORKSHOP PRACTICE

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

TIME SCHEDULE

S.No	Major Title	No of Periods
1.	Fitting shop	36
2.	Forging shop	39
3.	Carpentry shop	51
4.	Sheet metal work	51
	Test	03
	Total	180

OBJECTIVES

Upon completion of the course the student shall be able to

- **Practice the required operations in Fitting Shop**

- **Practice the required operations in Forging Shop**

- **Practice the required operations in Carpentry Shop**

- **Practice the required operations in Sheet metal Shop**

Competencies and Key competencies to be achieved by the student.

Title of the Job	Competencies	Key Competencies
Fitting shop 1.Marking and Chipping on Mild steel flat of 12 mm thick (12)	− Identify appropriate measuring tool − Handle appropriate marking tool − Handle appropriate chipping tool − Mark the dimensions − Remove the material by chipping from MS flats	• Mark the dimensions • Remove the material by chipping from MS flats
2.Cutting with hack saw of MS flats of 6mm thick (06)	− Check the raw material for size − Fix the work piece in vice − Mark the work as per given dimensions − Perform dot punching − Load and unload hack saw blade from its frame − Use the hack saw to perform cutting operation	• Load and unload hack saw blade from its frame • cut the work as per marked dimensions using Hack saw
3.Drilling and chamfering on MS flat of 12mm thick (06)	− Check the raw material for size − Apply the chalk on the surface and on all sides of the flat − Layout the dimensions and mark the lines using dot punch − Chamfer the edges through filing − Locate the hole centres using odd leg callipers and centre punching − Identify appropriate drill bit − Load and unload drill bit from the machine	• Load and unload drill bit from the machine

4.Tapping and Dieing on a MS flat of 12mm thick (06)	− Check the raw material for size − Identify appropriate tap and die − Secure the tap in the wrench − Tap the hole − Hold the bar in bench vice − Fix the die in die stock − Cut external threads using a Die − Check the fit for accuracy	• Identify appropriate tap • Secure the tap in the wrench • Tap the hole • Fix the die in die stock • Cut external threads using a Die
5.Assembling of two pieces, matching by filing 6mm thick MS flat (06)	− Cut the pieces to size using hack saw − File surface of flat for trueness − Mark the surfaces as per dimensions − Dot punch the marked lines − Cut with hack saw as per marked lines − Smoot the surfaces with file − Assemble the two pieces	• Identify appropriate file • File the specimen • Assemble two pieces

Title of the Job	Competencies	Key Competencies
Forging shop 6.Conversion of Round to Square (09)	− Identify the holding and striking tools − Heat the specimen to the appropriate temperature − Remove the specimen and hold it on the anvil − Hammer the specimen to the required shape	• Heat the specimen to the appropriate temperature • Hammer the specimen to the required shape
7.Conversion of Round to Hexagon (09)	− Identify the holding and striking tools − Heat the specimen to the appropriate temperature − Remove the specimen and hold it on the anvil − Hammer the specimen to the required shape	• Heat the specimen to the appropriate temperature • Hammer the specimen to the required shape
8.Preparation of a Chisel from round rod (09)	− Identify the holding and striking tools − Heat the specimen to the appropriate temperature − Remove the specimen and hold it on the anvil − Hammer the specimen to the required shape	• Heat the specimen to the appropriate temperature • Hammer the specimen to the required shape
9.Preparation of a ring and hook from M.S round (06)	− Identify the holding and striking tools − Heat the specimen to the appropriate temperature − Remove the specimen and hold it on the anvil − Hammer the specimen to the required shape	• Heat the specimen to the appropriate temperature • Hammer the specimen to the required shape
10.Preparation of a hexagonal bolt and nut (06)	− Identify the holding and striking tools − Heat the specimen to the appropriate temperature − Remove the specimen and hold it on the anvil − Hammer the specimen to the required shape	• Heat the specimen to the appropriate temperature • Hammer the specimen to the required shape

Title of the Job	Competencies	Key Competencies
Carpentry Shop 11.Cutting of wood with hand saw (06)	− Identify the orientation of grains − Select appropriate saw for cutting in each of the directions viz. across and along the grains − Select appropriate work holding device − Handle appropriate measuring and marking tools(Steel rule, Try square, Marking gauge) − Mark dimensions on work using Marking gauge − Fix the work in the vice − Perform cutting along the grains using Rip saw − Change the position of work in the vice − Perform cutting perpendicular the grains using cross cut saw	• Identify the orientation of grains • Mark dimensions on work using marking gauge • Perform cutting along and perpendicular the grains using appropriate saw
12.Planing of wood(06)	− Identify the direction for planing wood stock − Select appropriate jack plane − Prepare the jack plane for planing (Load and unload the blade of a jack plane − Select appropriate work holding device − Perform marking on work using appropriate tool − Fix the work in the vice − Plane the surfaces on all four sides using jack plane	• Identify the direction for planing wood stock • Prepare the jack plane for planing • Plane the surfaces on all four sides using jack plane

Title of the Job	Competencies	Key Competencies
Contd.,,, 13.Chiselling of wood (06)	− Select appropriate chisels and saw − Select appropriate work holding device − Select appropriate measuring and marking tools − Fix the work in the vice − Mark the position of grooves on work using marking gauge − Cut sides of grooves by hand saw − Chip the material using firmer chisel by applying pressure with mallet − Finish the grooves with rasp file	• Select appropriate chisels and saw • Mark the position of grooves on work using marking gauge • Cut sides of grooves by hand saw • Chip the material using firmer chisel by applying pressure with mallet
14.Preparation of a Dove tail joint (09)	- Select the appropriate cutting tools and work holding devices - Plane the wooden pieces on all sides - Mark at an angle of 75^0 with bevel square - Trim the dovetail by chisel to exact size - Cut the dovetail groove on second piece - Finish the groove - Assemble the two pieces to prepare dovetail halving joint by using mallet	• Trim the dovetail by chisel to exact size • Mark at an angle of 75^0 with bevel square • Cut the dovetail groove on second piece • Assemble the two pieces to prepare dovetail halving joint by using mallet
15.Preparation of Mortise and Tenon joint (09)	- Select the appropriate cutting tools and work holding devices - Plane the two pieces to the required size using jack plane - Mark the dimensions to make tenon using mortise gauge - Cut tenon with tenon saw along the marked lines	• Mark the dimensions to make tenon and mortise on two pieces using mortise gauge • Cut tenon with tenon saw along the marked lines

Title of the Job	Competencies	Key Competencies
Contd.,,, Preparation of Mortise and Tenon joint	− Use firmer chisel to remove the excess material to set finished tenon − Mark the dimension to make mortise on the second piece with mortise gauge − Use mortise chisel to provide recess in the second piece to accommodate tenon − Assemble the two pieces by fitting the tenon into mortise	• Use mortise chisel to provide recess in the second piece to accommodate tenon • Assemble the two pieces by fitting the tenon into mortise
16.Wood turning on lathe (06)	− Select appropriate tools − Plane the four corners of the work piece using jack plane − Mark the centres of the work on either side − Mount the work between head stock & tailstock centres − Fix the tool in the tool post & Position it in appropriate height − Start the lathe to make the work piece to revolve at desired speed − Feed the bevel gauge against the rotating work to get the required size and shape − Use outside callipers to check the diameter of the work piece − Use parting off tool to reduce the diameter on either ends of the work piece − Remove the work piece between centres and cut off excess material on either sides	• Mark the centres of the work on either side • Fix the tool in the tool post & Position it in appropriate height • Start the lathe to make the work piece to revolve at desired speed • Feed the bevel gauge against the rotating work to get the required size and shape

Title of the Job	Competencies	Key Competencies
Contd.,,, 17.Preparation of any household article (ex: stool) (09)	– Prepare the drawings of a stool required for a particular drawing table – State the specifications of the wood stock required – Identify the type of joints to be made – Identify the operations to be made and their sequence – Perform operations to produce pieces of joint – Assemble all joints as per the drawing	• Prepare the drawings of a stool required for a particular drawing table • Identify the operations to be made and their sequence • Perform operations to produce pieces of joint • Assemble all joints as per the drawing

Title of the Job	Competencies	Key Competency
Sheet metal Work 18.Practice on cutting of sheet (06)	– Cut the required sheet from the stock using snip – Mark the dimensions on the sheet using scriber & steel rule – Draw the circular shapes using divider – Perform rough cutting of the curved shapes using chisel and finish cutting using snips – Cut the straight edges using straight snips	• Identify the marking and cutting tools • Cut the sheet of different shapes using appropriate tools
19.Formation of joints like grooved joint, locked groove joint (06)	– Cut the sheet in to two halves – Form the flange on the sheet by folding the sheet along scribed lines using mallet & stakes – Perform bending edges of sheets applying moderate pressure using mallet – Inter lock the bent edges and apply pressure with mallet to make required joint	• Identify the marking and cutting tools • Cut the sheet • Perform bending along the marked lines.

Title of the Job	Competencies	Key Competency
20.Preparation of a rectangular open type tray (09)	− Draw the development of the object to be made − Place the pattern on the sheet − Mark the dimensions using scriber − Shear the required piece from the stock using straight snips − Mark the lines on the sheet to form bends − Strengthen the sides of sheet by single hem using hatchet stake − Form the sheet in to desired shape using stakes − Seam the corners by inserting laps of the adjacent sides with single hem	• Drawing development of objects • Cut the sheet • Seam the corners by inserting laps of the adjacent sides with single hem
21.Preparation of hollow cylinder (06)	− Draw the development of the object to be made − Place the pattern on the sheet − Mark the dimensions using scriber − Shear the required piece from the stock using straight snips − Mark the lines on the sheet to form bends − Strengthen the sides of sheet by single hem on top & bottom side using hatchet stake − Form the flat sheet into cylindrical shape by cylindrical stake and apply pressure using mallet − Prepare single hem on to longitudinal sides in opposite directions − Inter lock the sides and apply pressure to make a strong joint	• Identify the marking and cutting tools • Drawing development of objects • Cut the sheet • Inter lock the sides and apply pressure using mallet to make a strong joint

Title of the Job	Competencies	Key Competency
22.Preparation of pipe elbow (09)	− Draw the development of a cylindrical pipe truncated at an angle of 45^0 on one side − Scribe the lines on the sheet by placing the pattern on it − Cut the sheet over the marked dimensions using curved snips − Hem the straight side of the sheet and flange the curved side − Fold the edges of joining sides − Form the sheet into cylindrical shape using stakes − Seam the sides using mallet − Repeat the similar operation for making the second pipe − Butt the treated portions of the cylindrical pipes at rectangles − Seam the two pipes − Solder the joint to make leak proof	• Draw the development of a cylindrical pipe truncated at an angle of 45^0 on one side • Cut the sheet over the marked dimensions using curved snips • Form the sheet into cylindrical shape using stakes

Title of the Job	Competencies	Key Competency
23.Preparation of funnel (09)	− Draw the development of upper conical part − Place the pattern on the sheet and cut to required size − Hem the upper side of the sheet − Flange out the bottom side of the sheet − Fold the edges of the joining sides − form the sheet into conical shape using appropriate stake and mallet − Repeat the similar operation for making the bottom part − Seam the top conical part and bottom conical part to obtain required funnel	• Draw the development of upper and bottom conical parts • Place the pattern on the sheet and cut to required size • form the sheet into conical shape using appropriate stake and mallet • Seam the top conical part and bottom conical part to obtain required funnel
24.Preparation of utility articles such as dust pan, kerosene hand pump (06)	− Draw the development of given dust pan − Scribe the lines on the sheet and cut to required size − Hem all the four sides to strengthen the edges − Form the sheet into designed shape using suitable stakes and mallet − Solder the corner lap joints to make the required dust pan	• Identify the marking and cutting tools • Drawing development of objects • Cut the sheet • Perform bending along the marked lines and to form the article

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. Planing of wood.
3. Planing and chiseling of wood.
4. Orientation of wood grain.
5. Preparation of dovetail joint.
6. Mortise and tenon joint.
7. Wood turning on a lathe.
8. Preparation of one household article.

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

REFERENCE BOOKS

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

PHYSICS LABORATORY
(Common to all Branches)

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

TIME SCHEDULE

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

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

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

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

3.0   Verify the parallelogram law and Triangle law

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

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

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

7.0   Determine the refractive index of a solid using travelling microscope

8.0   Determine the surface tension of a liquid using travelling microscope

9.0   Determine the viscosity of a liquid using capillary method

10.0 Verify the Boyle's law employing a Quill tube

11.0 Determine the specific resistance of material of a wirel using Meter Bridge

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

Competencies and Key competencies to be achieved by the student

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

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

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

CHEMISTRY LABORATORY
(Common to all Branches)

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

TIME SCHEDULE

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

Objectives:

Upon completion of the course the student shall be able to

1.0 Practice volumetric measurements (using pipettes, measuring jars, volumetric flask, burettes) and gravimetric measurements (using different types of balances), making dilutions, etc.

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

3.0 Conduct titrations adopting standard procedures and using Std. Na_2CO_3 solution for estimation of HCl

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

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

estimation of H_2SO_4

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

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

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

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

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

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

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

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

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

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

Competencies and Key competencies to be achieved by the student

Name of the Experiment (No of Periods)	Competencies	Key competencies
Familiarization of methods for Volumetric analysis (03)	--	--
Preparation of Std $Na_2 CO_3$ and making solutions of different dilution (03)	▪ Weighing the salt to the accuracy of .01 mg ▪ Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette ▪ Making appropriate dilutions	▪ Weighing the salt to the accuracy of .01 mg ▪ Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette ▪ Making appropriate dilutions

Name of the Experiment (No of Periods)	Competencies	Key competencies
Estimation of HCl solution using Std. Na_2CO_3 solution (03)	■ Cleaning the glassware and rinsing with appropriate solutions ■ Making standard solutions ■ Measuring accurately the standard 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)		
Estimation of Dissolved Oxygen (D.O) in water sample (By electrometric method) (03)	■ Familiarize with instrument ■ Choose appropriate 'Mode' / 'Unit' ■ Prepare standard solutions / buffers, etc. ■ Standardize the instrument with appropriate standard solutions ■ Plot the standard curve ■ Make measurements accurately ■ Follow Safety precautions	■ Prepare standard solutions / buffers, etc. ■ Standardize the instrument with appropriate standard solutions ■ Plot the standard curve ■ Make measurements accurately
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)		

Name of the Experiment (No of Periods)	Competencies	Key competencies
Estimation of total solids present in water sample (03)	- Measuring the accurate volume and weight of sample - Filtering and air drying without losing any filtrate - Accurately weighing the filter paper, crucible and filtrate - Drying the crucible in an oven	- Measuring the accurate volume and weight of sample - Filtering and air drying without losing any filtrate - Accurately weighing the filter paper, crucible and filtrate

COMPUTER FUNDEMENTALS LABORATORY
(Common to all Branches)

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

Time Schedule

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

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

I. Computer Hardware Basics (Not for end examination)

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

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

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

III. Practice with MS-WORD

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

10. To insert Objects, Clipart and Hyperlinks
11. To use Mail Merge feature of MS Word
12. To use Equations and symbols features

IV. Practice with MS-EXCEL

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

V. Practice with MS-POWERPOINT

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

Competencies and Key Competencies to be achieved by the students

Exp No.	Name of the Experiment	Competencies	Key Competencies
1 (a).	To familiarize with Computer system and hardware connections	a. Identify the Parts of a Computer system a). CPU b) Monitor c) CD/DVD Drive d) Power Switch e) Start Button f) Reset Button b. Identify and connect various peripherals c. Identify and connect the cables used with computer system d. Identify various ports on CPU and connect Keyboard & Mouse	Connect cables to external hardware and operate the computer
1 (b).	To Start and Shut down Computer correctly	a. Log in using the password b. Start and shut down the computer c. Use Mouse and Keyboard	a. Login and logout as per the standard procedure b. Operate mouse & Keyboard
1 (c).	To explore Windows Desktop	a. Familiarize with Start Menu, Taskbar, Icons and Shortcuts b. Access application programs using Start menu, Task manager c. Use Help support	a. Access application programs using Start menu b. Use taskbar and Task manager
1(d).	To practice Internal and External DOS commands	a. Practice Internal commands b. Practice External commands	Familiarize with MS-DOS Commands
2.	To check the software details of the computer	c. Find the details of Operating System being used d. Find the details of Service Pack installed	Access the properties of computer and find the details
3.	To check the hardware present in your computer	a. Find the CPU name and clock speed b. Find the details of RAM and Hard disk present c. Access Device manager using Control Panel and check the status of devices like mouse and key board d. Use My Computer to check the details of Hard Disk Drives and partitions e. Use the Taskbar	a. Access device manager and find the details b. Type /Navigate the correct path and Select icon related to the details required
4.	Working with Files and Folders	a. Create folders and organizing files in different folders b. Use copy / paste or move commands to organize files and folders	a. Create files and folders rename , arrange and search for the required folder/file

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

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

15.	To edit spread sheet Copy, Cut, Paste, and selecting cells	a. Insert and Delete Columns and Rows-Create Borders-Merge and Center b. Add Background Color-Change the Font, Font Size, and Font Color c. Format text with Bold, Italicize, and Underline-Work with Long Text-Change a Column's Width	Format the excel sheet
16.	To use built in functions and Formatting Data	a. Sort and filter data in a worksheet b. Perform Mathematical Calculations verify -AutoSum c. Perform Automatic Calculations-Align Cell Entries	Use built in functions in Excel
17.	To enter a Formula for automatic calculations	a. Enter formula b. Use Cell References in Formulae c. Use Automatic updating function of Excel Formulae d. Use Mathematical Operators in Formulae e. Use Excel Error Message and Help	Enter formula for automatic calculations
18.	To Create Excel Functions, Filling Cells	a. Use Reference Operators b. Work with sum, Sum if , Count and Count If Functions c. Fill Cells Automatically	a. Create Excel sheets involving cross references and equations b. Use the advanced functions for conditional calculations
19.	To Practice Excel Graphs and Charts	a. Produce an Excel Pie Chart b. Produce an Excel Column Chart c. Practice creating any Chart	a. Use data in Excel sheet to Create technical charts and graphs Produce Excel Line Graph b. Produce a Pictograph in Excel
20.	To format a Worksheet in Excel, page setup and print	a. Shade alternate rows of data b. Add currency and percent symbols c. Change height of a row and width of a column d. Change data alignment e. Insert Headers and Footers f. Set Print Options and Print	a. Format Excel sheet b. Insert headers &footers and print
21.	To familiarize with Ribbon layout &features of PowerPoint 2007.	Use various options in Home, insert, design, animation , slideshow, Review &View in the PowerPoint	Access required options in the tool bar

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

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

III SEMESTER

DIPLOMA IN AUTOMOBILE ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
III Semester

Subject Code	Name of the Subject	Instruction periods / week		Total Periods per semester	Scheme of Examination			
		Theory	Practical /Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
A-301	Engineering Mathematics-II	5	-	75	3	20	80	100
A-302	Automobile power plants	5	-	75	3	20	80	100
A-303	Automobile Transmission Systems	4	-	60	3	20	80	100
A-304	Engineering materials and Manufacturing processes	5	-	75	3	20	80	100
A-305	Thermal Engineering	5	-	75	3	20	80	100
PRACTICAL:								
A-306	Machine Drawing	-	6	90	3	40	60	100
A-307	Automobile Laboratory	-	6	90	3	40	60	100
A-308	Workshop Practice- II	-	6	90	3	40	60	100
TOTAL		**24**	**18**	**630**		**220**	**580**	**800**

ENGINEERING MATHEMATICS – II
(Common to all Branches)

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

Blue print

S. No	Major Topic	No of Periods	Weightage of Marks	Short Type			Essay Type		
	Unit - I			R	U	App	R	U	App
1	Indefinite Integration	15	21	1	1	0	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
	Unit - II								
2	Definite Integration and its applications	35	60	1	1	3	1	1	$2\frac{1}{2}$
	Unit - III								

OBJECTIVES

3	Differential Equations	25	29	2	1	0	1	1	0
	Total	75	110	4	3	3	$2\frac{1}{2}$	$2\frac{1}{2}$	30
			Marks:	12	9	9	25	25	30

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

Upon completion of the subject the student shall be able to

Unit-I
1.0   Indefinite Integration
  1.1   Explain the concept of Indefinite integral as an anti-derivative.
  1.2   State the indefinite integral of standard functions and properties of Integrals $\int (u + v)\, dx$ and $\int ku\, dx$ where k is constant and u, v are functions of x.
  1.3   Solve integration problems involving standard functions using the above rules.
  1.4   Evaluate integrals involving simple functions of the following type by the method of substitution.
        i) $\int f(ax + b)\, dx$ where $f(x)\, dx$ is in standard form.
        ii) $\int [f(x)]^n\ f'(x)\, dx$
        iii) $\int f'(x)/[f(x)]\, dx$
        iv) $\int f\{g(x)\}\ g'(x)\, dx$
  1.5   Find the Integrals of *tan x, cot x, sec x* and *cosec x* using the above.
  1.6   Evaluate the integrals of the form $\int Sin^m\theta\ Cos^n\theta.\, d\theta$ where m and n are positive integers.
  1.7   Evaluate integrals of powers of *tan x* and *sec x*.
  1.8   Evaluate the Standard Integrals of the functions of the type

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

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

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

  1.9   Evaluate the integrals of the type

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

  1.10   Evaluate integrals using decomposition method.
  1.11   Evaluate integrals using integration by parts with examples.
  1.12   State the Bernoulli's rule for evaluating the integrals of the form $\int u.v\, dx$.
  1.13   Evaluate the integrals of the form $\int e^x\, [f(x) + f'(x)]\, dx.$

Unit-II

(a)   Understand definite integral and its properties

2.1   State the fundamental theorem of integral calculus

2.2   Explain the concept of definite integral.

2.3   Calculate the definite integral over an interval.

2.4   State various properties of definite integrals.

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

(b)   Real life applications of definite integrals

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

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

2.8   Obtain the volumes of solids of revolution.

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

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

(c) Certain special integrals: Laplace Transforms

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

2.12   Provide formulae for Laplace transforms of standard functions.

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

2.14   Write formulae for Laplace transform of $t^n f(t)$, $\dfrac{f(t)}{t}$, $f^{(n)}(t)$, $\displaystyle\int_0^t f(u)\,du$ in

terms of Laplace transform of $f(t)$. Provide simple examples on these functions.

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

State second shifting property.

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

2.17   Write first shifting property of inverse Laplace Transform with examples

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

(d)   Understand the Fourier series expansion of functions

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

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

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

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

3.0 Introduction to Differential Equations

3.1 Define a Differential equation, its order, degree
3.2 Form a differential equation by eliminating arbitrary constants.
3.3 Solve the first order first degree differential equations by the following methods:
    i. Variables Separable.
    ii. Homogeneous Equations.
    iii. Exact Differential Equations
    iv. Linear differential equation of the form dy/dx + Py = Q,
       where P and Q are functions of x or constants.
    iv. Bernoulli's Equation (Reducible to linear form.)

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

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

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

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

3.8 Solve simple problems leading to engineering applications

COURSE CONTENT
Unit-I
Indefinite Integration:
1. Integration regarded as anti-derivative – Indefinite integral of standard functions. Properties of indefinite integral. Integration by substitution or change of variable. Integrals of the form

   $\sin^m\theta.\ \cos^n\theta.$ where m and n are positive integers. Integrals of tan x, cot x, sec x, cosec x and powers of tan x, sec x by substitution.

Evaluation of integrals which are reducible to the following forms :

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

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

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

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

Unit-II
Definite Integral and its applications:
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. Volumes of solids of revolution. Mean and RMS   values of a function on a given interval. Trapezoidal rule, Simpson's 1/3 rule to evaluate an   approximate value of a define integral.

.   Definition, sufficient conditions for existence of Laplace Transform (LT), LT of elementary functions, linearity property, scale change property, first shifting property, multiplication by t^n, division by t, LT of derivatives and integrals, unit step function, LT of unit step function, second shifting theorem, inverse Laplace transforms- shifting theorems and change of scale property, multiplication by s^n and division by s – examples of inverse LT using partial fractions – convolution theorem (no proof).

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

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

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

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

Reference Books:

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

AUTOMOBILE POWER PLANTS

Course Title : **Automobile Power Plants**
Course Code : **A-302**
Periods/Week : **05**
Periods/Semester : **75**

TIME SCHEDULE

Sl. No	Major topic	Periods	Weightage of Marks	Short Type	Essay Type
1	Engine Construction	12	13	1	1
2	IC Engines	10	13	1	1
3	Inlet and Exhaust System	06	13	1	1
4	Fuel Supply System	14	23	1	2
5	Lubrication System	10	16	2	1
6	Cooling System	09	16	2	1
7	Fuels & Combustion	14	16	2	1
Total		**75**	**110**	**10**	**08**

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

1.0 Understand the Engine Construction
1.1 State the constructional details, materials use and function of various engine components
1.2 State the classification of engines According to Number of cylinders, Cylinder arrangement and explain their merits and demerits
1.3 State the requirements of firing order.
1.4 Explain the firing order arrangement for 4 - cylinders, 6 - cylinders and 8 - cylinder (in line and V-type).
1.5 Explain the Valve arrangement in L-type, I-type, F-type & T-type engines with sketches.
1.6 List various types of Gaskets and their materials used in an Engine.
1.7 Explain the function of components of valve actuating mechanism viz., guide, spring push rod, rocker arm, rocker arm shaft, rocker arm spring etc.,
1.8 Draw and explain side valve and over head valve arrangement and i-VTEC (Intelligent Variable Valve Timing and Lift Electronic Control)
1.9 Explain the need of valve clearance and State its importance
1.10 State the concept of vibrations and their causes.
1.11 Explain the use of vibration dampers.

2.0 Understand the working of I.C. Engines
2.1 List the Classification of I.C.Engines
2.2 State the principle of S.I.Engine both 2-stroke and four stroke petrol engine
2.3 Differentiate between 2 stroke and 4 stroke engines (Petrol)

2.4   State the principle of both 2-Stroke and 4 -Stroke C.I Engine
2.5   Differentiate between 2 stroke and 4 stroke engines (diesel)
2.6   Brief about scavenging
2.7   Draw valve timing diagram of S.I. and C.I. for 4 stroke and 2 stroke engines
2.8   State the function of combustion chamber
2.9   List various requirements of S.I and C.I engine combustion chamber.
2.10   Explain the different types of C.I Engine combustion chambers with sketches
2.11   State the relative advantages and disadvantages of the different types of C.I Engine
       combustion chambers

3.0   Understand the working of Inlet and Exhaust System
3.1   Draw and explain the working principle of different types of Air cleaners.
3.2   State the necessity of Manifolds
3.3   Explain the types and constructions of various Manifolds
3.4   State the necessity of Mufflers.
3.5   Explain the types and constructions of various Mufflers.

4.0   Understand the Fuel Supply System in Automobile Engines.
4.1   Draw the line diagram of petrol engine fuel supply system and identify the parts.
4.2   State the function of each component of fuel supply system viz., fuel tank, filter, fuel
       pump, carburettor etc.,
4.3   Classify the types of fuel pumps
4.4   Explain the construction & working principle of mechanical and electrical fuel
pums.
4.5   Explain the construction of carburettor
4.6   Draw and explain the simple carburettor
4.7   State the 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   .
4.10   State the types of fuel injection system in C I Engines.
4.11   Explain the working principle of air injection system, solid injection system,unit
       injection system
4.12   Explain the working principle of individual pump system and distributor pump
       system.
4.13 State the function and types of injectors.
4.14   State the function of governor and classify them.
4.15   Explain the working principle of mechanical and vacuum governors.

5.0   Understand the concept of Lubrication System
5.1   Classify the various lubricants used in I.C. engines
5.2   State the properties of lubricants
5.3   Explain the properties of lubricants, SAE number of lubricant and State its necessity.
5.4   State the requirements of engine lubrication.
5.5   Explain clearly the constructional details and working of Petroil, Splash type, Forced
       feed type lubrication systems.
5.6   Explain the dry sump and wet sump systems of Forced feed lubricating systems.
5.7   State the difference between Bypass filter and Full flow filter arrangements.
5.8   List the various additives of lubricants.

6.0   Understand the concept of Cooling System
6.1   Classify the cooling systems.
6.2   Explain the constructional details and State the working principle of Air cooling,
       Water cooling with the help of line diagrams
6.3   Explain the constructional details of water pump and thermostat

6.4 Explain the types of Thermostats, Radiator and Pressure cap.
6.5 List out various Anti-freeze and Anti-rusting liquids.

7.0 Understand the concept of Fuels and Combustion
7.1 Classify different types of fuels used in I.C. Engine
7.2 State their merits and limitations.
7.3 Define the term fuel
7.4 Classify different types of fuels
7.5 State the properties of fuels
7.6 Define calorific value of fuel (HCV, and LCV)
7.7 Explain Octane and Cetane rating and HUCR and fuel additives
7.8 State the meaning of Homogeneous mixture and Heterogeneous mixture
7.9 Explain the stages of combustion in S.I. engines
7.10 Explain the Phenomenon of pre ignition and detonation and their effects on the performance of S.I. engine
7.11 Explain the stages of combustion in C.I. engines
7.12 Explain about diesel knock and briefly know about factors influencing diesel knock

COURSE CONTENT

1) Engine Construction
Engine-CylinderBlock-Cylinder Liners-Number of Cylinders- Arrangement of Cylinders – Cylinder Bore and Piston Stroke – Crankcase and Oil Pan – Cylinder Head – Combustion Chamber– Gaskets – Piston, Piston Pin and Piston Rings – Piston types – Piston Clearance – Connecting Rod – Bearing cap – Crankshaft – Firing Order – Bearing – Main and Connecting Rod bearings – Oil Clearance – Crankshaft bearings – Flywheel –Vibration dampers -Valves - L, I, F and T-type valve arrangements- Valve mechanism- side valve and over head valve mechanisms and i-VTEC (Intelligent Variable Valve Timing and Lift Electronic Control) – Valve springs – Valve Seat – Valve guide bushing and oil seal – Cam Shaft – Valve Lifter, Pushrod and Rocker arm.

2) I.C. Engines
Introduction to Internal combustion Engines Classification of I.C. engines- Principle and working of 2– stroke and 4-stroke petrol engine. Comparison between two-stroke and four-stroke petrol engines valve timing diagrams of 2-stroke and 4-stroked petrol engine, Working principle of a 2 stroke and 4 stroke diesel engine, advantages and limitation of diesel engine over a petrol engine- Scavenging in 2 stroke engines – Valve timing diagram of 2- stroke and 4- stroke diesel engines.
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, and Turbulence chamber type – Air cell combustion chamber - Relative advantages and disadvantages.

3) Inlet and Exhaust System
Air Cleaners – construction details of various 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 various types of Mufflers

4) Fuel Supply System in Automobile Engines
Line diagram of petrol engine fuel systems- constructional details of fuel tank, fuel lines and fuel filters – working principle with constructional details of fuel pumps Mechanical and Electrical - constructional details of simple

carburettor. Defects in simple carburetor- Various circuits in Automobile carburetors-air fuel ratios for different conditions- Types of carburetors-Down draught, up draught and side draught–Constant Choke and Constant Vacuum type Carburetors.

Line diagram of Diesel engine fuel system – Function of diesel fuel feed pumps-Types of Diesel filter – primary and secondary filters - Requirements of fuel injection system – type of fuel injection systems – air injection and solid injection systems – common rail system, unit injection system, individual pump systems-distributor type pump system – constructional details and working of fuel injection pump - injectors- types of injectors – Types of Nozzles – single hole, multi hole, pintle and pintaux – governing system – mechanical and pneumatic types of governors.

5) Lubrication System
Types of lubricants – Properties of a lubricant – Viscosity - Fire and Flash points etc.,- S.A.E Number - Grades of Lubricants used in Engine, Gear-Box, Differential Requirements of lubrication of Motor vehicle engine and Other Components - 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

6) Cooling System
Necessity of cooling- Disadvantages of over cooling and under cooling- Types Of cooling system-air cooling-constructional details of an Air cooled engine-water Cooling-Thermo siphon and Force feed type water cooling – Constructional details and Working principle of water pump - Radiator – Different types and their constructional details –Thermostat – Wax pellet type and Bellows type thermostat - -Radiator pressure cap- Anti freezing additives - Anti rusting additives

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

REFERENCE BOOKS
1. Elements of Heat Engines - by R.C. Patel and C.J. Karamchandani.
2. Heat Engines - by R.S. Kurmi
3. Heat Engines - by Pandya and Shah
4. Automobile Engineering Vol – I & II - by Kirpal Singh
5. Automotive Mechanics - by Heitner
6. Automobile Engineering - by G.B.S. Narang
7. Automobile Engineering - by R.B.Gupta
8. Automobile Engineering - by Banga and Nathun Singh
9. Automobile mechanics - by William Chrouse
10. High speed combustion Engines - by P.M. Heldt
11. Heat power engg - by P.L. Ballany
12. Internal Combustion Engines - by Mathur &Sharma
13. Automobile Engineering Vol I - Anil Chhikaria (Satya Prakashan Publisher

AUTOMOBILE TRANSMISSION SYSTEMS

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

TIME SCHEDULE

Sl. No	Major Topic	Periods	Weightage of marks	Short type	Essay type
1	Transmission System and Clutch	12	21	2	1 ½
2.	Gear Box	12	21	2	1 ½
3	Universal joint and propeller shaft	06	13	1	1
4	Differential	10	18	1	1 ½
5	Front axle & Rear axle	08	16	2	1
6	Wheels and Tyres	08	16	2	1
7	Dynamics of Moving Vehicles	04	05	0	½
	Total	**60**	**110**	**10**	**8**

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Understand the working of Transmission System and Clutch
1.1 Necessity of Automobile transmission system.
1.2 State the various components in the manual transmission system.
1.3 Explain the arrangement of transmission system components
1.4 Explain the function of a Clutch.
1.5 Explain the Principles of operation of the clutch.
1.6 Describe the general requirements of an automobile clutch.
1.7 Draw the line diagram and explain the working of Single plate, Multi plate, Centrifugal, Semi Centrifugal and Diaphragm Clutches.
1.8 Explain the working principles of vacuum and hydraulically operated clutches.
1.9 Explain the working and the constructional detail of fluid coupling.
1.10 List the advantages and disadvantages of using fluid coupling.
1.11 Percentage of slip in a Fluid Coupling.

2.0 Understand the working of Gear Box
2.1 State the objectives of the gear box in the transmission system
2.2 List the types of gear boxes.
2.3 Explain the principles and operation of sliding mesh, Constant mesh,

Synchromesh and Epicyclic gear box.

2.4 Describe floor shifting & steering column mounted shifting mechanism
2.5 Explain about Inter locking device
2.6 Explain free wheel unit and over-drive-mechanism.
2.7 Explain the working principle of the torque converter
2.8 List the advantages of automatic transmission system

3.0 Understand the working of Propeller shafts and Universal joints
3.1 State the function of the propeller shaft.
3.2 Draw the line diagram of slip joint or sliding joint.
3.3 Explain the types of universal joints – Cross type or Spider and two yoke types, Ball and trunnion type etc.,
3.4 List the types of Constant velocity type joints.
3.5 Explain the types of Constant velocity type joints.

4.0 Understand the working of Final Drive and Differential unit
4.1 Explain the purpose of the final drive – Hypoid gear arrangementement - Worm and worm wheel – Single and Double reduction final drives.
4.2 State the purpose of the four wheel drive.
4.3 Explain the working principle of the four wheel drive.
4.4 Explain the working principle of differential and differential locking systems
4.5 Explain the working of Transaxle.

5.0 Understand the working of Front axle and Rear axle
5.1 Differentiate between live and dead axles.
5.2 List the components of front axle assembly.
5.3 Explain Stub axle and list various types of stub-axles
5.4 State the loads on the rear axles.
5.5 Explain the types of rear axles
5.6 List the various types of axle-housing.
5.7 Distinguish the types of drives
5.8 State the Differences between Hotch kiss drive and Torque tube drive.

6.0 Understand the construction of Wheels and Tyres
6.1 Explain the wheel assembly
6.2 State the functions of the wheels and list the types of wheels-rims etc
6.3 Classify cross ply tyre, radial tyre and tubeless tyre
6.4 Describe the construction of tyres
6.5 Explain tyre tread pattern.
6.6 State tyre wear and its causes
6.7 Explain various tyre properties – Causes of tyre wear.
6.8 Define the term tyre rotation.
6.9 Define the terms vulcanizing and retreading

7.0 Understand the concept of Dynamics of moving vehicles
7.1 List various resistances encountered by vehicle.
7.2 Define the terms Traction and tractive effort
7.3 Solve simple problems on the above topics

COURSE CONTENT

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.

Function of the clutch-Principle of Operation-General requirements of an automobile clutch-constructional details of different types of clutches – Single plate – Multi plate – Centrifugal – Semi centrifugal – Diaphragm clutches – Working principles of vacuum and Hydraulically operated clutches – Fluid coupling - Percentage slip - Advantages and disadvantages – Constructional details of fluid coupling.

Gear box

Object of the gear box in the transmission system – types of gear boxes – Principles and operation of sliding mesh, constant mesh and synchromesh gear box- types of gear shifting mechanism – floor shifting and steering column shifting- Inter lock devices -   Epicyclic gear box- principle and working of freewheeling – over drive mechanism – transfer case- Torque converter its principle and working- principle of automatic transmission system and advantages

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.

Differential:

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

Front Axle and Rear Axle:

Live and dead axles – Components of Front axle –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 Housings and types –Split, Banzo and Salisbury types -

Wheels and Tyres:

Wheel assembly – functions of the wheels – Types of wheels, types of rims – Types of tyres – Construction of tyres- cross ply tyre – radial tyre – merits of radial tyre over cross ply tyre- tubeless tyre –tyre tread patterns – tyre pressure & wear – Desirable tyre properties – causes of tyre wear – Tyre rotation –Vulcanizing – Retreading.

Dynamics of moving vehicles:

Types of resistances encountered by a vehicle - Road resistance, Gradient resistance, Air resistance-Traction -Tractive effort – Simple related problems

REFERENCE BOOKS:

1. The motor vehicle - Newton steeds. & Garret
2. Automotive Chassis - P.M. Heldt.
3. Mechanism of the car - A.W. Judge
4. Automotive mechanism - Joseph Heitner.
5. The Automobile - Harbansigh Reyat
6. Automotive Engineering - G.B.S. Narang
7. An introduction to Automobile Engineering - N.R. Khatawate
8. Problems in Automobile Mechanics - Dr. N K Giri

ENGINEERING MATERIALS AND MANUFACTURING PROCESSES

Course Title : **Engineering materials and Manufacturing Processes**
Course Code : **A-304**
No. of Periods /Week : **05**
Total periods /Semester : **75**

TIME SCHEDULE

Sl. No	Major Topic	Periods	Weightage of Marks	Short Type	Essay Type
1	Mechanical Properties and testing procedures	12	16	2	1
2	Iron – Carbon equilibrium diagram	08	13	1	1
3	Manufacture of Iron & steel	10	13	1	1
4	Heat Treatment	12	16	2	1
5	Ferrous and non ferrous Metals and alloys	10	13	1	1
6	Welding	09	16	2	1
7	Lathe and lathe work	08	13	1	1
8	Capstan and Turret Lathes	06	10	0	1
	Total	75	110	10	08

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

1.0   Understand the mechanical properties and its 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 various properties of materials in engineering applications.
1.4   Describe the tensile and compressive tests.
1.5   Describe the tests to measure impact strength, Hardness, Fatigue and creep resistance.
1.6   State the specifications of test samples for conducting these tests.
1.7   List the principles of non-destructive testing methods.
1.8   Select the appropriate testing method for a given application

2.0   Understand the construction of 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   Understand the manufacturing methods of iron and steel
3.1   Describe the sequence of operations involved in the manufacturing cast iron in cupola furnace.
3.2   List the sequence of steps to be followed in the manufacture of steel by Bessemer converter, open-hearth process, L.D. process, electric arc furnace and electric induction furnace.

4.0   Comprehend the need of heat treatment
4.1   List the sequence of operations involved for different heat treatment methods such as annealing, normalizing, hardening, tempering, case hardening, Nitriding and carburizing.
4.2   Explain the change in mechanical properties of materials when the above heat treatment methods are used.
4.3   State the appropriate heat treatment methods for a given application.

5.0   Appreciate the classification of ferrous metals and non-ferrous metals and their alloys, applications
5.1   List the composition properties and application of different types of cast iron and plain carbon steel.
5.2   State the need for alloying steel with other elements.
5.3   State the composition properties, Industrial applications of common alloy steels.
5.4   State the proper alloy steel for a given engineering application.
5.5   State the composition, properties and industrial applications of the alloys of the following non-ferrous metals: Nickel, Copper and Manganese.
5.6   Select the proper non-ferrous alloys for given engineering applications.

6.0   Understand the principle of joining metals by fusion and explain welding processes of metals

6.1   Explain the working principle of arc welding process

6.2   List the equipment used in arc welding and state their functions.

6.3   State the principle of gas welding and List the procedure of gas welding

6.4   Explain the types of flames Used in gas welding and list their applications.

6.5   List the limitations of gas and arc welding processes.

6.6   Describe shielded arc welding, inert gas welding-TIG welding, MIG welding and Atomic hydrogen welding processes.

6.7   State the principle of electric resistance welding and its types spot welding, seam welding,

7.0   **Understand the working principle of lathe with line sketch**

7.1   List the classification of lathe and State the parts of lathe and their functions.

7.2   List the steps to be followed in the following operations involved in turning, facing, forming, taper turning, screw cuttings and knurling.

7.3   Methods of taper turning

8.0 **Understand the working principle of Capstand and Turret lathes**

8.1 Explain the working principle of Turret and Capstan Lathes.

8.2 Comparison of Cpastan and Turret lathes

8.3 Explain the working of Turret Indexing mechanism.

8.4 List out tool holding and work holding devices.

COURSE CONTENT

1. **Mechanical properties and Testing 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 – Detailed explanation of the above terms with examples is to be covered at this stage.
   Types of testing – Destructive and non-destructive- testing methods to determine tensile strength, compressive strength, impact strength, Hardness, Fatigue strength – equipment procedure and for Testing- Formulae-Calculations – Importance of non – destructive testing – Magnetic particles testing – Radiography (X-ray and Gama ray) Testing – Ultrasonic testing – Spark stream, identification of metals-use of these tests in industry.

2. **Iron – Carbon equilibrium diagram**
   Space lattice, unit cell, three main types of metallic space lattices like BCC, FCC and HCP – Cooling curve for pure Iron – allotropic forms of pure iron
   – Iron – Carbon equilibrium diagram

3. **Manufacture of iron and steel**
   Manufacture of cast iron – Cupola Furnace -manufacture of steel – open hearth furnace – Bessemer converter – L.D.process –Electric arc furnace- Electric Induction furnace.

4. **Heat Treatment**
   Need for Heat Treatment –Stages of heat Treatment-Purpose of Heat Treatment - Description of different hear treatment processes– Annealing – Types – Normalising – Hardening –Types- Tempering-Types - case hardening and Nitriding - carburizing –
   Application of these heat treatment processes.

5. **Ferrous and Non – Ferrous Metals and Alloys**
   Classification of ferrous metals – types of cast irons white – gray – modular– malleable and alloy cast iron Types of plain carbon steel – low carbon – medium – and high carbon steel- alloy – Special alloy steels such as stainless steel and high speed steel, their composition properties and uses.
   Need for the use of Non – Ferrous metals and alloys in engineering applications –composition- properties and uses of Copper, Aluminum- Tin-Zinc-Lead-Nickel and magnesium and their alloys – Their Industrial applications.

6. **Welding**

Introduction – Types of welding – pressure welding and Non-pressure welding-Principle of Electric Arc welding – Metal Arc, Atomic Hydrogen welding – TIG and MIG welding – submerged Arc welding- Welding rods-types-specifications-Principle of Resistance – spot, seam and Butt welding

Oxy-acetylene gas welding –gas welding Equipment-Types of oxy-acetylene gas flames and their uses – Techniques of gas welding.

7. **Lathe and lathe work**

Functions –Types of Lathes – Engine Lathe and Tool room Lathe-Lathe construction – Functions of each part – 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 on Lathe. Methods of taper turning

8. **Capstan and Tturret lathes:**

Construction details and working principle of capstan and turret lathes - comparison between capstan and turret lathe. Working priniciple of Turret indexing mechanism.

List out tool holding and work holding devices.

REFERENCE BOOKS

1. Engineering Material and Manufacturing Processes - by V.N. Kumar
2. Engineering Materials - by Ray & Chowdhury
3. Engineering Materials - by R.S. Deshpande
4. Elements of workshop Technology Volume I and II - by   Hazra Chowdhary
5. A course in workshop Technology vol.I & vol. II- by Raghuvamsi

THERMAL ENGINEERING

Course Title : **Thermal Engineering**
Course Code : **A – 305**
Periods / Week : **05**
Periods /Semester : **75**

TIME SCHEDULE

Sl. No	Major Topic	Periods	Weightage of Marks	Short type	Essay type
1	Thermodynamics	12	16	2	1
2	Laws of perfect gases	10	16	2	1
3	Thermodynamic Processes	20	29	3	2
4	Air Standard Cycles	16	26	2	2
5	Performance of engines	17	23	1	2
	Total	**75**	**110**	**10**	**08**

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

1.0   Understand the Fundamentals and laws of Thermodynamics
1.1   Define the various terms associated with the Thermodynamic System.
1.2   Define the 'State and System'.
1.3   Name the types of thermodynamic Systems.
1.4   Explain the closed system with Examples.
1.5   Explain the open system with examples
1.6   Explain the isolated system with Examples.
1.7   List the thermodynamic Properties of System.
1.8   Define the various thermodynamic properties.
1.9   Write examples for each type of property and its units of measurement.
1.10   State the number of properties required to define the state of a system.
1.11   Define the modes of energy transfers to and from a system.
1.12   Represent the state of a system on a Graph.
1.13   State the Zeroth law of thermodynamics.
1.14   State the first law of thermodynamics.
1.15   State the second law of thermodynamics.
1.16   Solve problems dealing with conversion of heat into work and vice – versa.
1.17   Write non-flow energy equation.
1.18   Solve simple problems on non-flow energy equation.

2.0   Understand the laws of perfect gases
2.1   Define the term 'Perfect Gas'.
2.2   State "Boyle's Law".
2.3   State "Charle's Law".

2.4   State "Avagadro's Law".
2.5   State "Regnault's Law".
2.6   State "Joule's Law".
2.7   Derive Characteristic gas equation
2.8   Write the Universal Gas Equation.
2.9   State relationship between characteristic gas constant (R), Universal gas constant (G) and molecular weight (M).
2.10   Define "Specific heat at constant pressure" (C_p).
2.11   Define "Specific heat at constant volume (C_v).
2.12   Infer why Cp is more than Cv ?
2.13   Derive the relationship between C_p , C_v and R .
2.14   Solve simple problems using gas laws.

3.0   Understand 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.
3.3   Derive expression for work done in Iso-baric process.
3.4   Derive expression for work done in hyperbolic process.
3.5   Infer that Isothermal process is the same as hyperbolic process for gases.
3.6   Derive expression for work done in a Polytropic process.
3.7   Derive expression for work done in a Isentropic process.
3.8   Justify that work done in throttling process is Zero.
3.9   Explain the concept of Entropy, Enthalpy and change of Enthalpy
3.10   Derive the expression for change of Entropy for the above processes.
3.11   Compute the change in internal energy of gas during a process.
3.12   Explain the relationship between heat supplied, internal energy and work done.
3.13   Sketch pressure- volume and temperature - Entropy diagram for the above processes.
3.14   Solve simple problems on the processes.

4.0   Appreciate the study of air standard cycles
4.1   Define the term 'Air Standard cycle'
4.2   Define the term 'Reversible Cycle'.
4.3   Explain with the help of a p-v and T-S diagram the Working of carnot cycle.
4.4   State the assumptions made in Carnot cycle.
4.5   Derive the formula for the air standard efficiency of a Carnot cycle.
4.6   Solve simple problems on Carnot Cycle.
4.7   Explain the working of Otto Cycle with the help of a p-v and T-S diagram.
4.8   State the assumptions made in Otto Cycle.
4.9   Derive the formula for air standard Efficiency of Otto Cycle.
4.10   Solve simple problems on Otto Cycle.
4.11   Explain the working of a Diesel cycle with the help of a p-v and T-S diagram.
4.12   State assumptions made in Diesel Cycle
4.13   Derive the formula for Air Standard Efficiency of Diesel Cycle.
4.14   Solve the simple problems on Diesel Cycles.

5.0   Understand the Performance of I.C.Engine
5.1   Compute I.P and B.P.
5.2   Compute Mechanical efficiency and Specific Fuel consumption.
5.3   Compute Volumetric Efficiency.
5.4   Compute Indicated and Brake Thermal Efficiency.
5.5   Prepare Heat Balance sheet for a given test result of an I.C. engine.
5.6   Understand the concept of Morse Test.
5.7   Compute B. P by using Morse test.

COURSE CONTENT

1.0   Fundamentals and laws of Thermodynamics
Definitions for system - boundary, surrounding, working fluid and 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, specific heat -Zeroth, first, second laws of thermodynamics, simple problems on conversion of Heat into Work and vice versa - 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 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, hyperbolic, Isentropic, Polytropic and throttling processes. Equations representing the processes-Concept of Entropy - Derivation for work done, change in internal energy and Entropy 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 – reversible and irreversible cycles - conditions for reversibility of a cycle - Brief description of Carnot cycle with P.V. and T-S diagrams - Assumption 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 -Reasons for the highest efficiency of Carnot cycle over other cycles working between same temperature limits.

5.0   Performance of I.C. Engines
Need for Engine performance testing – Mean effective Pressure - Indicated, Brake and Friction Power - Mechanical Efficiency and Thermal Efficiency – Specific Fuel Consumption - Volumetric efficiency - Heat Balance - Problems pertaining to performance of I.C Engines and heat balance – Calculation of B P of an engine by using Morse Test.

REFERENCE BOOKS
1.   Thermal Engg.Vol I & Vol II - Mathur & Mehta
2.   Heat Engines R. C. Pate & Karamchandan
3.   C. Engine Fundamentals - Heywood
4.   Engineering Thermodynamics P. K. Nag
5.   Engineering Thermodynamics C. P. Arora
6.   Thermal Engineering - R. S. Kurmi
7.   Thermal Engineering Kumar & Vasundari.
8.   Problems in Automobile Mechanics - Dr. N K Giri

MACHINE DRAWING

Course Title : **Machine Drawing**
Course Code : **A- 306**
No. of periods per week : **06**
Total periods/Semester : **90**

TIME SCHEDULE

Sl. No.	Major topic	Periods	Weightage of Marks	Short Type	Essay Type
1	Nuts and Bolts	18	15	1	1
2	Rivets and Riveted joints	21	15	1	1
3	Keys	12	10	2	0
4	Assembly Drawing *	39	20	0	1
	Total	90	60	4	3

***Assembly drawing is compulsory question and its weightage is 20 marks,
Short answer questions weightage is each 5 marks, Remaining essay questions
weightage is each 10 marks. All questions are compulsory.**

OBJECTIVES
Upon completion of the course the subject shall be able to
1.0   Draw the various types of screw thread forms, nuts and bolts.
2.0   Draw the various types of riveted joints
3.0   Draw the various types of keys and cotters
4.0   Draw the different types of Knuckle and Cotter joints
5.0   Draw various types of shaft couplings
6.0   Draw various types of shaft bearings

Key competencies to be achieved by the student

Topic	Key competency
Nuts and Bolts	Differentiate the temporary and permanent joints and their applications Acquaint with the nomenclature of thread profile Draw the bolts, screws, nuts with standard proportions
Rivets and riveted joints	Differentiate the temporary and permanent joints and their applications Acquaint with the specifications of rivets Draw the rivets and types of riveted joints with standard proportions
Keys	Acquaint with the specifications of keys Draw the keys and types of keys with standard proportions
Assembly drawing	Understand function, working principle and field of application for the machine and its parts Study the external and internal features of each part Put the overall dimensions Prepare the table of parts giving part number, its name, material and quantity

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, wing nut, dome nut, cap nut, capston nut, ring 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, machines screw, set screws of different forms.

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 by N. D. Bhatt
2.   Machine Drawing by N. Siddeswar, Kannaiah, Sastri
3.   Machine Drawing by G. R. Nagpal
4.   Machine Drawing by R. B. Gupta

AUTOMOBILE LABORATORY

Course Title : **Automobile Laboratory**
Course Code : **A-307**
Periods per week : **06**
Total Periods/ Semester : **90**

LIST OF EXPERIMENTS

1. Identification of different tools, gauges and various instruments used in Automobile Laboratory.
2. Knowing the working principle of two stroke and four stroke engines (Petrol and Diesel)
3. Dismantle a given I.C. Engine and identify various basic components such as Cylinder, Cylinder block, Cylinder heads, Piston, Piston rings, Connecting rod, Crank shaft, Valves and various Valve actuating mechanisms, Timing gears, Crankcase, Spark plug, Fuel pump, Carburetor, Fuel Injector, Fuel Injection pump.
4. Demonstrate the fuel system of a multi cylinder engine with the aid of a chart
5. Demonstrate the Inlet and Exhaust system of a multi cylinder engine with the aid of a chart
6. Demonstrate the lubrication system of a multi cylinder engine with the aid of a chart or simulator.
7. Demonstrate the cooling system of a multi cylinder engine with the aid of a chart or simulator.
8. Driving Practice
9. Dismantling and Assembling of A.C. Mechanical fuel pump.
10. Dismantling and Assembling of Carburetor
11. Dismantling and Assembling of a single plate clutch and multi plate clutch
12. Dismantling and Assembling of a gear box (Constant mesh & synchromesh)
13. Dismantling and Assembling of a Differential

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	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
3	Inlet and Exhaust System of a Multi Cylinder Engine.	1) Know the working principle of two stroke and four stroke petrol and diesel engines by using cut models. 2) Understand the need of inlet and exhaust system. 3) 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
4	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
5	Cooling System of a Multi Cylinder Engine	1) Identify the components of a Cooling system. 2) Know the function of each component in the system	1)Draw a line diagram of a Cooling System of a given Multi Cylinder Engine
6	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 Foot Controls of a four Wheeler i.e A,B,C 2) State the Purpose of Foot controls. 3) Operate the foot controls efficiently 4)Operate the steering controls efficiently 5) Operate to change of gear by gear Shift lever 6) Identify the various accessories like Horn, Lights and Indicators. 7) Operate all the above Controls Simultaneously.

7	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.
8	AC Mechanical Pump	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	Carburetor		
10	Single plate clutch		
11	Gear box		
12	Differential		

Course Title : **Workshop Practice- II**
Course Code : **A – 308**
Periods per Week : **06**
Periods per Semester : **90**

OBJECTIVES

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   Centring 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   Understand the operation of welding transformer and generator.
   2.5   Perform various weld joint operations.

3.0   Hands on practice on Special Machines
   3.1   Plane the Surface of a given component
   3.2   Practice to hold a given component in a Milling Arbour
   3.3   Practice to run a given Planer 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.

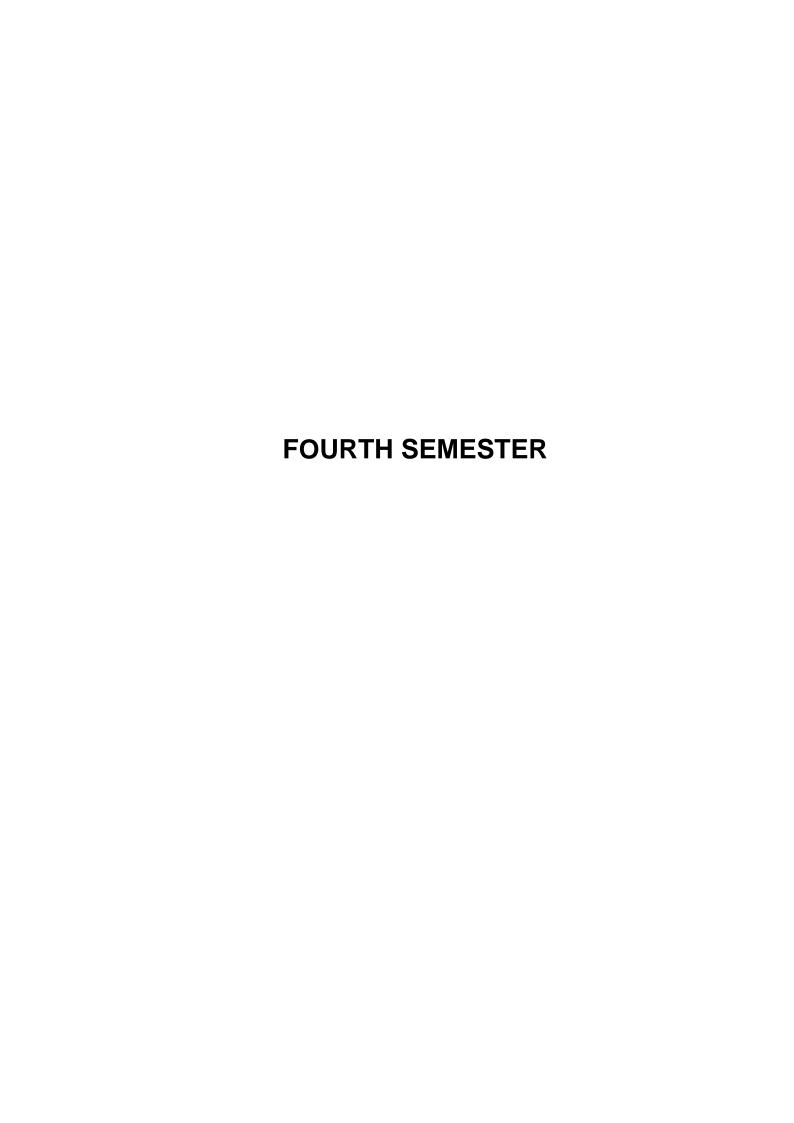   d.   T-Joint.

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
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 thedistance 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 thedistance 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

FOURTH SEMESTER

DIPLOMA IN AUTOMOBILE ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
IV Semester

Subject Code	Name of the Subject	Instruction period / week		Total Period / Semester	Scheme of Examination			
		Theory	Practical /Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
A-401	Automobile Electrical and Electronics systems	4	-	60	3	20	80	100
A-402	Strength of materials and Fluid mechanics	6	-	90	3	20	80	100
A-403	Automobile Chassis and Body Engineering	5	-	75	3	20	80	100
A-404	Automobile Servicing and Maintenance	5	-	75	3	20	80	100
A-405	Special Purpose Vehicles	4	-	60	3	20	80	100
PRACTICAL:								
A-406	Automobile Engineering Drawing	-	6	90	3	40	60	100
A-407	Automobile Servicing and Reconditioning Laboratory	-	6	90	3	40	60	100
A-408	Communication Skills	-	3	45	3	40	60	100
A-409	Strength of Materials Lab & Fluid Mechanics Lab	-	3	45	3	20+20	30+30	100
	TOTAL	24	18	630		-	-	900

AUTOMOBILE ELECTRICAL AND ELECTRONICS SYSTEMS

Course Title : **Automobile Electrical and Electronics Systems**

Course Code : **A-401**

No of periods/week : **04**

Total periods /Semester : **60**

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage	Short questions	Essay questions
1.	**Basic Electrical units, D.C. Circuits and Electromagnetic Induction**	08	16	02	01
2.	**Electronic devices in Automobiles**	10	16	02	01
3.	**Batteries**	08	13	01	01
4.	**Ignition Systems**	12	26	02	02
5.	**Starting Motors**	10	16	02	01
6.	**Automobile Wiring Systems, Lighting and Accessories**	12	23	01	02
	Total	60	110	10	08

OBJECTIVES

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

1.0   Comprehend the basic Electrical units of current, voltage, power, energy and Electro Magnetic induction

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   Appreciate the functions of basic Electronic devices.
2.1   Define conductors, insulators and semiconductors & mention their applications

2.2   Define P-N junction diode and mention its applications

2.3   Define P-N-P & N-P-N transistors and mention 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   Comprehend the batteries

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

3.2   State the 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 the different methods of charging of battery.

3.6   Explain the trickle charging of battery.

3.7   List the different methods of testing of a lead acid battery for fully charged and discharged condition.

3.8   State the maintenance of a lead acid battery.

4.0   Explain the working principle of ignition system

4.1   Explain the necessity of ignition system.

4.2   Draw the circuit diagram of coil ignition system and identify its components.

4.3   State the functions of the components of coil ignition system

4.4   Explain the constructional details of distributor.

4.5   State the function of contact breaker points and the condenser.

4.6   State the specifications of a spark plug.

4.7   State the terms spark plug, plug gap and C.B. point gap.

4.8   State the principle of Electronic ignition system.

4.9   Explain the working principle of transistorized ignition system

4.10   List the Advantages of transistorized ignition system over conventional ignition system.

4.11   Describe the magneto ignition system

4.12   List the applications of magneto ignition systems.

5.0   Comprehend D.C. Motors

5.1   State the principle of working of D.C. Motors.

5.2   List the types of D.C. Motors

5.3   Draw Load characteristics of D.C shunt motors.

5.4   State the functions of self starter.

5.5   Explain the conditions for starting an engine by a self Starter motor.

5.6   Describe the use of series motor as self starter.

5.7   Explain the working principle of Bendix drive with a sketch.

5.8   Explain the constructional details of self starter.

5.9 Describe the working of Lucas drive and Follow-through drive with sketches.

5.10 State the functions of over running clutch drive.

5.11 Explain the working principle of a solenoid switch with a sketch.

6.0 Comprehend the Automobile Electrical wiring systems, Lighting and Accessories

6.1 Differentiate between earth return and insulated return wiring systems.

6.2 State the meaning of wire harnessing.

6.3 Draw the wiring layout of a passenger car with petrol engine.

6.4 Draw the wiring layout of a commercial vehicle with diesel engine.

6.5 Draw the wiring layout of two wheeler.

6.5 Explain the constructional details of sealed beam head light.

6.6 Describe the adjustment of head lights.

6.7 Draw circuit diagrams and explain the working principles of Horn, Wind screen wiper, Traffic indicator, Flash type directional indicator lights, Fuel, Oil and Water gauge circuits.

COURSE CONTENT

1.0 Basic Electrical units, D.C. Circuits and Electromagnetic Induction:
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 semi conductors - 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.

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 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.

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

STRENGTH OF MATERIALS AND FLUID MECHANICS

Subject Title   **:**   **Strength of Materials and Fluid Mechanics**
Subject Code   **:**   **A – 402**
Periods /week   **:**   **06**
Periods /year/Semester   **:**   **90**

TIME SCHEDULE

Sl.No	Major Topics	Periods	Weightage of Marks	Short type	Essay Type
STRENGTH OF MATERIALS					
1.	Simple stresses and strains	16	18	1	$1\,^1/_2$
2.	Geometrical Properties of sections	16	21	2	$1\,^1/_2$
3.	S.F and B.M diagrams	12	16	2	1
FLUID MECHANICS					
4.	Properties of Fluids	12	16	2	1
5.	Flow of fluids	16	18	1	$1\,^1/_2$
6	Oil Power hydraulics & Pneumatics	12	16	2	1
7	Hydraulic Machinery	06	05	0	1/2
	Total	90	110	10	08

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Understand the behavior of Materials under simple stresses and strain

1.1 Define the terms: Stress, strain, Modulus of elasticity, longitudinal strain, lateral strain, Poisson's ratio, Modulus of rigidity, Bulk modulus, working stress, factor of safety, Resilience, Proof resilience, Modulus of Resilience.

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 Calculate stresses in simple composite members under axial loading.

1.9 Explain the mechanical properties of materials.

2.0 Understand the center of gravity , Centriod, Moment of Inertia and

radius of gyration for a given area of cross section

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, 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 theorem.

2.9 Explain the term radius of gyration

3.0 Understand the types of beams namely cantilever, simply supported beam

and over hanging beams.

3.1 Define different types of beams

   a) Cantilever beam

   b) Simply supported beam

   c)   Overhanging beam

3.2 Define different types of loads

   a) Point load

   b) Uniformly distributed load

3.3   Explain the terms

   a) Shear force

   b) Bending moment

3.4   Deduce the relationship among the rate of loading, shear force and bending

   moment.

3.5   Determine shear force and bending moments on cantilever and simply

   supported beam for simple cases of loading (Point load, Uniformly

   distributed load) analytically.

3.6   Describe the procedures for sketching the shear force diagrams (SFD) and

   Bending Moment diagrams (BMD)

3.7   Sketch Shear Force Diagrams (SFD) and Bending Moment Diagrams

   (BMD) for cantilever and Simply Supported Beams.

3.8   Define Point of contra flexure

3.9   Determine the Shear Force, Bending Moment and Point of contra flexure

   for overhanging beams.

3.10 Sketch Shear Force Diagrams (SFD) and Bending Moment Diagrams

   (BMD) for overhanging beams.

4.0 Understand the properties of fluids

4.1   Define fluid, differentiate between compressible and Incompressible fluids.

4.2   Define various properties of fluids.

4.3   State Pascal law and its applications

4.4   Explain the meaning of atmospheric pressure , absolute

   Pressure and pressure head of fluid

4.5   Explain the working principle of pressure Gauges .

4.6   Problems on manometers.

5.0 Understand the concept of 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 Write the total energy equation of fluid in motion. Bernoulli's theorem (proof not necessary) and its practical applications in venturimeter. Simple problems.

5.4 Explain the phenomenon of flow through orifices under constant heads.
Know the coefficient of velocity, coefficient of contraction and coefficient of discharge and the relation among the three coefficients – 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 and Chezy's expressions (without proof)- simple problems.

6.0 Understand the basic components of an oil power hydraulic control unit

and constructional details and working principle of Hydraulic Machinery

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 oil pumps like gear pump, vane pump, rotary pump, (other pumps not necessary).

6.5   Explain the constructional details of gear pump (external and internal gear type), vane pump, rotor pump and the working principle.

6.9   List the different types of actuators

6.10 Write the basic symbols used in hydraulic circuit.

6.11 Explain the concept of pneumatics.

6.12 List Advantages and limitations of Pneumatics over hydraulic control.

7.0 Explain the Constructional details and working principle of

    a)   Hydraulic press
    b)   Hydraulic jack
    c)   Hydraulic lift
    d)   Hydraulic crane
    e)   Hydraulic intensifier, fluid valves like reducing and relief valves.

COURSE CONTENT

STRENGTH OF MATERIALS

1.0 Simple stresses and strains

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 constants.

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 and Chezy's formula (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

2.	Solid Mechanics	-by	Pakirappa
3.	Strength of Materials	-by	Ramamrutham
4.	Hydraulics	- by	R.S. Khurmi
5.	Hydraulics &Hydraulics		
	Machines,vol I &II	- by	Jagadish Lal
6.	Hydraulics	- by	Reya and Rao

AUTOMOBILE CHASSIS AND BODY ENGINEERING

Subject Title : **Automobile Chassis and body engineering**

Subject Code : A- 403

Periods / Week : 05

Periods / Semester : 75

TIME SCHEDULE

SL.NO.	MAJOR TOPICS	PERIODS	Weightage of marks	Short type	Essay type
1.	Steering system	13	26	2	2
2.	Braking system	15	26	2	2
3.	Suspension system	13	16	2	1
4.	Automobile chassis and body	17	21	2	1 $^1/_2$
5.	Body design and construction	17	21	2	1 $^1/_2$
	total	75	110	10	08

OBJECTIVES:

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

1.1   Explain the requirement of the steering system and steering gear layout

1.2   Identify and explain Rack and Pinion, Worm and Roller, Worm and Sector, Re–circulating ball type Steering gear box

1.3   Explain the steering linkage mechanism, Electric power steering and Hydraulic power   steering

1.4   Explain collapsible steering mechanism

1.5   Explain the reversible and irreversible steering, Under steering, and over steering. Turning radius..

1.6   Explain Wheel alignment – Steering geometry - caster, camber, and king-pin inclination.

1.7   Identity the adjustment of Toe-in, Toe out.

1.8   Identity and adjust steering defects wheel wobble and wheel shimmy.

2.0   Braking System:

2.1 To know about the functions and requirements of brakes

2.2 Calculate the stopping time & distance –braking efficiency

2.3 Identify the types of braking system viz., mechanical, Hydraulic brakes. Sketch the hydraulic braking system.

2.4 Draw and explain the constructional details of master and wheel cylinder, Tandem master cylinder.

2.5 Explain the types of disk brakes

2.6 Explain the advantages and disadvantages of disk brakes and hydraulic brakes.

2.7 Explain power assisted brakes, viz., vacuum servo assisted brakes- Boosters - air brakes.

2.8 List out types of brakes used in various vehicles.

3.0   Suspension system:

3.1 State the requirements of a good suspension system.

3.2 Identity the types of suspension systems.

3.3 Distinguish the types of springs, viz., Laminated (leaf) springs, coil spring, helical springs.

3.4 Types of leaf springs

3.5 Sketch and explain torsion bars, telescopic type hydraulic shock absorber, and stabilizer bar.

3.6 To know about the McPherson, and double wish bone type of independent suspension system.

4.0   Automobile Chassis and Body:

4.1 List the types of chassis and its main components.

4.2 Explain the functions of the frames

4.3 Describe the types of chassis frames

4.4 Explain construction features

4.5 Identify various loads acting on the frame

4.6 Explain the requirement of vehicle body

4.7 to know about the types of automobile body of Trucks, cars and buses

4.8   to know about the various body materials

4.9 To know about various load acting on body

5.0 Body design and Construction

5.1 To know about the major dimensions of vehicle body

5.2 To know about streamlining and aerodymics of auto body.

5.3 To know in detail various body components

5.4   To know about production methods of body

5.5 To know about methods of assembling of body

5.6 To know about interior finish of automobile body

5.7   To know about power windows, Central locking system.

5.7 To know about body exterior finishing techniques.

COURSE CONTENTS:

1.0 Steering System:

Requirements of the vehicle steering system – Steering gear layout -types of steering gear-steering –linkages-power steering –Reversible and irreversible steering under steering and over steering-steering gear ratio-Turning radius- Ackerman's & Davi's steering gear mechanism. Steering geometry – Caster, Camber, Kingpin Inclination, Toe-in and Toe-out - Types of steering gears- rack and pinion, worm and sector, recirculating ball and nut and worm and wheel – Collapsible steering column – Steering defects – Wheel wobble and shimmy

2.0 Braking System:

Functions of brakes – requirements of automobile brakes - stopping time – stopping distance – braking efficiency – types of braking systems – Mechanical and Hydraulic brakes – Layout of hydraulic braking systems – constructional details of internal shoe brakes - Disc brakes – Types of disk brakes - advantages and limitations of hydraulic over mechanical brakes, advantages of disc brakes over drum brakes – power assisted brakes – vacuum servo assisted brakes – air brakes – list out types of brakes used in various vehicles.

3.0 Suspension System:

Objectives of the suspension system – requirements of a good suspension system – types of suspension system – conventional and independent suspension system – types of springs – laminated or leaf spring, coil springs, helical 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 – air suspension system.

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.

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- sheet metal fabrication methods, plastic panel fabrication methods - Method of joining body components - Interior finish – trimming, upholstery - Exterior – body painting –types –company painting method and paint booth -Merits of paint booth method of painting- central locking.

Reference Books:

1. The motor vehicle   - Newton steeds. &Garret

2. Automobile engineering   - G.B.S.Narang

3. Automobile engineering   - Sethi.

4. Automobile chassis   - P.M.Heldt.

5. Body engineering   - S.F.Page.

6. Automotive Mechanics   - William crouse.

AUTOMOBILE SERVICING AND MAINTANANCE

Course Title : **Automobile Servicing and maintenance**
Course Code : **A-404**
Periods/Week : **05**
Periods/Semester : **75**

TIME SCHEDULE

Sl. No.	Major Topic	Periods	Weightage of Marks	Short Type	Essay Type
1.	Introduction	05	08	1	½
2.	Servicing equipment	10	13	1	1
3.	General procedure for servicing and Maintenance	12	16	2	1
4.	Servicing and maintenance of Two and four wheelers	20	34	3	2 1/2
5.	Automobile reconditioning equipment.	18	26	2	2
6.	Reconditioning of diesel fuel injection System	10	13	1	1
	Total	**75**	**110**	**10**	**8**

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

1.0 Understand the Details of garage-service station, its equipment
    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 Understand the importance of 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 various lubrication equipment and their function
    2.5 Explain working of High pressure lubrication equipment

3.0 Understand the General procedure of servicing and Maintenance of motor vehicles
    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 brake down maintenance and its necessity.
    3.6 Explain operation maintenance and its purpose.
    3.7 State the necessity of Servicing and Quick Service

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.
3.11   Explain about Engine tune up

4.0   Understand the Serving and maintenance of two and four wheelers
4.1   Explain about general maintenance like periodic checkup and the trouble shooting of motor cycle
4.2   Enumerate trouble shooting of cooling, lubrication, Fuel and ignition system.
4.3   Enumerate trouble shooting of clutch, gear box and differential

5.0   Understand the Automobile reconditioning equipment
5.1   State working of degreasing plant.
5.2   Explain decarburizing methods
5.3   Explain the procedure of reboring and line boring.
5.4   State the necessity of valve seat cutting and grinding.
5.5   Identify the correct valve seating position and extent of grinding.
5.6   State the necessity of valve refacing.
5.7   Explain the procedure of valve lapping
5.8   Explain servicing of valves.
5.9   Explain the procedure of crank shaft grinding.
5.10   Explain working of Brake drum Lathe
5.11   Explain working of Brake shoe riveting machine

6.0   Understand the Reconditioning of Diesel Fuel injection system
6.1   Explain Fuel injection pump Test Bench.
6.2   Explain Phasing and Calibration of F.I.P.
6.3   Narrate various servicing and testing procedures of fuel injectors.
6.4   Enumerate 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   Automobile service station 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, Quick Service 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 & four wheelers
General maintenance - periodic checkup and the trouble shooting of motor cycle
(a). Engine systems:-Fuel system - General diagnosis and fault rectification in fuel system (Carbureted 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 Engine reconditioning Equipment

Degreasing plant – Procedure of degreasing – De-carbonising 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

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.
2.   Automobile Engineering   : Harbanth Singh
3.   Manual on Depot   : A.P.S.R.T.C Manuals
      Maintenance
4.   Transmission Overhaul   : Station Abbey.
5.   The Modern motor Engineer Vol I, II : Arthen Judge
6.   Practical Auto Engineering   : Odamis.

SPECIAL PURPOSE VEHICLES

Course Title	:	Special Purpose Vehicles
Course Code	:	A-405
Periods/Week	:	04
Periods /Semester	:	60

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage Of Marks	Short Answer Questions	Essay Questions
1.	Introduction to Special purpose Vehicle	04	08	1	½
2.	Farm tractors	16	29	3	2
3.	Special features in tractors	12	26	2	2
4.	Earth moving vehicles	16	26	2	2
5.	Automotive emission and control	12	21	2	1½
	Total	**60**	**110**	**10**	**8**

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

1.0 Understand the concept of Special Purpose Vehicles
    1.1 State the meaning of Special Purpose Vehicle
    1.2 Enumerate types of Special Purpose Vehicles
    1.3 State applications of these vehicles

2.0 Understand the types of Farm Tractors
    2.1 Classify Tractors.
    2.2 Describe wheel type tractor. and the purposes for which it is used viz. utility tractor, row crop tractor, orchard type tractor, Industrial type tractor, garden tractor, Rotary tiller, implement carrier, earth moving tractors etc.,
    2.3 List tractor manufacturing companies in India.
    2.4 Identify the elements in transmission system.
    2.5 Explain the transmission system of tractors.
    2.6 Explain the differential assembly, Differential lock and types
    2.7 Explain steering and braking system of tractors.

3.0 Understand the Special features in tractors
    3.1 Define P.T.O shaft.
    3.2 State the drive used for P.T.O. shafts and explain each drive.
    3.3 State safety precautions to be taken for various P.T.O. drives.
    3.4 Explain belt pulley drive and precautions to be taken while using belt pulley.
    3.5 Draw the general layout of Hydraulic system in tractor.
    3.6 Describe the lift mechanism for tractor.
    3.7 Explain the trouble shooting of Hydraulic system.
    3.8 Explain about the types of Draw bars and hitches.
    3.9 Explain about draft and depth control mechanisms

4.0 Understand the working of Earth Movers

    4.1   State the functions and specifications of various types of earth moving vehicles.

    4.2   State the types, working and applications of Bulldozers

    4.3   State the types, working and applications of Dumpers

    4.4   State the types, working and applications of Shovels

    4.5   State the types, working and applications of Excavators

    4.6   State the types, working and applications of Graders

5.0 Understand the various Automotive emission and control system

    5.1   List out sources of Automotive pollutants

    5.2   State ill effects of pollutants

    5.3   Classify S.I. Engine pollutants

    5.4   Explain control measures of automotive pollution

    5.5   Classify C.I. Engine emissions.

    5.6   Explain about emission norms.

COURSE CONTENT

1. **Introduction**
   special purpose vehicles –Types - applications.

2. **Farm Tractors**
   Types of tractors - Wheel type and Track type – Types of drives- classification of tractor chassis – 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 used in tractor– Lift mechanism for tractor - Trouble shooting of hydraulic system. Draw bar – Types (two point linkages, three point linkages.)- Types of hitches- Depth control – Draft control

4. **Earth moving machinery**
   Different types of Earthmovers - Dumpers, Bull Dozers, shovels, Excavators, Tippers and graders – working and applications .

5. **Automotive emission and control**
   Various sources from vehicles, effects of pollutants on human and environment. SI Engine emissions – CO, NO_X, HC- Control measures - EGR, CATALYTIC CONVERTOR, ELCD, PCV etc. CI Engine Emissions- particulate emissions, smoke- control measures- particulate traps. Emission norms – BS (Bharat) and Euro.

REFERENCE BOOKS

1. Farm Machinery   by   C. P. Nakra
2. Automobile Engineering   by   K.K. Ramalingam
3. Truck Cranes   by   A. Astakhov (MIR)
4. Motor Graders   by   E. G. Ronioson(MIR)
5. Construction equipment   by   Y. Pokras & Tushnyakov MIR)

AUTOMOBILE ENGINEERING DRAWING

Course Title : Automobile Engineering Drawing

Course Code : A–406

Periods / Week : 06

Periods / Semester : 90

TIME SCHEDULE

Sl. No	Major Topics	Periods	Weightage of marks		Total Marks
			Part A	Part B	
1	Automobile Engine Components	24	2	1	10+10
2	Chassis and Transmission Components	24	1	1	05+10
3	Automobile Parts assembly drawings	42	1	1	05+20
	Total	**90**	**4**	**3**	**20+40**

* All questions are to be answered

OBJECTIVES

Upon completion of the course the student shall be able to

Supply their views of the following (Sectional Views where ever necessary)

1.0   Draw the pistons for diesel and petrol.

2.0   Draw the connecting rods for diesel and petrol engines.

3.0   Draw the cylinder Head for 2 stroke petrol engine.

4.0   Draw the crank shaft.

5.0   Draw the cam shaft.

6.0   Draw the valves.

7.0   Draw the Rocker Arms.

8.0   Draw the spark plugs.

9.0   Draw the following chassis and transmission components

      1. Linkage Bracket   2.Chassis Bracket

3. Gear box selector fork   4. Engine Mount   5. Bell crank lever

11.0   Understand and draw the automobile parts of the assembly drawing.

1. Screw Jack   2. Master Cylinder   3. Wheel cylinder.

COURSE CONTENT

I.   **Draw to scale, the following Automobile parts including different views of Automobile Engine Components**

1.   Pistons for petrol engine.

2.   Pistons for diesel engine.

3.   Connecting rod for petrol engine.

4.   Connecting rod for diesel engine.

5.   Cylinder head for 2 stroke petrol engine.

6.   Crank shaft.

7.   Cam shaft.

8.   Valves.

9.   Rocker Arms

10.   Spark plugs.

II.   **Chassis and Transmission Components.**

1.   Linkage Bracket

2.   Chassis Bracket

3.   Gear box selector fork

4.   Engine Mount

5.   Bell crank Lever

III.   **Automobile Parts Assembly Drawing**

1.   Screw Jack

2.   Master Cylinder.

3.   Wheel Cylinder

REFERENCE BOOKS:

1.   Automobile Engineering Drawing   by   R.B Guptha

2.   Machine Drawing   by   N.D Bhat

AUTOMOBILE SERVICING & RE-CONDITIONING LABORATORY

Course Title   :   Automobile Servicing & Re-conditioning laboratory

Course Code   :   A – 407
Periods / Week   :   06
Periods / Semester :   90

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. Starting system
10. Generating system
11. Ignition system
12. Rear axle hubs

Re-conditioning:

1. Decarburization
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
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	(a) Identify the tools and gauges required (b) dismantling and assembling (c) Fault finding and rectification of different troubles (d) Servicing and adjustments.	(a) Understand the construction and working (b) Understand the steering systems used in different types of vehicles (c) understand the grades of oils used in automobile steering systems
4	Braking systems of automobiles	(a) Identify the tools and gauges required	(a) Understand the Construction and working of braking system

		(b) dismantling and assembling (c) Fault finding and rectification of different troubles (d) Servicing and adjustments (e) brake bleeding.	(b) Understand the braking systems used in different types of vehicles (c) Understand the grades of oils used in automobile braking systems
5	Independent suspension systems of automobiles	(a) identify the tools and Gauges required (b) dismantling and assembling (c) Fault finding and rectification of different troubles (d) Servicing and adjustments	(a) Understand the construction and working (b) Understand the independent suspension systems used in different types of vehicles.
6	Rigid axle suspension system of automobiles	(a) Identify the tools and gauges required (b) dismantling and assembling (c) Fault finding and rectification of different troubles (d) Servicing and adjustments.	(a) Understand the construction and working (b) Understand the rigid axle suspension systems used in different types of vehicles.

S.No.	Name Of The Experiment	Key Competencies	Competencies
1	De-carbonisation	• 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 Reboring	• 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, refacing and lapping	• check the condition of valve face and seat. • Align valve with grinding wheel. • Check concentricity	• State different grades of emery paste. • check the condition of valve face and seat. • Apply lapping compound on valve

		for valve face and seat.	seat and valve face. • Align valve with grinding wheel. • Check concentricity for valve face and seat.
5	Line - boring	• Align Main journal with line boring machine. • Check for correctness of bearing journals.	• Measure diameter of journal using micrometer. • 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 micrometer • 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 brakedrum	• 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	• Identify the tools required for removing lining from brake shoe. .

			liner.	• 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
10	Fuel injector - servicing and testing	• 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.

Communication Skills

(Common to all Branches)

Subject title	:	Communication skills	
Subject code	:	A - 408	
Periods per week	:	3	
Periods per semester	:	45	

Introduction :

 In the context of globalization , competence in speaking skills is the need of the hour The gap between the needs of the industry and the curriculum can be bridged by enabling the students to hone their speaking and listening skills. This course aims at providing opportunities for practicing speaking.

Time Schedule

Sno.	Topic	Periods	Weightage of marks (End Exam)	Sessional marks	Total
1	Listening I	3			
2	Listening II	3	10	10	20
3	Introducing oneself	3			
4	Describing objects	3			
5	Describing events	3			
6	Reporting past incidents	3			
7	Speaking from observation / reading	3	50	30	80
8	JAM	6			
9	Group discussion	6			
10	Mock interviews	6			
11	Making presentations	6			
		45	60	40	100

Objectives :

On completion of the course the students will be able to

- Strengthen their listening skills
- Strengthen their speaking skills

Competencies and key competencies to be achieved by the student

Topic	Teacher's input/ methodology	Students competence
Listening I Listening II	Pre- Listening –eliciting, pictures While - Listening Post –Listening –project , writing	Identifying the main idea, Identifying specific details, Identifying parallel and contradictory ideas Drawing inferences, Reasoning
Introducing oneself	Kinds of introduction --official/ personal, dynamic vocabulary, Body language, Model introduction, Use of line ups	Use of simple present tense, Sequencing, Appropriate vocabulary
Reporting incidents	Group work /pair work, Elicit, Use of past tense, Student presentations	Use of past tense, Relevant vocabulary
Describing objects	Vocabulary , Use of adjectives, Games—I spy, Group presentations	Use of adjectives, Dimensions, shapes Compare and contrast, Sequence
Describing events	Group work/pair work Use of appropriate tense	Use of appropriate tense, Sequencing

Reporting past incidents	Use of past tense, Vocabulary, Student presentations	Use of past tense , sequencing
Speaking from observation/reading	Group work/pair work, Reading techniques ,	Use of past tense, Summarising , evaluating, comprehension
JAM	Effective techniques , Good beginning , conclusion, tips, Use of line ups	Vocabulary, Sequencing, Fluency, Thinking spontaneously
Group discussion	Expressing opinion, body language,	Expressing opinion, agree/ disagree, fluency,Persuasive and leadership skills
Mock interview	FAQs , body language	Role play, body language,
Making presentations	Student presentations	Using charts , pictures, interpreting data, sequencing, PPTs

Communicative methodology (CLT) should be used to create an interactive class. Apart from the suggestions given teachers are free to innovate to use any activity to improve the language competence of students . Attention can also be given to improve the accent and intonation of students.

Note:

* This subject   is a theory subject.

** The workload should be calculated as theory workload.

***Examinations in the subject will be treated as a practical one.

Strength of materials Lab & Fluid mechanics Lab / Electrical Lab

Subject Title: Strength of materials Lab & Fluid mechanics Lab /Electrical Lab

Subject Code   :   **A-409**

Periods/Week   : **03**

Total Periods/Semester   : **45**

TIME SCHEDULE

Sl. No.	Major Topics	Periods
(i)	**Strength of materials Fluid Mechanics Lab**	**27**
(ii)	**Electrical Lab**	**18**
	Total	45

NOTE :

1. *Sessional Marks will be 20 in each laboratory*
2. *The End Examinational will be conducted separately in two laboratories subjected to 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 passed at a time which fails they have to appear for both exam even though they passed any one of them*

(I)(A) List of Experiments in S.M LAB

Study and use Mechanical Extensometers and Universal testing Machine.

1. **Test on ductile material and finding Young's Modulus yield points – percentage elongation and percentage reduction in area – stress – strain diagram.**

2. **Torsion Test on Mild steel-relation between torque and angle of twist. Determination of Shear Modulus.**

3. **Bending and deflection Test for steel – Determination of Young's Modulus for steel.**

4. **To determine rock well hardness number for materials like Mild steel, Aluminum etc.**

5. **To determine the resistance of materials to impact loads by conducting IZOD's Test.**

6. **Testing of strength of welded joints.**

The competencies and key competencies to be achieved by the student

S.No	Title of the experiment	Competencies expected	Key competencies
1.	**Test on ductile material for finding yield points and young's modulus.**	**1)To understand young's modulus** **2)To understand yield point** **3)To understand percentage elongation** **4)To understand stress-strain diagram**	**1)To use UTM by fixing specimen between the jaws.** **2)Must be able to measure the elongation and load.**
2.	**Torsion Test on Mild steel**	**1)To understand about torsion** **2)To measure angle of twist** **3)To understand shear Modulus**	**1)Able to measure load and angle of twist on the torsion machine**
3.	**Bending and deflection Test for steel**	**1)To understand bending and deflection.** **2)Able to fix the specimen on Bend test machine.** **3)Able to draw the graph between load vs deflection** **4)Able to draw the graph vs different spans and deflections for a given load**	**1)Able to measure and apply different loads on the specimen and concerned deflections on the machine.**
4.	**Determine rock well hardness number for materials like Mild steel, Aluminum**	**1)To understand hardness** **2)Able to measure the load on specimen and depth of indentation**	**1)Able to fix the specimen and operate the machine.** **2)Able to use the formula for finding Rockwell hardness number**
5.	**Determine the resistance of materials to impact loads by conducting IZOD's Test.**	**1)Understand the resistance of material** **2)Able to fix the specimen on the machine and apply different loads.**	**1)Able to read the impact load reading after the arm is released on the specimen from a specific height.**
6.	**Testing of strength of welded joints.**	**1)Able to fix welded joint specimen on the test machine.** **2)Able to apply the force and measure the elongation on the specimen**	**1)Able to ascertain the values of stress ReL, tensile strength Rm, and elongation A.**

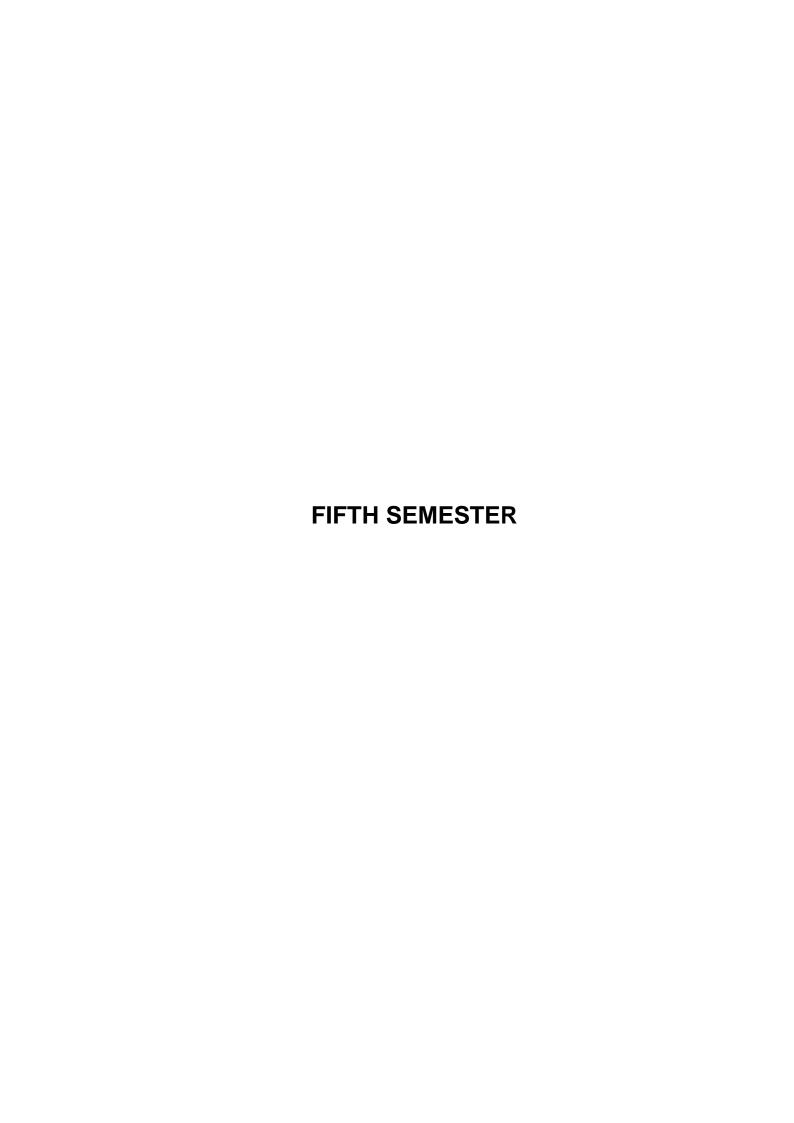|		3)Able to draw the graph between tension and strain.	

(I)(B) List of Experiments in F.M LAB

1   Bernoulli's Theorem-Proof verification.

2   Application of Venturi meter.

3.   Study of reciprocating/Rotary Pump available and load test on it.

S. No	Title of the experiment	Competencies expected	Key competencies
1	**Bernoulli's Theorem-Proof verification.**	To understand the Bernoulli's Theorem	(a)Able to write Bernoulli's equation. (b)Able to substitute the values in the Bernoulli's equation
2	**Application of Venturi meter.**	(a)Able to measure inlet, throat and out let section areas. (b)Calculate the value of discharge in a given time. .	(c)Able to measure the volume of the measuring tank. (d)Must calculate potential , kinetic and pressure energy at inlet
3	**Study of reciprocating/Rotary Pump available and load test on it.**	(a) Able to measure the energy meter reading. (b) Able to calculate the input given to the motor and output delivered by the pump	(a)Able to measure the various readings like pressure, speed, vacuum gauge reading. (b) Able to find out efficiency of the pump.

(II) List of Experiments in Electrical Lab

1. Verification of Ohm's Law
2. Use of Ammeter and Volt meter in simple series and Parallel Circuits
3. Charging and Testing of Batteries
4. Load Test on a shunt Generator

FIFTH SEMESTER

DIPLOMA IN AUTOMOBILE ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
V Semester

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-501	Industrial Management & Smart Technologies	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	Motor Transport Organization	4	-	60	3	20	80	100
PRACTICAL:								
A-506	CAD Practice	-	6	90	3	40	60	100
A-507	I.C. Engines Testing and Vehicle Diagnosing Laboratory	-	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	630	-	260	640	900

Industrial Management & Smart Technologies

Subject Title	:	Industrial Management & Smart Technologies
Subject Code	:	A-501
Periods/Week	:	5
Period/Semester	:	75

TIME SCHEDULE

S. No.	Major Topics	Periods	Weightage Of Marks	Short Answer Questions	Essay Type Questions
1.	Basics of Industrial Management	06	13	1	1
2.	Organisation structure & Organisational behaviour	10	18	1	$1^{1/2}$
3.	Production Management	10	18	1	$1^{1/2}$
4.	Materials Management	08	13	1	1
5	Maintenance management & Industrial Safety	08	13	1	1
6	Entrepreneurship Development	08	13	1	1
7	Total Quality Management	05	06	2	
8	Smart technologies	20	16	2	1
	Total	**75**	**110**	**10**	**08**

1.   **Basics of Industrial Management**

   On completion of the course the student will be able to
1.0   **Understand the principles of management as applied to industry.**
   1.1   Define industry, commerce (Trade) and business.
   1.2   Know the need for management.
   1.3   Understand the evolution of management
   1.4   Understand functions of Management.
   1.5   Explain the principles of scientific management.
   1.6   Explain the principles of management.
   1.7   Differentiate between management and administration.
   1.8   Understand the nature of management as a profession
   1.9   Differentiate between supervisory, middle and Top level management
   1.10   Explain the importance of managerial skills (Technical, Human, Conceptual)

2.   **Organisation Structure & organisational behaviour**

   Know types of ownerships, the organisation structure of an industry and the behaviour of an

   individual in an organisation.

   2.1   Understand the philosophy and need of organisation structure of an industry.
   2.2   Understand the line, staff and Functional organisations
   2.3   Understand the Authority and Responsibility Relationships
   2.4   Understand the differences between Delegation and decentralization
   2.5   Explain the factors of effective organisation.
   2.6   Outline the communication process
   2.7   State motivation theories.
   2.8   State Maslow's Hierarchy of needs.
   2.9   List out different leadership models.

2.10   Explain the trait theory of leadership.
2.11   Explain behavioural theory of Leadership.
2.12   Explain the process of decision making.
2.13   Assessing Human resource requirements
2.14   Know the concept of Job analysis, Job description and specifications
2.15   Understand the process of recruitment, selection, training and development
2.16   Understand types of business ownerships
2.17   Differentiate between the business ownerships
2.18   Know the objectives of Employee participation
2.19   Understand the meaning and definition social responsibilities
2.20   Corporate social responsibility

3. **Production management**

   Understand the different aspects of production management.

   3.1   Identify the factors of Plant Location
   3.2   Know the objectives of plant Layout
   3.3   Understand the principles of plant Layouts
   3.4   Explain the types of plant Layouts
   3.5   Relate the production department with other departments.
   3.6   State the need for planning and it's advantages.
   3.7   Explain the stages of Production, planning and control.
   3.8   Know the basic methods demand forecasting
   3.9   Explain routing methods.
   3.10   Explain scheduling methods.
   3.11   Explain dispatching.
   3.12   Explain Break Even Analysis
   3.13   Define supply chain Management, competitive strategy, Supply chain strategy
   3.14   Draw PERT/CPM networks.
   3.15   Identify the critical path

4. **Materials Management**

   Understand the role of materials management industries.

   4.1   Explain the importance of materials management in Industry.
   4.2   Know Functions of Materials Management
   4.3   Derive expression for inventory control.
   4.4   Explain ABC analysis.
   4.5   Define safety stock.
   4.6   Define reorder level.
   4.7   Derive an expression for economic ordering quantity.
   4.8   Know the functions of Stores Management,
   4.9   Explain types of store layouts.
   4.10   List out stores records.
   4.11   Explain the Bin card.
   4.12   Describe Cardex method.
   4.13   Explain general purchasing procedures
   4.14   Explain tendering, E-tendering and E-procurement procedures
   4.15   List out purchase records.
   4.16   Know the applications of RFID (Radio Frequency Identification Device)
   4.17   Understand the applications of RFID in material management

5. **Maintenance Management & Industrial Safety**

   Comprehend the Importance of Maintenance Management & Safety procedures
   5.1   Explain the importance of maintenance management in Industry.

5.2   Know the Objectives of maintenance management
5.3   Know the activities of maintenance management
5.4   Understand the importance of Preventive maintenance
5.5   Understand the need for scheduled maintenance
5.6   Differentiate between scheduled and preventive maintenance
5.7   Know the principles of 5 s for good house keeping
5.8   Explain the importance of safety at Work place.
5.9   List out the important provisions related to safety.
5.10   Explain hazard and accident.
5.11   List out different hazards in the Industry.
5.12   Explain the causes of accidents.
5.13   Explain the direct and indirect cost of accidents.
5.14   Understand the types of emission from process Industries, their effects on environment and control
5.15   Understand the principles of solid waste management

6. **Entrepreneurship Development.**

Understand the role of entrepreneur in economic development and in improving the quality of life.

6.1   Define the word entrepreneur.
6.2   Explain the requirements of an entrepreneur.
6.3   Determine the role of entrepreneurs in promoting Small Scale Industries.
6.4   Describe the details of self-employment schemes.
6.5   Characteristic of successful entrepreneurs
6.6   Explain the method of site selection.
6.7   List the financial assistance programmes.
6.8   List out the organisations that help an entrepreneur
6.9   Know the use of EDP Programmes
6.10   Understand the concept of make in India, Zero defect and zero effect
6.11   Understand the importance for startups
6.12   Explain the conduct of demand surveys
6.13   Explain the conduct of a market survey
6.14   Evaluate Economic and Technical factors.
6.15   Prepare feasibility report study

7. **Total Quality Management:**

Understand the concepts adopted in total quality management

7.1   Explain the concept of quality.
7.2   List the quality systems and elements of quality systems.
7.3   State the principles of quality Assurance.
7.4   Understand the basic concepts of TQM
7.5   Know the Pillars of TQM
7.6   List the evolution of ISO standards.
7.7   Explain ISO standards and ISO 9000 series of quality systems.
7.8   List the beneficiaries of ISO 9000.
7.9   Explain the concepts of ISO 14000
7.10   Know the overview of PDCA cycle

8. **Smart Technologies**
   8.1 Get an overview of IoT
      8.1.1   Define the term IoT
      8.1.2   Know how IoT work
      8.1.3   List the key features of IoT
      8.1.4   List the components of IoT : hardware, software, technology and protocols

8.1.5   List the advantages and disadvantages of IoT
8.2 IoT Applications
    8.2.1   Smart Cities
    8.2.2   Smart Energy and the Smart Grid
    8.2.3   Smart Transportation and Mobility
    8.2.4   Smart Home, Smart Buildings and Infrastructure
    8.2.5   Smart Factory and Smart Manufacturing
    8.2.6   Smart Health
    8.2.7   Food and Water Tracking and Security
    8.2.8   Social Networks and IoT

Course Content

1.   Basics of Industrial Management

Introduction: Industry, Commerce and Business; Definition of management; Characteristics of management; Functions of management - Planning, Organizing, Staffing, Directing, Co-ordination, Controlling, Motivating, Communication, Decision Making; Principles of scientific management: – F.W.Taylor, Principles of Management: Henry Fayol; Administration and management; Nature of management; levels of management; managerial skills;

2.   Organisation Structure & organisational behaviour

Organizing - Process of Organizing; Line/Staff and functional Organizations, Decentralization and Delegation, Effective Organizing; Communication, Motivational Theories; Leadership Models; Human resources development; Forms of Business ownerships: Types – Sole proprietorship, Partnership, Joint Stock Companies, Cooperative types of Organizations; Employee participation in management; Corporate Social responsibility;

3.   Production management

Definition and importance; Plant location and layout; Types of production -job, batch and mass; production Planning and Control: Demand forecasting, routing, scheduling, dispatching and follow up; Break even analysis; Supply chain Management (Definition, Competitive strategy Vs Supply chain Strategy, Supply chain drivers); Project scheduling; Application of CPM and PERT techniques; simple numerical problems;

4.   Materials Management

Materials in industry, Basic inventory control model, ABC Analysis, Safety stock, re-order level, Economic ordering quantity, Stores Management: Stores layout, stores equipment, Stores records, purchasing procedures, e-tendering, e-procurement; purchase records, Bin card, Cardex RFID (Radio Frequency Identification Device)application in materials management;

5.   Maintenance Management & Industrial Safety

Objectives and importance of plant maintenance, Different types of maintenance, Nature of maintenance problems, Range of maintenance activities, Schedules of preventive maintenance, Advantages of preventive maintenance, 5 S principles; Importance of Safety at work places; Causes of accidents-psychological, physiological and other industrial hazards; Domino sequence; methods of promoting safe practices; Pollution control in process industries; Introductory concepts on Solid waste management (General introduction including definitions of solid waste including municipal, hospital and industrial solid waste, Waste reduction at source – municipal and industrial wastes)

6.   Entrepreneurship Development.

Definition of Entrepreneur; Role of Entrepreneur; Concept of Make In India, ZERO defect, Zero Effect, Concept of Start-up Company, Entrepreneurial Development: Role of SSI, MSME, DICs, Entrepreneurial development schemes; Institutional support, financial assistance programmes; Market survey and Demand survey; Preparation of Feasibility study reports

7. Total Quality Management:

Total Quality Management (TQM)- Concept of quality discussed by B. Crosby W. Edward, Deming, Joseph M. Juran, Kooru Ishikawa, Genichi Taguchi, Shigco Shingo. Quality systems – Definitions of the terms used in quality systems like, quality policy, quality management, quality systems, Stages of development of ISO 9000 series , ISO-14000, Deming's PDCA Cycle (Plan, Do, Check and Action). Japanese Quality Management, culture, Kaizen Strategy (continuous improvement).

8. Smart Technologies :

Overview of IoT - Define IoT, how IoT work, key features of IoT, components of IoT : hardware, software, technology and protocols, advantages and disadvantages of IoT - IoT Applications - Smart Cities, Smart Energy and the Smart Grid, Smart Transportation and Mobility, Smart Home, Smart Buildings and Infrastructure, Smart Factory and Smart Manufacturing, Smart Health, Food and Water Tracking and Security, Participatory Sensing, Social Networks and IoT.

REFERENCE BOOKS

1.   Industrial Engineering and Management -by O.P Khanna
2.   Production Management- by Buffa.
3.   Engineering Economics and Management Science - by Banga & Sharma.
4.   Personnel Management by Flippo.
5.   Production and Operations Management –S.N. Chary
6.
        Converging_Technologies_for_Smart_Environments_and_Integrated_Ecosystems_IERC_ Book_ Open_Access_2013 pages-54-76
7.   Supply Chain Management –Sunil Chopra and Meindl, PHI publishers
8   5 S made easy by David Visco

DESIGN OF MACHINE ELEMENTS

Course Title	:	Design of Machine Elements
Course Code	:	A-502
Periods / Week	:	05
Periods / Semester	:	75

TIME SCHEDULE

Sl.No.	Major Topic	Periods	Weightage of marks	Short type	Essay type
1.	Bolts and Nuts	10	16	2	1
2.	shafts	20	26	2	2
3.	Keys and couplings	12	16	2	1
4.	Cams,	11	13	1	1
5.	Governors and Flywheels	16	26	2	2
6.	Design of automobile components	06	13	1	1
	TOTAL	75	110	10	8

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

1.0   Understand the concept of Design of Bolts and Nuts
    1.1   State the terminology used in bolts and nuts – its proportions.
    1.2   Mention 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.
    1.3   Calculate the dimensions of bolt and nut by using empirical formula

2.0   Understand the concept of Design of shafts
    2.1   Explain the concept to torsion–torque equation.
    2.2   State the assumptions made in pure torsion
    2.3   State the functions of a shaft-various materials used in the manufacture of shaft with respect to its adaptability.
    2.4   Calculate diameters of hollow and solid shafts
    2.5   Calculate diameters of hollow and solids hafts considering both strength and stiffness.

3.0   Understand the concept of Design of keys and couplings
    3.1   Interpret the function of keys and splines with the help of neat sketches and material used for them.
    3.2   Explain the types of keys -saddle, flat, round sunk keys etc.
    3.3   Design rectangular sunk key considering its failure against shear and crushing using empirical proportions

3.4   Obtain proportions for a spline for various application

3.5   State the function of a coupling

3.6   Calculate the proportions of muff coupling and CI 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   Understand the concept of Design of Cams

4.1   State various types of cams and followers

4.2   Define the terms cam profile, base circle, cam angle, trace point and lift.

4.3   Draw the displacement diagrams for (i) Uniform velocity (ii) Uniform Acceleration (iii) Simple harmonic motion.

4.4   Draw cam profiles in above three cases for a knife edge follower, roller follower and flat follower.

5.0   Understand the concept of Design of Governors and Flywheel

5.1   State the types of Governors and their applications

5.2   Explain working of porter Governor

5.3   Simple problems on porter governor (no derivation)

5.4   State the purpose and applications of flywheel

5.5   Differentiate between the governor and a flywheel.

5.6   Explain the turning moment diagram – problems on flywheel

6.0   Understand the concept of Design of automobile components

6.1   Piston

6.2   Connecting Rod

6.3   IC Engine valve

6.4   Universal coupling

COURSE CONTENT

1. **Bolts and Nuts**
   Definition of terms like 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 (Hexagonal only)

2. **Shafts**
   Theory of pure torsion – Torque (torsion) equation (No Derivation) –assumptions made .- Function of shafts – materials used. –Power transmitted by solid and hollow circular shafts – Design solid and hollow shafts . (i)subjected to shear stress and angle of twist. (ii) subjected to shear stress and bending stress

3. **Keys and couplings**
   Functions of keys and sp lines-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 sp lines. Functions of coupling–classification of couplings– design of muff coupling and flange coupling

4. **Cams**
   Types of cam sand followers- applications – cam profile, base circle, cam angle, trace point andlift.Displacementdiagrams-1.Uniformvelocity 2.Uniform acceleration and retardation3.simple Harmonic motion. Draw Cam profiles for above three cases for

knife edge, Flat plate and roller follower. (No offset)

5. **Governors and fly wheels**
   Function of Governor-types-application- working of porter Governor -simple problems Flywheel types –purpose and application-Comparison between governors and flywheels- turning moment diagram- design of flywheel – simple problems.

6. **Design of simple automobile components**
   1.Piston
   2.Connecting Rod
   3. IC Engine valve
   4 Universal coupling

REFERENCE BOOKS

1. Auto Design   R.B Gupta
2. Machine Design   R.S Khurmi

PRODUCTION TECHNOLOGY

Course Title   :   **Production Technology**
Course Code   :   **A–503**
Periods / Week   :   **05**
Periods / Semester :   **75**

TIME SCHEDULE

Sl. No.	Major Topic	Periods	Weightage of Marks	Short type	Essay type
1.	Milling	08	13	1	1
2.	Gear Making	06	08	1	½
3.	Grinding	18	26	2	2
4.	Surface Finishing Process	05	08	1	½
5.	Jigs and fixtures	08	13	1	1
6.	Processing of Plastics	08	13	1	1
7.	Modern Machining process	14	16	2	1
8.	Flexible manufacturing system and Robotics	08	13	1	1
	Total	75	110	10	8

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

1.0   Understand the working of Milling Machine
    1.1   Explain the working of milling machine
    1.2   Classify milling machines.
    1.3   Illustrate the constructional details and function of each part of milling machine –specifications of milling machine.
    1.4   Describe the various milling operations.
    1.5   List out indexing methods – explain direct and simple indexing.

2.0   Understand the methods of gear making
    2.1   State methods of gear making.
    2.2   Explain gear shaping and gear hobbing
    2.3   Explain different gear finishing methods

3.0   Understand the working of grinding machines
    3.1   Identify different abrasives.
    3.2   Explain the bonds–bonding process.
    3.3   Know the designation /marking system of grinding wheel.
    3.4   State the factors for selection of grinding wheel.
    3.5   List out methods of grinding.
    3.6   Classify the grinding machines.
    3.7   Write the specification of grinding machines.
    3.8   Explain the working of grinding machines

4.0 Understand the surface finishing processes
- 4.1 List different types of surface finishing process.
- 4.2 Explain the principle of Electro plating with a sketch.
- 4.3 Explain the principle of hot dipping processes–galvanizing-tin coating– Parkerizing – anodising.

5.0 Understand the importance of jigs and fixtures in mass production
- 5.1 State the differences between jigs and fixtures.
- 5.2 State the principle of location and clamping.
- 5.3 Explain different types of drill jigs – fixtures (welding and milling)

6.0 Understand the processing of the plastics
- 6.1 Statetheadvantagesandlimitationsofplasticsasengineeringmaterials.
- 6.2 Differences between thermoplastics and thermosetting plastics.
- 6.3 Explain the principle of making plastic products by compression molding, transfer molding.
- 6.4 Explain the principle of extruding, casting and calendaring.

7.0 Understand the modern machining processes
- 7.1 Compare non –conventional machining with traditional(conventional) machining.
- 7.2 State the relative advantages and limitations of non-conventional Machining.
- 7.3 State the equipment used in USM process.
- 7.4 Explain the principle of USM with a neat sketch.
- 7.5 Explain Electric Discharge Machining with sketch..
- 7.6 Explain the principle of open loop NC machine and closed loop NC Machine.
- 7.7 List the elements of NC machine.
- 7.8 Explain the NC system –point to point positioning control system, Straight cut positioning system – continuous path system.
- 7.9 State the advantages and limitations of NC machining system over the Conventional machining system.
- 7.10 Explain the principle of computerized numerical control (CNC).
- 7.11 State the difference between NC and CNC machines.
- 7.12 Explain direct numerical control (DNC) system.
- 7.13 State the application of computers in design like geometric modeling, Engineering analysis, design reviews and evaluation and automated Drafting.
- 7.14 State Definition, applications, advantages and procedure of CAD.

8.0 Understand the Flexible Manufacturing System (FMS) and Robotics
- 8.1 Define FMS
- 8.2 Explain how FMS can be applied in manufacturing.
- 8.3 Describe the major elements and features of FMS.
- 8.4 State the components of FMS
- 8.5 State designing steps of FMS
- 8.6 State the advantages and limitations of FMS
- 8.7 State the meaning of concept 'Robot'
- 8.8 Describe the basic elements common to all robots.
- 8.9 State typical applications of Robots in Industry.
- 8.10 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 cutting
Manufacture of Gears by casting, moulding, stamping, coining, Extruding,rolling.Gearshaping–descriptionofGearshaper-Gearhobbing–descriptionofGearhob–operationofgearhobbingMachine-Gearfinishing processes.

3.0 Grinding
Abrasives – types – natural &artificial, Bonds and bonding processes for making grinding wheel – vitrified, silicate, Shellac, rubber, Bakelite. Factors effecting the selection of grinding wheel – size and shape of wheel–kind of abrasives. Grain size, grade and strength of bond-structure of grain spacing-bond materials.
Standard marking systems-letters and numbers – sequence of marking system, grades of letters. Grinding machines – classification – cylindrical – surface – tool & cutter. Grinding machines – construction details and working principles. Principle of center-less grinding – advantages and limitations – constructionaldetailsofcenter-lessgrindingmachine.Work–holdingdevices.Wheelmaintenance–
balancing,dressingandtruing of grinding wheels.

4.0 Surface finishing (Treatment) processes.
Electroplating–basicprinciples–Platingmetals–applications.Hotdipping: Galvanising–Tin coating – Parkerizing, Anodising.
Metalspraying:Wireprocess–powderprocessandtheirapplications.Organic
coating:oilbasepaints,lacquerbasepoints,varnish,enamels,Bituminous   paints, Rubber base coatings.

5.0 Jigs and fixtures
Advantages of using jigs and fixtures in mass production, Design principle of jigs and fixture – principle of location and clamping.
Worklocation-typesoflocatorsandclamps.Drilljigs,weldingandmilling fixtures.

6.0   Processing of plastics.
Advantages and limitations of plastics over other engineering Materials. And differences between thermoplastics and thermosetting plastics.
Processing of plastics: (a).Compression moulding (b).Transfer moulding
(c) Extruding (d). Casting and moulding (e). Calendaring

7.0 Modern machining process
Introduction-Comparison of modern machining processes with traditional machining process 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 servo drives- Classification of NC systems–Point to point positioning control system, straight cut positioning system, continuous path or contouring system., Functions carried out by NC machines-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)

Introduction, definition of FMS Principles of flexibility, changes in manufacturing system – External and internal changes, job flexibility, machine flexibility Features of FMS – Production equipment support system, material handlingsystemandcomputercontrolsystem,AdvantagesandlimitationsofFMS
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.
2.   Elements of workshop Technology (vol.II)-Hazra Chowdhary.
3.   Production Technology -R. K. Jainand S. C.Gupta.
4.   Work shop Technology(Vol.III)-Chapman
5.   Manufacturing Process -B. M. L. Begeman
6.   Workshop Technology (Vol.II)-Gupta and Kaushisk
7.   Production Technology -H.M.T.
8.   Automation production system and-Michel P Groover (Prentice Computer
       integrated manufacturing Hall of India Ltd, New Delhi)
9.   CAD / CAM – Michel P. Groover
10   Computer aided design and manufacturing-W. Zimmer (Prentice Hall of India Ltd.,
                                                                    NewDelhi)

MODERN TRENDS IN AUTOMOBILE ENGINEERING

Subject Title   : MODERN TRENDS IN AUTOMOBILE ENGINEERING

Subject Code   : A-504

No of periods/week   : 05

Total periods /Semester: 75

TIME SCHEDULE

Sl. No	Major topic	Periods	Weight age of marks	Short type	Essay type
1	Alternate Fuels	15	26	2	2
2	Automotive Fuel System	15	26	2	2
3	Engine Air Flow Systems	10	16	2	1
4	Steering, Brakes, Suspension and Transmission Systems	20	26	2	2
5	Electrical Systems, Circuits & Computer Controlled Systems	15	16	2	1
		75	110	10	8

OBJECTIVES

1.0   Understand the concept of Alternate Fuels

1.1   Define fuel and alternate fuel

1.2   State the necessity of alternate fuels.

1.3   Explain the availability and properties of alternate fuels.

1.4   List the types of alternate fuels that can be used for propulsion of automobile.

1.5   Identify the types of alternative energy sources.

1.6   List general properties of alcohols

1.7   List various types of alcohols that can be used as fuel in automobiles

1.8   Explain the effects of Alcohol Fuels used directly in S.I engine.

1.9   Explain the effects of blending of methanol or ethanol with gasoline or diesel.

1.10   Summarize the emission characteristics of these blends.

1.11   List the Advantages and Limitations of Alcohol blends as automobile fuels.

1.12   Define a Biodiesel

1.13   List the properties of Biodiesel

1.14   Define a Gaseous fuel

1.15   List at least eight types of Gaseous fuels

1.16   List the gaseous fuels used in an automobile.

1.17   Explain the modifications required in the fuel system of the engine.

1.18   Describe the working of the fuel system of a gas engine

1.19   List the Advantages and Limitations of gaseous fuels as automobile fuels.

2.0   Understand the Fuel Systems used in Modern Automotives

2.1   Understand the basic components of electronically controlled unit (ECU)

2.2   Explain the working principle of Multi point fuel Injection System (MPFI)

2.3   Know the advantages & disadvantages of MPFI System

2.4   Compare MPFI System with carbureted System

2.5   Know different types of sensors

2.6   Explain the working Principle of Direct Petrol Injection System

2.7   Explain Diesel Electronic Control Injection System (DECI)

2.8   Explain common Rail Diesel Injection System (CRDI)

2.9   Explain Electronic Unit Injection System (EUI)

3.0   Understand the Engine Air Flow System used in Modern Automotives.

3.1   Know the Principle of Thermostatic Air Cleaners

3.2   Know the Method of Super Charging and Turbo Charging

3.3   Explain the working Principle of fixed Geometry Turbo Charger (FGT) and Variable Geometry Turbo Charger (VGT)

3.4   Know the Principle of Turbo Stratified Injection System.

3.5   Know the Principle of Turbo Charger Inter cooling System.

3.6   Know the Modifications required for the Turbo Charged Engine

4.0   Understand the Steering, Braking, Suspension Transmission Systems used in Modern Automotives.

4.1   Explain the working of ECU Controlled Power Assisted Steering.

4.2   Explain the working of Electronic Power Assisted Steering.

4.3   Explain the working of Four Wheel Steering.

4.4   Know the necessity of Hand Brakes.

4.5   Know the Automatic Brake Adjustment, Wear Indicators, Brake Pressure Control Valve.

4.6   Explain Antilock Braking System (ABS), Equal Braking Distribution System(EBD), Traction Control System (TC) and Electronic Stability Control System(ESC).

4.7   Know about Multi-collision Braking System

4.8   Know about Hydro lastic suspension, Hydro gas suspension and Adaptive Suspension Systems.

4.9   Explain Continuously Variable Transmission System (CVT)

4.10   Explain Duel Shift Gear Box (DSG)

5.0   Know about Electrical Circuits and computer Control Systems.

5.1   Know the colour code and Symbols used in Automotive wiring Diagram.

5.2   Know about Vehicle condition Monitor (VCM).

5.3   Explain the Supplementary restraint System (SRS)- Air Bags & Seat Belts with Pre-tensioners.

5.4   Know the fault codes of control systems.

5.5   Know about computer Control Operation, Input Sensors, Actuator Mechanism & Operation.

5.6   Know about On- Board Diagnostics.

COURSE CONTENT

1)   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 - Introduction to alternative energy sources like Electric, solar, fuel cells– merits and demerits of these alternative energy sources. General properties of alcohols – 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 – general properties 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 engine – working of fuel system of a gas engine with a block diagram – advantages and limitations of gaseous fuels as automobile fuels

2) **Automotive Fuel System**

Fuel System & ECM

Multi point fuel Injection System (MPFI)- Introduction and Advantages- comparision with Carburetor-Catalyst and oxygen sensor- Throttle position sensor- Air flow sensor-engine speed and piston position sensor-coolant temperature sensor- idle speed control- petrol injection- Electronic Fuel injection system (EFI)- Introduction – components Direct petrol Injection-Common Rail Diesel Injection System(CRDI)- Diesel Electronic control injection(DECI)- Electronic unit Injector(EUI)

3) **Engine Air Flow System**

Thermostatic Air Cleaners - Super Charging method - Turbo Charger- Fixed Geometry Turbo (FGT)- Variable Geometry Turbo(VGT)- Turbo Stratified Injection (TSI).
– TC with inter cooling systems- turbo charged engine modifications

4) **Steering, Brakes, Suspension and Transmission Systems**

Steering:
ECU Controlled Power assisted steering – Electric power assisted steering- four wheel steering-

Brakes:
Hand brakes- Automatic Brake adjustment- Wear Indicators- brake pressure control Valve- 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 Pnuematic suspension – Adaptive Suspension System

Transmission:

Continuously Variable Transmission System (CVT) and Duel Shift Gear Box (DSG)

5)   Electrical Systems, Circuits & Computer Control Systems

Colour code & Symbols of wiring Diagram- Vehicle condition monitoring (VCM) - Supplementary resistant systems (SRS) – Air bags-seat belt pretensioners- fault codes – control operation-input Sensors- Actuator Mechanism and operation- Onboard Diagonostics.

Reference Books:
1. Trends in Automobile Engineering - A S Rangwala (New Age International Publishers)
2. A Practical Approach to Motor Vehicle Engineering and Maintenance – Allan Bonnick, Derek Newbold (Routledge Publishers)
3. Automobile Engineering – Vol –I Engine System – Anil Chhikara (Satya Prakashan Publishers)

MOTOR TRANSPORT ORGANISATION

Course Title : **Motor Transport Organization**
Course Code : **A-505**
Periods/Week : **04**
Periods/ Semester : **60**

TIME SCHEDULE

Sl.No.	Major Topics	Periods	Weightage of Marks	Short answer question	Essay type question
1.	Organizational structure	12	21	2	1 1/2
2.	Operations	12	21	2	1 1/2
3.	Bus and crew scheduling	06	13	1	1
4.	Transport economics	06	13	1	1
5.	Traffic and Fares	12	21	2	1 1/2
6.	Legal aspects of motor transport	12	21	2	1 1/2
	Total	**60**	**110**	**10**	**8**

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

1.0   Understand the organization structure of Motor Transport Organization
   1.1   State the importance of Motor Transport Organization.
   1.2   Classify the Motor Transport Organization.
   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 organization.
   1.5   Give the functional wings of a transport system.
1.6   state the need of training Programmes for drivers and conductors.
2.0   Understand the fundamentals of Operations
   2.1   State the types of operation.
   2.2   Distinguish – city; city-suburban and inter –city operation.
   2.3   State the operating characteristics.
   2.4   State the factors such as utility, capacity, dependability, safety, distance, flexibility, speed, road condition, fuel economy, traffic interference.
   2.5   Explain the terms – trip generation, factors to be considered for trip generation.
   2.6   Explain about traffic data – published data.
   2.7   Explain the following terms – duty roasters – trip sheet, way bill – log book.
   2.8   State the meaning of trip generation and explain the factors to be considered for trip generation.
   2.9   State the collection methods of traffic data.

2.10   State the meaning of 'trip sheet ' , 'waybill' and logbook.

3.0   Understand the bus and crew scheduling
3.1   State the factors to be considered in bus scheduling.
3.2   Calculate number of buses required.
3.3   State the factors to be considered in crew scheduling..
3.4   Explain how the productivity can be increased by scheduling.
3.4   Applications of computer in scheduling.

4.0   Understand the fundamentals of transport economics
4.1   State different types of costs involved in a transport organization.
4.2   Explain the components of vehicle operational cost.
4.3   Compute the total cost for specific type of operation.
4.4   Explain Vehicle taxes and depreciation

5.0   Understand the traffic and fare system in transport organisation
5.1   Explain fare structures
5.2   State the requirement of good fare system
5.3   State different fare methods
5.4   Explain straight line method, Taper scale method, flat fare method, concessional
        Fare and luggage fare.
5.5   State the types of ticketing system
5.6   Know about hand written ticket, card ticket, pre printed denomination ticket,
        Advance booking and reservation voucher and ticketing machine.
.

6.0   Understand 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.
6.7   Explain briefly the motor claim settlement procedure.

COURSE CONTENT
   1.   Organizational 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 functions – – Training Programmes for driver and conductor.

   2.   Operations
   Types of operations – city operation – suburban operation – inter-city (short distance and long distance) operation – other specific operations for goods carriers –operating characteristics – utility – capacity , Dependability – safety , distance, speed – road condition- fuel economy , Traffic interference , flexibility – 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, maintenance time – 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 – handling 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.

5.   Traffic and fares.

Elementary treatment of traffic investigation to improve services – peak hour demand – fare structure – requirements of good fare system – different fares for hilly areas – Fare methods – Straight line method, tapered scale method, flat rate, concessional fare, luggage fare – structure and method of drawing of fare stages – stage – 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.
      Traffic Engineering and Transport Planning   -   L.R. Kadiyali
2.   Motor vehicle workshop organization and
      administration   -   Bernard Chandler
3.   Bus Operation and Bus Crew Scheduling   -   C.I.R.T. (Pune)
4.   An introduction to Transport Engineering   -   Wilton W Hey
5.   Elements of Transport   -   R.J. Eatan
6.   Bus Operation   -   L. Kitchero

CAD PRACTICE

Subject Title : **CAD Practice**
Subject Code : **A–506**
Periods per week : **06**
Period per semester : **90**

TIME SCHEDULE

SI No.	Major Topics	No. of periods
1.	Introduction to CAD	03
2.	Selecting commands & Working with drawing	06
3.	Viewing drawing	03
4.	Working with coordinates	03
5.	Creating simple and complex entities	06
6.	Getting Drawing information	06
7.	Modifying entities	06
8.	Working with text	03
9.	Dimensioning drawing	03
10.	2D Drawing	24
11.	Layers	03
12.	Isometric views	06
13.	Working with blocks	03
14.	Printing drawing	03
15.	3D Drawings	12
	TOTAL	90

OBJECTIVES
Up on completion of the course the student shall be able to

1.0 Understand about the Computer Aided Drafting and its software
    1.1   Define Computer Aided Drafting
    1.2   List the Advantages of CAD
    1.3   Explain the importance of CAD software
    1.4   Explain the features of Graphic Work station
    1.5   Use CAD Environment: Screen, Various tool bars and menus.

2.0 Use appropriate selection commands
    2.1   Practice commands using toolbars, menus, command bar
    2.2   Practice repeating a command, Nesting a command and modifying

a command
2.3 Use prompt history window and scripts
2.4 Practice mouse shortcuts
2.5 Practice the Creating the drawing, Opening existing and damaged Files, saving the drawing
2.6 Practice the setting up a drawing
2.7 Practice the setting and changing the grid and snapping alignment
2.8 Practice the Entity snaps

3.0 Use Viewing tools of CAD
3.1 Practice the use of Scroll bar, pan command, and rotating view to move around within drawing
3.2 Practice the changing of magnification of drawing
3.3 Practice the displaying of multiple views
3.4 Practice the use of controlling visual elements like Fill, Text, Blips and Line weight

4.0 Use coordinate systems of the drawing
4.1 Practice how the coordinate system work
4.2 Practice how the coordinate system displayed
4.3 Practice the Find tool to determine the coordinates of a point
4.4 Practice the Two dimensional coordinates such as Absolute Cartesian, Relative Cartesian and Polar coordinates
4.5 Practice the use of right-hand rule
4.6 Practice the how to enter into x, y, z - coordinates
4.7 Practice the Three dimensional coordinates such as Spherical and Cylindrical coordinates
4.8 Practice the use of filters in two and three dimensions
4.9 Practice the defining user coordinate system
4.10 Practice the use of present user coordinate system

5.0 Create the simple and complex entities
5.1 Draw the lines, circles, arcs, ellipses, elliptical arcs, rays and infinite lines
5.2 Practice the Creation of point entities
5.3 Practice the Editing of point entities
5.4 Draw the complex shapes like rectangles, polygons, polylines, Splines, donuts, planes
5.5 Practice the adding of hatch pattern

6.0 Use the drawing information retrieving tools Measure, Divide, Calculate, Display, and Track
6.1 Measure the intervals on entities
6.2 Divide the entities in to segments
6.3 Calculate the areas defined by points, of closed entities, and Combined entities
6.4 Calculate the distance between the entities
6.5 Calculate the angle between the entities
6.6 Display the information about the entities and drawing status
6.7 Track time spent working on a drawing

7.0 Use the Modifying tools to modify the properties of entities
7.1 Practice the entity selection and de selection methods
7.2 Practice the Deletion of entities
7.3 Practice the Copying of entities within a drawing, between drawings
7.4 Practice the making of parallel copies, Mirroring entities and

Arraying entities

7.5 Practice the Rearranging of entities by Moving, Rotating and Reordering

7.6 Practice the Resizing of entities by Stretching, Scaling, Extending, Trimming, and Editing the length

7.7 Practice the Braking and joining of entities

7.8 Practice the creating, modifying the groups and ungrouping of Entities

7.9 Practice the Editing of polylines: Opening, Closing, Curving, De curving, Joining, Changing width and editing vertices

7.10 Practice the Exploding of entities

7.11 Practice the Chamfering and Filleting of entities

8.0 Use the Text tool to create and formatting the various types of text fonts and its styles

8.1 Practice the creating, naming and modifying the text fonts

8.2 Practice the Creation of line text, paragraph text

8.3 Practice the Setting of line text style and its alignment

8.4 Practice the Setting of Paragraph text style and its alignment

8.5 Practice the Changing of line text and Paragraph text

8.6 Practice the use of alternate text editor

9.0 Use Dimensioning concepts to create dimensions, Edit dimensions, Control dimension styles & variables and Adding geometric tolerances

9.1 Practice the creating of linear, Angular, Diametral, Radial, Ordinate dimensions

9.2 Practice the creating leaders and annotations

9.3 Practice the making dimensions oblique

9.4 Edit the dimension text

9.5 Practice the Controlling of dimension arrows and format

9.6 Practice the Controlling of line settings and dimension text

9.7 Practice the Controlling of dimension units, and dimension tolerance

10.0 Create 2D Drawings

10.1 Create 2D drawings of standard mechanical components

11.0 Organize the information on layers

11.1 Practice the setting a current layer, layers color, line type, line weight, print style

11.2 Practice the locking and unlocking of layers

11.3 Practice the layer visibility and layer printing

11.4 Practice the setting of current line type

11.5 Practice the loading of additional line types

11.6 Practice the creating and naming of line type

11.7 Practice the editing of line type

12.0 Create Isometric Views

12.1 Create Isometric views of simple objects

13.0 Use the Blocks, Attributes and External references to manage the Drawing

13.1 Define a block

13.2 Explain the purpose of a block

13.3 Practice the creating a block

13.4 Practice the inserting a block

13.5 Practice the redefining a block

13.6 Practice the exploding a block

13.7 Define an Attribute

13.8   Practice the editing attribute definitions
13.9   Practice the attaching attribute to blocks
13.10   Edit attributes attached to blocks
13.11   Extract attributes information
13.12   Define external reference
13.13   Practice the Attaching, Removing, and Reloading of external references
13.14   Practice the Binding, Clipping and changing the path of external
         References

14.0   Use Layouts, Layout view ports, and customizing printing in CAD
14.1   Define layout for printing
14.2   Understand the layouts
14.3   Practice the viewing of drawings in paper and model space
14.4   Display the model and layout tabs
14.5   Create the new layout
14.6   Reuse the layouts from other files
14.7   Manage the layouts in a drawing
14.8   Define layout view ports
14.9   Create layout view ports
14.10   Practice the viewing and scaling of layout view ports
14.11   Modify the layout viewports
14.12   Select the appearance of print dialog
14.13   Set the paper size and orientation
14.14   Select a printer or a plotter
14.15   Set the scale and view
14.16   Choose how line weight print

15.0   3D Drawings
15.1   Explain the concept of 3D
15.2   Create 3D solids using solid tool bar options
15.3   Create 3D Drawings of Standard Mechanical Components
15.4   Practice Rendering

KEY competencies to be achieved by the student

S.No	Experiment Title	Key Competency
1.	Introduction to CAD	• Open/close Autocad program • Understands Autocad Graphic User Interface(GUI) and various toolbars
2.	Selecting commands & Working with drawing	• Use prompt history window and scripts • Practice the setting up a drawing • Practice the Entity snaps
3.	Viewing drawing	• Use Scroll bar, pan command, and rotating view to move around within drawing • Control visual elements like Fill, Text, Blips and Line weight
4.	Working with coordinates	• Use Two dimensional coordinates and Three

		• dimensional coordinates
		• Use right-hand rule
		• Use filters in two and three dimensions
		• Define user coordinate system
5.	Creating simple and complex entities	• Draw the simple shapes like lines, circles, arcs and complex shapes like polygons, planes etc., • Practice the adding of hatch pattern

S.No	Experiment Title	Key Competency
6.	Getting Drawing information	• Measure the intervals and distance between entities • Divide the entities in to segments • Calculate the areas defined by points, of closed entities, and Combined entities
9.	Dimensioning drawing	• Create linear, Angular, Diametral, Radial, Ordinate dimensions • Practice the making dimensions oblique • Edit the dimension text • Practice the Controlling of dimension units, and dimension tolerance
10.	2D Drawings	• Use proper 2D commands to create 2D drawings
12.	Isometric Views	• Use Iso snap command to create Isometric views
13.	Working with blocks	• Create , insert and explode a block Attach attribute to blocks • Edit and extract attributes attached to blocks
14.	Printing drawing	• Display the model and layout tabs • Create the new layout and Manage the layouts from other files • Practice the viewing, scaling and Modifying of layout view ports • Set the paper size, orientation, scale, view and line weight to print
15.	3D Drawings	• Region 2D Drawings • Use proper 3D commands to create 3D drawings

COURSE CONTENT

1.0   The Computer Aided Drafting and its software
Definition of Computer Aided Drafting, the Advantages and importance of
CAD software ,The features of Graphic Work station, CAD Environment:
Screen, Various tool bars and menus.

2.0   Selection of commands
Commands using toolbars, menus, command bar
Repeating a command, Nesting a command and modifying a command
Use of prompt history window and scripts, mouse shortcuts
Creating the drawing, Opening existing and damaged files, saving of
drawing, setting up a drawing

Setting and changing the grid and snapping alignment, the Entity snaps

3.0 Use of viewing tools of CAD
Use of Scroll bar, pan command, and rotating view to move around within drawing, changing of magnification of drawing
Displaying of multiple views, the use of controlling visual elements like Fill, Text, Blips and Line weight

4.0 Use of coordinate systems of the drawing
Two dimensional coordinates such as Absolute, Cartesian, Relative, Cartesian and Polar coordinates, the use of right-hand rule,Three dimensional coordinates such as Spherical and Cylindrical Coordinates, the use of filters in two and three dimensions, Defining user Coordinate system.

5.0 Creating simple and complex entities
Drawing of lines, circles, arcs, ellipses, elliptical arcs, rays and infinite lines, Creating and editing of point entities, Drawing of complex shapes like rectangles, polygons, polylines, Splines, donuts, planes, and adding of hatch pattern

6.0 Use the drawing information retrieving tools Measure, Divide, Calculate, Display, and Track
Measuring the intervals on entities, dividing the entities in to segments,Calculation of areas of defined by points, closed entities, and combined, Entities, calculate the distance and angle between the entities, Displaying the information about the entities and drawing status, Tracking time spent working on a drawing.

7.0 Use the Modifying tools to modify the properties of entities
Entity selection and de selection methods, the Deletion of entities, Copying of entities within a drawing, between drawings, parallel copies, Mirroring entities and Arraying entities, The Rearranging of entities by Moving, Rotating and Reordering, The Resizing of entities by Stretching, Scaling, Extending, Trimming, and Editing the length, The Braking and joining of entities, The creating, modifying the groups and
ungrouping of Entities , Editing of polylines : Opening, Closing, Curving, Decurving, Joining, Changing width and editing vertices,The Exploding of entities, the Chamfering and Filleting of entities

8.0 Use the Text tool to create and formatting the various types of text Fonts and its styles
The creating, naming and modifying the text fonts, the Creation of line text, paragraph text, setting of line text style and its alignment, The Setting of Paragraph text style and its alignment, the Changing of line, text and Paragraph text, the use of alternate text editor

9.0 Use Dimensioning concepts to create dimensions, Edit dimensions, Control dimension styles & variables and Adding geometric tolerances
The creating of linear, Angular, Diametral, Radial, Ordinate dimensions,The creating leaders and annotations, making dimensions oblique, Editing the dimension text, controlling of dimension arrows and format.The Controlling of line settings and dimension text, the Controlling of dimension units, and dimension tolerance.

10.0 2D Drawings

Using appropriate commands creation of 2D drawings of standard mechanical components

11.0   Organize the information on layers
Setting a current layer, layers color, line type, line Weight, print style Locking and unlocking of layers, the layer visibility and layer printing Setting of current line type, the loading of additional line types, creating and naming of line type, editing of line type

12.0   Isometric Views
Create Isometric views of simple objects

13.0   Use the Blocks, Attributes and External references to manage the Drawing Blocks
The purpose of a block, creating a block, inserting a block, redefining a block, exploding a block
Attribute
Editing attribute definitions, attaching attribute to blocks
Editing attributes attached to blocks, Extracting attributes information
External reference
Attaching, Removing, and Reloading of external references, The Binding, Clipping and changing the path of external references

14.0   Use the Layouts, Layout view ports, and customizing printing in CAD layout for printing
Layouts, Viewing of drawings on paper and model space, Displaying of model and layout tabs, creating the new layout, Reuse the layouts from other files, Manage the layouts in a drawing
Define layout view ports
Create layout view ports, Practice the viewing and scaling of layout view ports, Modify the layout viewports,
Select the appearance of print dialog
Setting the paper size and orientation, selecting a printer or a plotter
Setting the scale and view, choosing line weight

15.0   3D Drawings
3D drawings of standard components
Rendering of 3D images

REFERENCE BOOKS

4MCAD User Guide- IntelliCAD Technology Consortium (WWW.intellicad.org)

4MCAD Software:
1. 4MCAD Viewer,
2. 4MCAD Classic,
3. 4MCAD Standard,
4. 4MCAD Professional.

I.C. ENGINE TESTING AND VEHICLE DIAGNOISING LAB

Subject Title : **IC ENGINETESTING AND VEHICLE DIAGNOISING LAB**
Subject Code : **A-507**

Periods/Week : **06**

Periods/Semester : **90**

List of Experiments:

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 DIAGONOSIS

1. Wheel Balancing.

2. Wheel Alignment.

3. Engine Analyzer

4. Exhaust gas Analyzer for Petrol and Diesel Engines.

5. Spark Plug Testing and cleaning

6. Driving Practice on Four Wheeler

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	- State different strokes of an I.C.Engine - State the parts of an I.C. Engine - Identify the dead centres

Sl.No.	Name of the Experiment	Key Competencies	Competencies
		gaps for the valve opening and closing and convert them into degrees	• 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 • 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	• 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 • 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	• 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

		• Record the readings in spring balance without parallax error	• 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

The competencies and key competencies to be achieved by the student

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 Examinational 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.*

PROJECT WORK

Subject Title   :   Project Work
Subject Code   :   A-509
Periods per week   :   03
Periods per semester :   45

OBJECTIVES

Upon Completion of the course the student shall be able to

1.0   Prepare technical project report

1.1   Identify and select component

1.2   Design and draw the production drawings

1.3   Prepare a project report with details of materials, processes etc

1.4   Develop a prototype /model of the product series with the facilities available in polytechnic.

1.5   Conduct a detailed market survey.

1.6   Identify and select of a product service with an aim to set up a small scale industry

1.7   Conduct a detailed market survey

1.8   Listing out the raw materials, equipment and tools needed for manufacturing a specified quantity

1.9   Explore the various financial arrangements to start the manufacturing under technocrat scheme in small scale industrial sector

1.10   Make a survey of requirements of the departments of industries, municipal, health, inspectorate of factories for starting an industry

1.11   Plan for a type of organization

1.12   Select a site

1.13   Prepare a techno feasibility report consisting of drawings, plant layouts, building requirements, machinery and equipment requirements, raw material, labour, production and administrative staff requirements, working capital material flow sheet, cash flow sheet, financial analysis etc.

COURSE CONTENT

The following activities are envisaged in the course of study

1.   Identification and selection of a product services with an aim to set small scale industry

2.   Conduct a detailed market survey

3.   Preparation of production drawings

4.   List out the raw materials, equipment and tools needed for manufacturing a specific quantity

5.   Develop a prototype model of the product in workshop (if possible) with the available facilities in the polytechnics

6.   Explore the various financial arrangements to start the manufacturing of the

product under technocrat scheme in small scale industrial sector.

7. Make a detailed survey of requirements of the departments of industry, municipal, health inspectorate of factories, electrical inspectorate, banks other financial agencies etc., for starting an industry

8. Plan for type of organization

9. Selection of site

10. Preparationoftechnofeasibilityreportconsistingofproductiondrawings
Plant layout building requirements, equipment requirements, list of raw materials and their availability tools and other items, labour force production,ministerialstaffrequirements,materialflowsheet,cashflow sheet, financial analysis etc.

DIPLOMA IN AUTOMOBILE ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS

C-16-VI SEMESTER
A - 601 INDUSTRIAL TRAINING

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

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

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

OBJECTIVES:

- Realization of the following broad objectives are expected from the students on completion of the industrial training program.
- To know the dismantling and assembling of the engine
- To know how to replace the parts of clutch assembly
- To know how to repair the gear box
- To know how to adjust the Differential
- To know how to repair steering gear box
- To know how to repair the rear axle
- To know how to repair the braking system
- To know how to balance and align the wheels
- To observe the various safety precautions
- To know about the job card preparation

INDUSTRIAL TRAINING SCHEME

VI SEMESTER

1. A candidate shall be assessed twice in the spell of industrial training i.e. at the end of third month and finally before he/she completes the industrial training
2. The assessment shall be carried out by a committee comprising of

   (a) A representative of the Industry where the candidate is undergoing training

   (b) A staff member of the concerned section of the polytechnic.

3. The assessment at the end of the third month and the end of training shall each carry 100 marks for the progress made during the corresponding period of training.
4. The remaining 100 marks are allotted as follows:

   For the training report (Record) 30 marks,

   For maintenance of log book 30 marks

   For seminar 40 marks.

   These are to be evaluated at the institution at the end of training by a committee consisting following staff members
   (1) Head of Section.
   (2) External Examiner preferably from Industry
   (3) Staff member who assessed the student during the Industrial Training.

5. The progress made during the end of assessment will be evaluated on the basis of the following parameters.

ASSESSMENT SCHEME

S. No.	Name of the Parameter	Max. Marks Allotted for each Parameter
1.	Attendance and punctuality	05
2.	Familiarity with Technical terms	06
3.	Familiarity with tools and material	10
4.	Attitude towards job	07
5.	Manual skills	04
6.	Application of knowledge	10
7.	Problem solving skills	10
8.	Comprehension and observation	04
9.	Safety and Environmental consciousness	03
10.	Human relations	04
11.	Ability to communicate	06
12.	Supervising ability	10
13.	General conduct during the period	06
14.	Maintenance of dairy	15
	Total	**100**