STATE BOARD OF TECHNICAL EDUCATION AND TRAINING

Andhra Pradesh :: AMARAVATI

Globally Competitive

CURRICULUM (C-20)

For Polytechnic Diploma Courses
in Andhra Pradesh

3½ YEAR (SW)
DIPLOMA IN
CHEMICAL ENGINEERING

CURRICULUM -2020

(C-20)

3½ YEAR (SW)

DIPLOMA IN CHEMICAL ENGINEERING

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CURRICULUM -2020
(C-20)
FOR DIPLOMA COURSES IN ANDHRA PRADESH CURRICULUM – C - 20

PREAMBLE

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

The State Board of Technical Education and Training, (SBTET) AP, has been offering Diploma programmes to meet the above said aspirations of the stake holders: industries, students, academia, parents and the society at large. As such, it has been the practice of SBTET, A.P., to keep the curriculum abreast with the advances in technology through systematic and scientific analysis of current curriculum and bring out an updated revised version at regular intervals. Accordingly the SBTET, AP under the aegis of the Department of Technical Education, Andhra Pradesh in it's 57th Board Meeting held on 05-02-2019 (vide item no: 18) resolved to update the Polytechnic Curriculum C-16 with the guidance of National Institute of Technical Teachers Training & Research (NITTTR), Extension Centre, Vijayawada (ECV), to be implemented with effect from the academic year '20-21.

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

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

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

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

Highlights of Curriculum C-20:

1. Duration of course for regular Diploma and for sandwich Diploma is 3 years and 3½ years respectively.
2. The Curriculum is prepared in Semester Pattern. However, First Year is maintained as Year-wise pattern.

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

RULES AND REGULATIONS OF C-20 CURRICULUM

1   DURATION AND PATTERN OF THE COURSES

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

All the Diploma courses are run on year wise pattern in the first year, and the remaining two or two & half years are run in the semester pattern. In respect of few courses like Diploma in Bio-Medical course, the training will be in the seventh semester. Run-through system is adopted for all the Diploma Courses, subject to eligibility conditions.

2   PROCEDURE FOR ADMISSION INTO THE DIPLOMA COURSES:

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

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

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

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

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

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

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

3   MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

4   PERMANENT IDENTIFICATION NUMBER (PIN)

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

5   NUMBER OF WORKING DAYS PER SEMESTER / YEAR:

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

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

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

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

6   ELIGIBILITY (ATTENDANCE TO APPEAR FOR THE END EXAMINATION)

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

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

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

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

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

f)   For INDUSTRIAL TRAINING:

i) During Industrial Training the candidate shall put in a minimum of 90% attendance.

ii) If the student fails to secure 90% attendance during industrial training, the student shall reappear for 6 months industrial training at his own expenses.

7   READMISSION

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

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

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

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

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

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

8   SCHEME OF Evaluation

a)   First Year

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

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

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

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

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

9   INTERNAL ASSESSMENT SCHEME

a)   **Theory Courses**: Internal assessment shall be conducted for awarding sessional marks on the dates specified. Three unit tests shall be conducted for I year students and two Unit Tests for semesters.Internal Assessment shall be of 90 minutes duration and for a maximum of 40 marks. For each test The average of marks of all the test, reduced to 20 shall be taken as final sessional in any case.

b)   **Practical Courses**:

(i) **Drawing Courses:**

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

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

All Drawing exercises are to be filed in serial orderand secured for further scrutiny by a competent authority.

(ii) Laboratory Courses:

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

Evaluation for Laboratory Courses, other than Drawingcourses:

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

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

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

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

d) For practical examinations, except in drawing, there shall be two examiners. External examiner shall be appointed by the Principal in consultation with respective Head of Section preferably choosing a qualified person from in the order of preference.
   i) Nearby Industry
   ii) Govt / Semi Govt organization like R & B, PWD, PR, Railways, BSNL,APSRTC,APSEB etc.,
   iii) Govt / University Engg.College.
   iv) HoDs from Govt.Polytechnic
   Internal examiner shall be the person concerned with internal assessment as in (c) above. The end examination shall be held along with all theory papers in respect of drawing.

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

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

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

Assessment no	Upon completion of	By	Based on	Max Marks
1	12 weeks	1.The faculty concerned and 2. Training Mentor of the industry	Learning outcomes as given in the scheme of assessment for Industrial Training	120
2	20-22 weeks			120
3.Final summative Evaluation	23 week	1.The faculty member concerned, 2.HOD concerned Branch and 3.An external examiner	1.Demonstration of any one of the skills listed in learning outcomes	30
			2.Training Report	20
			3.Viva Voce	10
			TOTAL	**300**

10 **MINIMUM PASS MARKS**
   THEORY EXAMINATION:
   For passing a theory Course, a candidate has to secure a minimum of 35% in end examination and a combined minimum of 35% of both Sessional and end examination marks put together.
   PRACTICAL EXAMINATION:
   For passing a practical Course, a candidate has to secure a minimum of 50% in end examination and a combined minimum of 50% of both sessional and practical end examination marks put together. In case of D.C.C.P., the pass mark for typewriting and short hand is 45% in the end examination. There are no sessional marks for typewriting and Shorthand Courses of D.C.C.P course.

   INDUSTRIAL ASSESSMENT:

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

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

12. **RULES OF PROMOTION FROM 1ST YEAR TO 3,rd, 4,th 5th ,6th and 7th SEMESTERS:**
A) For Diploma Courses of 3 Years duration
i. A candidate shall be permitted to appear for first year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds upto 10%) i.e. attendance after condonation on Medical grounds should not be less than 65% and pay the examination fee.

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

iii. A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and pay the examination fee. A candidate, who could not pay the 3rd semester exam fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training AP from time to time before commencement of 4th semester.
A candidate is eligible to appear for the 4th semester examination if he/she
a) Puts the required percentage of attendance in the 4th semester
b) Should not have failed in more than four Courses in 1st year

For IVC & ITI Lateral Entry Students:

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

  b) A candidate is eligible to appear for the 4thsemester examination if he/she clears at least two Courses in third semester.

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

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

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

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

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

For IVC& ITI Lateral Entry students:

v) A candidate shall be sent to Industrial training provided he/she puts in the required percentage of attendance in the 4th semester and pay the examination fee/ promotion fee as prescribed by SBTET.

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

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

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

For IVC & ITI Lateral Entry students:

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

  b) Should get eligibility to appear for 5th Semester Examination.

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

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

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

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

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

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

  b) Should not have failed in more than <u>four backlog Courses of 1st year.</u>

For IVC & ITI Lateral Entry students:

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

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

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

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

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

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

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

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

For IVC & ITI Lateral Entry students:

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

      b) Should not have failed more than four backlog Courses of 3rd Semester

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

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

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

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

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

A candidate is eligible to appear for the 4th semester examination if he/she
- a) Puts in the required percentage of attendance in the 4th semester
- b) Should not have failed in more than Four backlog Courses of 1st year

For IVC & ITI Lateral Entry Students:

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

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

A candidate is eligible to appear for the 5th semester exam if he/she
- a) Puts in the required percentage of attendance in the 5th semester.
- b) Should get eligibility to appear for 4th Semester examination.

For IVC & ITI Lateral Entry students:
- a) Puts in the required percentage of attendance in the 5th semester.
- b) Should not have failed in more than Four backlog Courses of 3rd Semester.

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

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

A candidate is eligible to appear for 6th semester examination
- a) Puts in the required percentage of attendance in 6th semester and
- b) should get eligibility to appear for 4th Semester Examination.

For IVC & ITI Lateral Entry students:
- a) Puts in the required percentage of attendance in 6th semester.
- b) Should get eligibility to appear for 5th Semester Examination.

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

A candidate is eligible to appear for 7th semester Industrial Training assessment (Seminar/Viva-voce) if he/she
- a) Puts in the required percentage of attendance, ie., 90% in 7th semester Industrial Training
- b) Should get eligibility to appear for 4th Semester Examination.

For IVC & ITI Lateral Entry students:
- a) Puts in the required percentage of attendance, ie., 90% in 7th semester Industrial Training.
- b) Should get eligibility to appear for 5th Semester Examination.

Important Note:

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

OTHER DETAILS

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

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

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

13.   STUDENTS PERFORMANCE EVALUATION

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

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

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

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

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

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

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

14.   EXAMINATION FEE SCHEDULE:

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

15.   STRUCTURE OF EXAMINATION QUESTION PAPER:

I. Formative assessment (Internal examination)

a) For theory Courses:

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

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

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

The sum of marks of 3 tests for I year and 2 tests for semesters shall be reduced to 20 marks in each Course for arriving at final sessional marks.

b) For drawing Courses:

For I year:

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

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

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

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

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

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

II. Summative assessment (End examination)

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

a) **Each theory paper consists of Section 'A', 'B' and 'C'.**

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

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

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

Thus the total marks for theory examination shall be: 80.

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

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

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

c) **Practical Examinations**
   For Workshop practice and Laboratory Examinations, Each student has to pick up a question paper distributed by Lottery System.
   Max. Marks for an experiment / exercise   : 50
   Max. Marks for VIVA-VOCE   : 10
   Total Max. Marks   : 60
   In case of practical examinations with 50 marks, the marks shall be distributed as
   Max. Marks for an experiment / exercise   : 25
   Max. Marks for VIVA-VOCE   : 05
   Total Max. Marks   : 30
   In case of any change in the pattern of question paper, the same shall be informed sufficiently in advance to the candidates.

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

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

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

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

18. **ELIGIBILITY FOR AWARD OF DIPLOMA**

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

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

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

For IVC & ITI Lateral Entry students:

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

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

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

A) FOR ISSUE OF PHOTO COPIES OF VALUED ANSWER SCRIPTS

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

II. Photo copies of valued answer scripts will be issued to all theory Courses and Drawing Course(s).

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

IV. No application can be entertained from third parties.

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

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

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

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

I. **RE-COUNTING**

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

II. **RE-VERIFICATION**

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

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

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

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

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

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

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

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

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

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

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

20.   MAL PRACTICE CASES:

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

21.   DISCREPANCIES/ PLEAS:

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

22.   ISSUE OF DUPLICATE DIPLOMA

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

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

23.   ISSUE OF MIGRATION CERTIFICATE AND TRANSCRIPTS:

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

24.   SPECIFIC CHANGES INCORPORATED IN PRESENT CURRICULUM C-20

DIPLOMA IN CHEMICAL ENGINEERING

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

i)   It is proposed to have 5 theory and 4 practical subjects in III, 6 theory and 5 practical subjects in IV semesters, and 5 theory subjects and 5 practical subjects in VII semester.

ii)   The sequence of the core subjects is slightly modified for aiding sequential learning and enhancing application adoptability.

iii)   New titlesare assigned to some subjects. The Chemical Engineering Drawing Lab using CAD in third semester in C-16 is renamed as CAD Practice in Chemical Engg. to provide full knowledge to the student on CAD application in chemical Engg.

iv)   In Curriculum C-16, CH – 307 is E.Tech Lab/organic and physical chemistry Lab. With an intention to give more emphasis to practical skills, In C-20, separate slots have been allocated to these labs as CH-307 – E. Tech Lab and CH-308 – OPC Lab.

v)   The subject Chemical plant equipment drawing, CH-706,is continued in C-20 to enable the student to learn about various equipment and their internal parts for better understanding of working of unit operations used in chemical Engg.

vi)   Life Skills Practicals CH-708 is introduced in VII Semester in C-20 instead of IV Semester in C-16. This is done for the better understanding.

Vii)   For Engineering Drawing subjects out of 40 sessional marks, 20 marks is awarded by conducting 3 unit tests for first year drawing and 2 unit tests for semester drawings. Another 20 marks shall be awarded by evaluating drawing sheets from time to time during the academic year/semester

VIII)   Engineering Mathematics-III is introduced in IV Semester for acquiring more knowledge and better understanding.

25. GENERAL

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

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

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

VISION
To develop a complete chemical process technician trained to be competent, ethical and professional leader who keeps pace with advanced process technologies with quality control applied in chemical and allied industries.

MISSION	
M1	To impart high quality –job ready diploma program in chemical engineering
M2	To prepare students for professional career or higher studies
M3	To promote excellence in teaching and industry collaborative activities for fruitful contribution to society

PROGRAMME OUTCOMES(POs)

1. **Basic and discipline specific knowledge**: Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
2. **Problem analysis**: Identify and analyze well-defined engineering problems using codified standard methods.
3. **Design / Development of solutions**: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
4. **Engineering tools, Experimentation and Testing**: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.
5. **Engineering practices for society, sustainability and environment**: Apply appropriate technology in context of society, sustainability, environment and ethical practices.
6. **Project Management**: Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well defined engineering activities.
7. **Life-long learning**: Ability to analyze individual needs and engaging updating in the context of technological changes.

PROGRAMME SPECIFIC OUTCOMES(PSOs)

1. An ability to understand the concepts of Chemical Engineering and apply them to various Chemical Engineering industries.
2. An ability to solve complex Chemical engineering problems, using latest analytical skills to arrive appropriate solutions.
3. Wisdom of social and environmental awareness along with ethical responsibility to have a successful career in the field of Chemical engineering and sustain passion and zeal for real-world applications in the field of chemical engineering using optimal resources as an entrepreneur.

DIPLOMA IN CHEMICAL ENGINEERING (DCHE)
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
C-20, FIRST YEAR

Subject Code	Name of the Subject	Instruction periods / week		Total Period / year	Scheme of Examination			
		Theory	Practical /Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
CH-101	English	03	-	90	3	20	80	100
CH-102	Engineering Mathematics - I	05	-	150	3	20	80	100
CH-103	Engineering Physics	04	-	120	3	20	80	100
CH-104	Inorganic Chemistry	04	-	120	3	20	80	100
CH-105	General Mechanical Engineering	05	-	150	3	20	80	100
CH-106	Materials Technology	03	-	90	3	20	80	100
PRACTICAL								
CH-107	Engineering Drawing		06	180	3	40	60	100
CH-108	Work Shop practice		06 (4+2)	180	3	40	60	100
CH-109	109-A Physics Laboratory	-	3	45	3 (1.5+1.5)	20	30	100 (50+50)
	109-B Inorganic Chemistry Laboratory	-		45		20	30	
CH-110	Computer Fundamentals Practice	-	03	90	3	40	60	100
TOTAL		**24**	**18**	**1260**				**1000**

CH-101, 102, 103, 107,109A, 109B, 110 Common to all

CH-104 Common with DPET/DPCT

CH-105: Common with DPCT

CH-106: Common with DCHE(PC)/DCHE(PP)/DCHE(OT)/DPCT

Note: 30 students will go to Physics lab and the remaining 30 will go to Chemistry lab

DIPLOMA IN CHEMICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
C-20, III Semester (SECOND YEAR)

Subject Code	Name of the Subject	Instruction period / week Mod(non-mod)		Total Period /seme ster	Scheme of Examination			
		Theory	Practical /Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
CH- 301	Engineering Mathematics – II	4	--	60	3	20	80	100
CH-302	Electrical Technology	4	--	60	3	20	80	100
CH-303	Organic and Physical Chemistry	5	--	75	3	20	80	100
CH-304	Fluid Mechanics	6	--	90	3	20	80	100
CH-305	Mass and Energy Balance	5	--	75	3	20	80	100
PRACTICAL								
CH-306	CAD practice in Chemical Engineering	--	3	45	3	40	60	100
CH-307	Electrical Technology Lab	--	3	45	3	40	60	100
CH-308	Organic & Physical Chemistry Lab.	--	6	90	3	40	60	100
CH-309	Fluid Mechanics Lab	--	6	90	3	40	60	100
TOTAL		**24**	**18**	**630**		**260**	**640**	**900**

CH-301 Common to all branches.
CH-302 Common with DCHE(PC)/DCHE(PP)/DCHE(OT)/DPCT/DPET
CH-303 Common with DCHE(PC)/DCHE(PP)/DCHE(OT)/DPCT
CH-304 Common with DPET
CH-305 Common with DCHE(PC)/DCHE(PP)/DCHE(OT)/DPCT
CH-306 Common with DCHE(PC)/DCHE(PP)/DCHE(OT)/DPCT
CH-307 Common with DCHE(PC)/DCHE(PP)/DCHE(OT)/DPET/DPCT

CH-308 Common with DCHE(PC)/DCHE(PP)/DCHE(OT)/DPCT
CH-309 Common with DPET

DIPLOMA IN CHEMICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
C-20,IV Semester (SECOND 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								
CH- 401	Engineering Mathematics-III	3	--	45	3	20	80	100
CH-402	Mechanical Unit Operations	4	--	60	3	20	80	100
CH-403	Inorganic Chemical Technology	4	--	60	3	20	80	100
CH-404	Organic Chemical Technology	4	--	60	3	20	80	100
CH-405	Heat Transfer	4	--	60	3	20	80	100
CH-406	Mass Transfer	5	--	75	3	20	80	100
PRACTICAL								
CH-407	Chemical Technology Lab	--	6	90	3	40	60	100
CH-408	Communication skills	--	3	45	3	40	60	100
CH-409	Mechanical Unit Operations Lab	--	3	45	3	40	60	100
CH-410	Heat transfer Lab	--	3	45	3	40	60	100
CH-411	Mass transfer Lab	--	3	45	3	40	60	100
TOTAL		24	18	630		320	780	1100

CH-401 Common to all branches.   CH-408 Common to all branches
CH-405 Common with DPET   CH-410 Common with DPET
CH-406 Common with DPET   CH-411 Common with DPET

DIPLOMA IN CHEMICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
C-20, V Semester (Industrial Training)   CH-501

S.No.	Subject	Scheme of Examination			
		Duration (hours)	Nature	Item Each spell of 6 months	Max. marks
1.	Practical Training in a Chemical or Allied Industry	6 months	Viva voce	1.First assessment	120
				2.Second Assessment (written & viva-voce)	120
				3.At the institution after completion of the training	
				1.Demonstration of any one of the skills listed in learning outcomes	30
				2.Training Report	20
				3.Viva Voce	10
	TOTAL				**300**

DIPLOMA IN CHEMICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
C-20,VI Semester (Industrial Training)   CH - 601

S.No.	Subject	Scheme of Examination			
		Duration (hours)	Nature	Item Each spell of 6 months	Max. marks
1.	Practical Training in a Chemical or Allied Industry	6 months	Viva voce	1.First assessment	120
				2.Second Assessment (written & viva-voce)	120
				3.At the institution after completion of the training	
				1.Demonstration of any one of the skills listed in learning outcomes	30
				2.Training Report	20
				3.Viva Voce	10
	TOTAL				**300**

DIPLOMA IN CHEMICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
C-20, VII 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								
CH-701	Industrial Management and Entrepreneurship	5	--	75	3	20	80	100
CH-702	Thermodynamics and Reaction Engineering	5	--	75	3	20	80	100
CH-703	Instrumentation and Process Control	5	--	75	3	20	80	100
CH-704	Environmental studies & Pollution Control Engineering	4	--	60	3	20	80	100
CH-705	Energy Technology	5	--	75	3	20	80	100
PRACTICAL								
CH-706	Chemical plant equipment drawing	--	6	90	3	40	60	100
CH-707	Instrumentation and Process Control and Reaction Engineering Lab	--	3	45	3	40	60	100
CH-708	Life skills	--	3	45	3	40	60	100
CH-709	Energy Technology Lab	--	3	45	3	40	60	100
CH-710	Project work	--	3	45		40	60	100
TOTAL		**24**	**18**	**630**		**300**	**700**	**1000**

CH-701 Common with DCHE(PC)/DCHE(PP)/DCHE(OT)/DPCT/DPET
CH-702 Common with DCHE(PC)/DCHE(PP)/DCHE(OT)/DPCT/DPET
CH-703 Common with DCHE(PC)/DCHE(PP)/DCHE(OT)/DPCT/DPET
CH-706 Common with DCHE(PC)/DCHE(PP)/DCHE(OT)/DPCT
CH-707 Common with DCHE(PC)/DCHE(PP)/DCHE(OT)/DPCT
CH-708 Common to all branches

FIRST YEAR

DIPLOMA IN CHEMICAL ENGINEERING (DCHE)
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
C-20/FIRST YEAR

Subject Code	Name of the Subject	Instruction periods / week		Total Period / year	Scheme of Examination			
		Theory	Practical /Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
CH-101	English	03	-	90	3	20	80	100
CH-102	Engineering Mathematics - I	05	-	150	3	20	80	100
CH-103	Engineering Physics	04	-	120	3	20	80	100
CH-104	Inorganic Chemistry	04	-	120	3	20	80	100
CH-105	General Mechanical Engineering	05	-	150	3	20	80	100
CH-106	Materials Technology	03	-	90	3	20	80	100
PRACTICAL								
CH-107	Engineering Drawing		06	180	3	40	60	100
CH-108	Work Shop practice		06 (4+2)	180	3	40	60	100
CH-109	109-A Physics Laboratory	-	3	45	3 (1.5+1.5)	20	30	100 (50+50)
	109-B Inorganic Chemistry Laboratory	-		45		20	30	
CH-110	Computer Fundamentals Practice	-	03	90	3	40	60	100
TOTAL		**24**	**18**	**1260**				**1000**

Note: 30 students will go to Physics lab and the remaining 30 will go to Chemistry lab

ENGLISH

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

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

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

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

CO-PO Matrix

Course Code CH-101	Course Title: English Number of Course Outcomes: 4			No. of Periods: 90	
POs	Mapped with CO No.	CO Periods Addressing PO in Column 1		Level of Mapping (1,2,3)	Remarks
		Number	Percentage		
PO1		Not directly Applicable for English course, however activities that use content from science and technology relevant to the Programme taken up by the student shall be exploited for communication in the Course.			
PO2					
PO3					
PO4					
PO5	CO1, CO2, CO3, CO4	20	22		>50%: Level 3
PO6	CO1, CO2, CO3, CO4	52	58		21-50%: Level 2
PO7	CO1, CO2, CO3, CO4	18	20		Up to 20%: Level 1

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

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1					✓	✓	✓
CO2					✓	✓	✓
CO3					✓	✓	✓
CO4					✓	✓	✓

NOTE: CO-PO groups shall be fulfilled through activities that use content from science and technology relevant to the Programme taken up by the student shall be exploited for communication in the Course.

BLUE PRINT OF QUESTION PAPER

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

PART-A: 10 Questions 3 marks each =30 Marks   All Questions are compulsory   : 60 minutes

PART-B: 5 Questions 8 marks each =40 Marks   Internal choice   : 90 minutes

Part-C: 1Question 10 marks   =10 Marks

(Higher Order Question)   No choice, one compulsory question : 30 minutes

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

Question Paper Pattern for Unit Tests

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

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

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

Learning Outcomes

1.   English for Employability
1.1.   Explain the need for improving communication in English for employability
1.2.   Use adjectives and articles effectively while speaking and in writing
1.3.   Write simple sentences
2.   Living in Harmony
2.1.   Develop positive self-esteem for harmonious relationships
2.2.   Use affixation to form new words
2.3.   Use prepositions and use a few phrasal verbs contextually
3.   Connect with Care
3.1.   Use social media with discretion
3.2.   Speak about abilities and possibilities
3.3.   Make requests and express obligations
3.4.   Use modal verbs and main verbs in appropriate form
3.5.   Write short dialogues for everyday situations
4.   Humour for Happiness
4.1.   Explain the importance of humour for a healthy living
4.2.   Improve vocabulary related to the theme
4.3.   Display reading and speaking skills
4.4.   Frame sentences with proper Subject – Verb agreement
4.5.   Explain the features of a good paragraph and learn how to gather ideas as a preliminary step for writing a good paragraph.
5.   Never Ever Give Up!
5.1.   Practice to deal with failures in life
5.2.   Use the present tense form for various every day communicative functions such as speaking and writing about routines, professions, scientific descriptions and sports commentary
5.3.   Write paragraphs with coherence and other necessary skills
6.   Preserve or Perish
6.1.   Describe the ecological challenges that we face today and act to save the environment.
6.2.   Narrate / Report past events
6.3.   Develop vocabulary related to environment
6.4.   Write e-mails
7.   The Rainbow of Diversity
7.1.   Illustrate and value other cultures for a happy living in multi-cultural workspace
7.2.   Usedifferent types of sentences
7.3.   Ask for or give directions, information, instructions
7.4.   Use language to express emotions in various situations
7.5.   Write letters in various real life situations
8.   New Challenges – Newer Ideas
8.1.   Explain the functional difference between Active Voice and Passive Voice
8.2.   Use Passive Voice to speak and write in various contexts
8.3.   List the major parts and salient features of an essay
8.4.   Explain latest innovations and get motivated

9.   The End Point First!
9.1.   Illustrate the importance of setting a goal in life
9.2.   Report about what others have said both in speaking and writing
9.3.   Write an essay following the structure in a cohesive and comprehensive manner
9.4.   Apply the words related to Goal Setting in conversations and in life
10.   The Equal Halves
10.1. Value the other genders and develop a gender-balanced view towards life
10.2. Identify the use of different conjunctions in synthesising sentences
10.3. Write various types of sentences to compare and contrast the ideas
10.4. Apply the knowledge of sentence synthesis in revising and rewriting short essays
10.5. Develop discourses in speech and writing
11.   Dealing with Disasters
11.1. Speak and write about different kinds of disasters and the concept of disaster management
11.2. Generate vocabulary relevant to disaster management and use it in sentences
11.3. Analyze an error in a sentence and correct it
11.4. Write different kinds of reports

Textbook: INTERACT (A Textbook for I Year English) - Published by SBTET, AP

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

STATE BOARD OF TECHNICAL EDUCATION- A.P
MODEL QUESTION PAPER
C20-CH-101- ENGLISH

Time: 3hrs   Max.Marks:80

PART-A   10X3=30 Marks

Instructions: Answer all the questions. Each question carries Three marks.

1. a)   Fill in the blanks with suitable articles:
         I have seen _____ European at _____local market.
    b)   Fill in with proper form of adjective given in the bracket:
         China is the _____country in the world. (populous, more populous, most populous)
    c)   i) Choose the synonym from the following for the word : 'filthy'
              dirty / clean / hygienic / tidy
         ii) Choose the antonym from the following for the word: 'exterior'
              external / internal   / open / interior

   *(Question1 : Remembering- Mapping with CO2 & CO3)
2. a)   i) Give prefix for the word: 'popular'
         ii) Write suffix for the word : 'king'
    b)   He was married _____ her _____ January 2015. (Fill in with appropriate preposition)
    c)   Match the words in column A with their corresponding meanings in column B:

Column-A	Column-B
i) Dynamic	a) tasty
ii) Gloomy	b) active
	c) sad
	e) proud

    *(Question 2 : Remembering- Mapping with CO2 & CO3)

3. a)   The old man hunted for his spectacles. (Give the contextual meaning of the word in italics)
    b)   The committee / have submitted / its report / to the President. (identify the part which
         contains an error)
    c) recently has a scooter purchased Shanthi. (Rearrange the jumbled words to make a
    meaningful sentence.)
    *(Question 3 : Understanding- Mapping with CO2 & CO3)

4. a)   Use the following primary auxiliary verb in sentence of your own:
                        ' does'
    b)   Fill in the blank with proper modal auxiliary verb based on the clue in the bracket:
             Harish _____ speak four languages. (ability)
    c)   Rakesh wants two hundred rupees from his father. (Write the sentence how he requests his
         father)
    *(Question 4 : Applying - Mapping with CO2 & CO3)

5. Fill in the blanks with suitable form of the verb given in brackets:
    a)   He _____ (go) for a walk daily.
    b)   The bus _____ (arrive) just now.
    c)   We _____ (live) in Chennai since 2005.

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*(Question 5 : Applicative- Mapping with CO2 & CO3)

6. Change the voice of the following sentences:
   a) English is spoken all over the world.
   b) They watched a movie yesterday.
   c) The Chief Minister will inaugurate the exhibition.

*(Question 6 : Applicative- Mapping with CO2 & CO3)

7. a) It is a beautiful rainbow. (Change into an exclamatory sentence)
   b) C.V. Raman won the Nobel Prize in 1930. (Frame a question using 'When')
   c) He can swim across the river. (change into 'Yes / No' question)

*(Question 7 : Applicative- Mapping with CO2 & CO3)

8. Change the speech of the following:
   a) He said, "I will go to Delhi tomorrow."
   b) Ravi said to Ashok, " Where are you going?"
   c) She told him to mind his own business.

*(Question 8 : Applicative- Mapping with CO2 & CO3)

9. Rewrite as directed:
   a) In spite of being busy he attended the meeting. (Rewrite the sentence using 'though')
   b) She is poor. She is honest. (combine the two sentences using 'but')
   c) On seeing the tiger, he climbed a tree. (split into two simple sentences)

*(Question 9 : Applicative- Mapping with CO2 & CO3)

10. Rewrite the following sentences after making necessary corrections:
    a) We have gone to picnic yesterday.
    b) Suresh watched T.V when I went to his house.
    c) They left Gujarat before the earthquake occurred.

*(Question 10 : Applicative- Mapping with CO2 & CO3)

<div align="center">

PART-B   **5X8=40Marks**
</div>

Instructions: Answer the following questions. Each question carries EIGHT marks.
11. Write a paragraph in about 100 words on what you do daily.
<div align="center">OR</div>
Write a paragraph in about 100 words on the uses and misuses of social media.

*(Question 11 : Understanding - Mapping with CO1, CO3 & CO4)

12. Construct a dialogue of at least five turns between an American and you about places worth visiting in your city.
<div align="center">OR</div>
Compose a dialogue of at least five turns between two friends, one favouring homemade food and the other, fast food.

*(Question 12 : Applying - Mapping with CO1, CO3 & CO4)

13. Write a letter to your parents about your preparation for year-end examinations.

<div align="center">OR</div>

Write a letter to the editor of a newspaper about the inconvenience caused due to loud speakers in your area.

*(Question 13 : Understanding - Mapping with CO1, CO3 & CO4)

14. Write an essay in about 120 words on measures to prevent water pollution.

<div align="center">OR</div>

Write an essay in about 120 words on importance of gender equality.

*(Question 14 : Applying - Mapping with CO1, CO3 & CO4)

15. Read the following passage and answer the questions that follow:

A farmer in ancient China had a neighbour who was a hunter, and who owned ferocious and poorly trained hunting dogs. They jumped over the fence frequently and chased the farmer's lambs. The farmer asked his neighbour to keep his dogs in check, but this fell on deaf ears. One day the dogs again jumped the fence, attacked and severely injured several of the lambs.

The farmer had had enough, and went to town to consult a judge who listened carefully to the story and said: "I could punish the hunter and instruct him to keep his dogs chained or lock them up. But you would lose a friend and gain an enemy. Which would you rather have, friend or foe for a neighbour?" The farmer replied that he preferred a friend. "Alright, I will offer you a solution that keeps your lambs safe, and which will keep your a neighbour a friend." Having heard the judge's solution, the farmer agreed.

Once at home, the farmer immediately put the judge's suggestions to the test. He took three of his best lambs and presented them to his neighbour's three small sons, who were beside themselves with joy and began to play with them. To protect his son's newly acquired playthings, the hunter built a strong kennel for his dogs. Since then, the dogs never again bothered the farmer's lambs. Out of gratitude for the farmer's generosity toward his sons, the hunter often shared the game he had hunted with the farmer. The farmer reciprocated by sending the hunter the cheese he had made. Within a short time the neighbours became good friends.

a) What kind of dogs does the neighbour have?
b) When did the farmer consult the judge?
c) What would be the consequence if the judge punished the neighbour?
d) What was the solution suggested by the judge?
e) What did the neighbour's sons do with the gifts they received?
f) How did the dogs stop bothering the farmer's lambs?
g) What items are exchanged happily between the two neighbours?
h) Pick the word from the passage that would mean: 'a closed shelter for dogs'.

<div align="center">**OR**</div>

Read the following short poem and answer the questions that follow:
Crisp in the winter's morning,
Softly all through the night,
What is this without warning,
Falling and white?

I have never seen snow,
But I can imagine it quite –
Not how it tastes, but I know,
It falls and is white.

<div align="center">**35**</div>

One morning I'll open the door,
To bring in the morning's milk,
And all around there'll be snow –
Fallen and still.

How I'll roll in the stuff!
How I'll tumble and spin!
Until the neighbours cry,
Enough!And send me back in.

1. What is the poem about?
2. How does snow fall?
3. Did you ever touch snow? How did you feel?
4. a) Pick the word from the poem that means 'slip and fall'
b) Write the antonym for the word 'soft'
*(Question 15 : Understanding - Mapping with CO1, CO3 & CO4)

SECTION – C

1X10=10 Marks

16. Write a report on the blood donation camp organized by International Red Cross Society in your college. Use the following clues: date, time, place, arrangements, donors, equipment, doctors, response, sponsors, snacks, volunteers, help others, save lives…etc.
    *(Question 16 : Applying - Mapping with CO1, CO3 & CO4)

***

Time: 90 minutes   **Max. Marks: 40**

PART-A   **4X4= 16 marks**

Instructions: Answer all the questions. Each question carries FOUR Marks.

1.   Rewrite / Fill in the blank as directed. Each question carries ½ Mark.**(CO1,CO2)**

    a) Write the antonym of 'cruel'   **CO2**

    b) Write the synonym of 'love'   **CO2**

    c) Give prefix to 'adventure'.   **CO2**

    d) Give suffix to ' liberate'   **CO2**

    e) It is _____ universal truth. (Fill in with suitable article)   **CO1**

    f) The boy is fond _____ ice-cream. (Fill in the blank with proper preposition)   **CO1**

    g) He _____not like sweets. (Fill in the blank with correct primary auxiliary verb.)   **CO1**

    h) We _____ respect our national flag. (Fill in with a proper modal verb)   **CO1**

2.   Rewrite the sentences as directed. Each question carries One mark. 4X1=4 Marks   **CO1**

    a) No other metal is so useful as iron. (Change into superlative degree)

    b) Very few students are so clever as Ramesh. (Change into comparative degree)

    c) Guess the contextual meaning of the italicized word in the following sentence.

    "The CBI officer has *interrogated* the bank employees in connection with the scam."

    d) only sings plays Prasanth not also well but cricket. (Rearrange the jumbled words)

3.   Fill in the blanks with proper form of the verb given in brackets. 4X1 = 4 marks   **CO1**

    The IPSGM _____(hold) in our college last month. Nearly all the colleges in our zone _____(participate) in the event. The prizes _____ (distribute) by the district collector.

    Next year, Government Polytechnic, Vijayawada _____ (conduct) the games meet.

4.   Rewrite the following sentences after making necessary corrections: 4X 1= 4 Marks   **CO1**

    a) The police has arrested the culprit.

    b) Three hundred miles are a long distance.

    c) The Principal along with the Heads of Sections have visited the laboratories.

    d) Either he or I is to blame.

PART-B   **3X8=24 Marks**

Instructions: Answer all the questions and each question carries EIGHT marks.

5. Write a dialogue of at least five turns between a shopkeeper and customer about buying a mobile phone.   **CO3**

6. Make an analysis and write a paragraph in around 100 words about your strengths and weaknesses in learning and using English and also the measures to improve it.   **CO3**

7. Write a paragraph in about 100 words on how to overcome low esteem and negativity.   **CO3**

*** *** ***

Time: 90 minutes   **Max. Marks: 40**

PART-A   **4X4= 16 Marks**

Instructions: Answer all the questions. Each question carries FOUR marks.

1. Match the words in column A with their corresponding meanings in column B   **CO2**

Column A	Column B
a) Deserve	i) continuous
b) hidden	ii) protect
c) Preserve	iii) worthy
d) Incessant	iv) praise
	v) unseen
	vi) affection

2. Rewrite as directed: **CO1**
   a) You ask your Mom to give you another chocolate. (Change into a request)
   b) The baby fell down and got injured. (Change into an exclamatory sentence)
   c) The match was very interesting. (Frame a question using 'how')
   d) Hemanth submitted his project report last week. (Frame Yes-No question)

3. Fill in the blanks with appropriate forms of verbs given in brackets: **CO1**
   a) The Sun _____ (set) in the west.
   b) Balu _____ (sing) for over fifty years in the films.
   c) We _____ (see) a camel on the road yesterday.
   d) They _____(enter) the stadium before the gates were closed.

4. Change the voice of the following: **CO1**
   a) Marconi invented the radio.
   b) Sravanthi has been offered a job.
   c) Pragathi can type the letter.
   d) The Chief Guest will be received by the Final year students.

PART-B   **3X8=24 Marks**

Answer all the questions. Each question carries EIGHT marks.   **CO3**

5. Write a letter to your younger brother motivating him to deal with failures and hurdles in life.

6. Write an essay in around120 words on the role of robots in the modern world.

7. Read the following passage and answer the questions that follow:

   The greatest enemy of mankind, as people have discovered, is not science, but war. Science merely reflects the social forces by which it is surrounded. It was found that when there is peace, science is constructive when there is war, science is perverted to destructive end. The weapons which science gives us do not necessarily create war. These make war increasingly more terrible. Until now, it has brought us on the doorstep of doom. Our main problem, therefore, is not to curb science, but to substitute law for force, and international government for anarchy in the relations of one nation with another. That is a job in which everybody must participate, including the scientists. Now we are face to face with these urgent questions: Can education and tolerance,

understanding and creative intelligence run fast enough to keep us side by side without our mounting capacity to destroy? That is the question which we shall have to answer, one way or the other, in this generation. Science must help us in the answer, but the main decision lies within ourselves. The hour is late and our work has scarcely begun.

a. What is the chief enemy of man?
b. What does science reflect?
c. When is science perverted?
d. What makes war more terrible?
e. Why do we need international government?
f. What are the four aspects that may stop destruction?
g. Have we really started our work to fight the problem discussed?
h. Pick the word from the passage that would mean: 'replace with other one'

***

Time: 90 minutes   **Max. Marks: 40**

PART-A   **4X4 = 16 Marks**

Instructions: Answer all the questions. Each question caries Four marks.

1. Give the meaning of the word in italics: **CO1,CO2**
    a) When the girls laughed in the class, the teacher was *furious.*
    b) He was *rusticated* from the school for his misbehavior.
    c) Vikram aditya was a *benevolent* Indian King.
    d) We should not show any *discrimination* between boys and girls.

2. Change the speech of the following: **CO2**
    a) He said, "I am sorry."
    b) The teacher said to the boys, "Why are you late?"
    c) Sushma said that she had submitted her report recently.
    d) Pratap requested Priya to give him her pen.

3. Rewrite as directed: **CO2**
    a) Though he was weak, he took the test. (change into a simple sentence)
    b) You must work hard to achieve success. (change into a complex sentence)
    c) If you run fast, you will catch the bus. (change into a compound sentence)
    d) The fog disappeared when the Sun rose. (Split into two simple sentences)

4. Locate eight errors from the following passage and correct them.   **CO3, CO1**
        Once upon a time there live a king who was very kind to his people. In his council of ministers,there is a wise man. He had a son called Sumanth who was a educated and highly learned. Once the wise minister fall sick. All the physicists in the country could not heal him. Then Sumanth will go in search of medicine in Himalayas. He bring the special medicinal roots to cure his father's sickness. Sumanth looked before his father carefully and healed him. The king rewarded Sumanth with rich gifts.

PART- B   **3X8 = 24 Marks**

Instructions: Answer all the questions and each one carries eight marks.   **CO3**

5. Read the following paragraph and make notes first and then its summary.
        Astronauts are people who travel on space ships. They need to have a very clean home. They travel far from Earth. We need clean kitchens everywhere on earth and in space. Astronauts have to solve two problems: how to get food and how to keep their spaceship clean. Here is how they solved the food problem. At first, the astronauts took tubes of food with them into space. They would squeeze a tube and eat semi-liquid food. It did not taste great, but since they did not need to take dishes or silverware with them, they had no dishes to wash. Today's spaceships have a bigger menu. Astronauts can eat from bowls. In fact, they take cereal and other standard foods with them. The foods are packaged in special containers to keep them fresh. They use knives, forks, and spoons. One unusual item on their table is a pair of scissors. They use the scissors to open the food packages. They can eat right from the package. They have a kitchen on the spaceship. Its oven can heat food to 170 degrees. The kitchen has water and sets of meals that come on trays. The astronauts choose their menu before they go into space. They take a lot of food with them. The astronauts keep bread and fresh fruits and vegetables in a special food locker. How do they keep the kitchen clean? They do not have to worry about mice or other

rodents. They make sure that there are no rodents before the ship leaves. But sometimes mice travel on the ship. Those mice are part of experiments. They live in cages. How do astronauts keep their trays clean? That is another health problem the astronauts solve. They need to stay healthy in space. To carry a lot of water to wash trays would be a lot of extra weight. They pack wet wipes in plastic bags. They use them to clean trays. So, their kitchen is clean and they stay healthy.

6. Write an essay in about 120 words on the importance of goal setting and your short and long term goals.

7. Write a report about the bush fire that raged in Australia recently by using the following clues: forest, natural disaster, wild fire, dried leaves, no rain fall, wild animals, burnt alive, loss of flora and fauna, fire fighters, uncontrollable, moderate rains, environmental pollution, measures to protect...etc.

***

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

S.No.	Unit Title	No. of periods	COs mapped
1	Algebra	31	CO1
2	Trigonometry	44	CO2
3	Co-ordinate Geometry	23	CO3
4	Differential Calculus	33	CO4
5	Applications of Differentiation	19	CO4, CO5
	Total Periods	**150**	

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

Course Outcomes	CH-102.1	Identify various functions, resolve partial fractions and solve problems on matrices.
	CH-102.2	Solve problems using the concept of trigonometric functions, their inverses and complex numbers.
	CH-102.3	Find the equations and properties of straight lines, circles and conic sections in coordinate system.
	CH-102.4	Evaluate the limits and derivatives of various functions.
	CH-102.5	Evaluate solutions for engineering problems using differentiation.

ENGINEERING MATHEMATICS – I
CH-102, COMMON TO ALL BRANCHES

Learning Outcomes
UNIT - I
C.O. 1 Identify various functions, resolve partial fractions and solve problems on matrices.
L.O. 1.1 Define Set, ordered pairs and Cartesian product - examples.
1.2 Explain Relations and functions – examples
1.3 Find Domain & Range of functions – simple examples.
1.4 Classify types of functions (into, many-to-one, one-one, onto and bijective).
1.5 Define inverse functions - examples.
1.6 Define rational, proper and improper fractions of polynomials.
1.7 Explain the procedure of resolving rational fractions of the type mentioned below into partial fractions:

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

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

1.8   Define a matrix and order of a matrix

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

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

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

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

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

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

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

UNIT - II

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

L.O. 2.1   Define trigonometric ratios of any angle.

2.2   List the values of trigonometric ratios at specified values.

2.3   Draw graphs of trigonometric functions

2.4   Explain periodicity of trigonometric functions.

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

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

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

2.8   Solve simple problems on compound angles.

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

2.10   Derive useful allied formulas like $\sin^2 A$= (1- cos2A)/2 etc.

2.11   Solve simple problems using the above formulae

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

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

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

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

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

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

2.17   State various properties of inverse trigonometric functions and identities like

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

2.18 Apply 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., to solve

Simple problems

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

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

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

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

2.23 List various formulae for the area of a triangle.

2.24 Solve problems using the above formulae.

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

2.26 Represent inverse hyperbolic functions in terms of logarithms.

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

2.28 Define the operations on complex numbers with examples.

2.29 Define amplitude of a complex number

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

2.31 Write DeMoivre's theorem (without proof) and illustrate with simple examples.

UNIT - III
Coordinate Geometry

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

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

3.2 Solve simple problems on the above forms

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

3.4 Define locus of a point and define a circle.

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

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

3.7. Define a conic section.

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

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

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

Syllabus for Unit test-II completed

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

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

limits .

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

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

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

these standard limits.

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

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

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

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

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

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

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

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

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

4.13   Find the derivatives of hyperbolic functions.

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

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

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

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

4.18   Explain the definition of Homogenous function of degree n

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

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

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

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

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

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

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

5.6 Define the concept of increasing and decreasing functions.

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

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

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

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

Syllabus for Unit test-III completed

C-20
CH-102,ENGINEERING MATHEMATICS – I
CO/PO – Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	2				3	2	3
CO2	3	3	3	2				3	3	1
CO3	3	2	2	1				3	2	2
CO4	3	3	2	2				3	2	1
CO5	3	3	3	3				3	3	3
Avg	3	2.6	2.5	2				3	2.4	2

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

Note:

PO5: Appropriate quiz programme may be conducted at intervals and duration as decided by concerned teacher.

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

PO7: Such activities are to be planned that students visit library to refer standard books on Mathematics and latest updates in reputed national and international journals, attending seminars, learning mathematical software tools.

PSO1: An ability to understand the concepts of basic mathematical concepts and to apply them in various areas like computer programming, civil constructions, fluid dynamics, electrical and electronic systems and all concerned engineering disciplines.

PSO2: An ability to solve the Engineering problems using latest software tool, along with analytical skills to arrive at faster and appropriate solutions.

PSO3: Wisdom of social and environmental awareness along with ethical responsibility to have a successful career as an engineer and to sustain passion and zeal for real world technological applications.

PO no	Mapped with CO no	CO periods addressing PO in column I		Level (1,2 or 3)	Remarks
		No	%		
1	CO1, CO2, CO3,CO4,CO5	150	100%	3	>40% Level 3 Highly addressed
2	CO1, CO2, CO3,CO4,CO5	138	92%	3	
3	CO1, CO2, CO3,CO4,CO5	133	88.6%	3	25% to 40% Level 2 Moderately addressed
4	CO1, CO2, CO3,CO4,CO5	120	80%	3	
PSO 1	CO1, CO2, CO3,CO4,CO5	150	100%	3	
PSO 2	CO1, CO2, CO3,CO4,CO5	135	90%	3	5% to 25% Level 1 Low addressed
PSO 3	CO1, CO2, CO3,CO4,CO5	125	83.3%	3	<5% Not addressed

C-20
ENGINEERING MATHEMATICS – I
COMMON TO ALL BRANCHES
COURSE CONTENT
Unit-I
Algebra

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

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

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

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

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

Unit-II
Trigonometry

4. **Trigonometric ratios:**
   Definition of trigonometric ratios of any angle, values of trigonometric ratios at specified values, draw graphs of trigonometric functions, periodicity of trigonometric functions.
5. **Compound angles:**
   Formulas of sin(A±B), cos(A±B), tan(A±B),cot(A±B),and related identities with problems.
6. **Multiple and sub multiple angles:**
   Formulae for trigonometric ratios of multiple angles 2A,3A and 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 :
   sinx =k , cosx= k, tanx =k, where k is a constant. Solutions of simple quadratic equations, equations involving usage of transformations- problems.
10. **Properties of triangles:**
    Relation between sides and angles of a triangle- sine rule, cosine rule, tangent rule and projection rule-area of a triangle- problems.
11. **Hyperbolic functions:**
    Definitions of hyperbolic functions, identities of hyperbolic functions, inverse hyperbolic functions and expression of inverse hyperbolic functions in terms of logarithms.
12. **Complex Numbers:**
    Definition of a complex number, Modulus and conjugate of a complex number, Arithmetic operations on complex numbers, Modulus- Amplitue (polar) form , Exponential form (Euler form) of a complex number- Problems. DeMoivre's theorem.

UNIT-III
Coordinate geometry
13. **Straight lines:** various forms of straight lines, angle between lines, perpendicular distance from a point, distance between parallel lines-examples.
14. **Circle:** locus of a point, Circle, definition-Circle equation given (i) centre and radius, (ii) two ends of a diameter (iii) centre and a point on the circumference (iv) three non collinear points - general equation of a circle – finding centre, radius..
15. Definition of a conic section, equation of a conic when focus directrix and eccentricity are given. properties of parabola, ellipse and hyperbola in standard forms.

UNIT-IV
Differential Calculus

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

UNIT-V
Applications of Derivatives:

18. Geometrical meaning of the derivative, equations of Tangent and normal to a curve at any point. Lengths of tangent, normal, subtangent and subnormal to the curve at any point - problems.
19. Physical applications of the derivative – velocity, acceleration, derivative as a rate measure – Problems.
20. Applications of the derivative to find the extreme values – Increasing and decreasing functions, finding the maxima and minima of simple functions - problems leading to applications of maxima and minima.
21. Using the concept of derivative of a function of single variable, find the absolute error, relative and percentage errors and approximate values due to errors in measuring.

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

Reference Books:

1. Shanti Narayan, A Textbook of matrices, S.Chand&Co.
2. Robert E. Moyer & Frank Ayers Jr., Schaum's Outline of Trigonometry, 4th Edition, Schaum's Series
3. M.Vygodsky, Mathematical Handbook, Mir Publishers, Moscow.
4. Frank Ayers & Elliott Mendelson, Schaum's Outline of Calculus, Schaum's Series

BLUE PRINT

S. No	Chapter/ Unit title	No of Periods		Weightage Allotted	Marks wise distribution of weightage				Question wise distribution of weightage				COs mapped
	Unit - I : Algebra	Theory	Practice		R	U	Ap	An	R	U	Ap	An	
1	Relations and Functions	4	2	3	0	3	0	0	0	1	0	0	CO1
2	Partial Fractions	3	2	3	0	3	0	0	0	1	0	0	CO1
3	Matrices and Determinants	10	10	11	3	0	8	0	1	0	1	0	CO1
	Unit - II : Trigonometry												
4	Trigonometric Ratios	1	1	0	0	0	0	0	0	0	0	0	CO2
5	Compound Angles	3	2	3	3	0	0	0	1	0	0	0	CO2
6	Multiple and Submultiple angles	4	4	3	0	3	0	0	0	1	0	0	CO2
7	Transformations	3	3	8	0	8	0	0	0	1	0	0	CO2
8	Inverse Trigonometric Functions	3	2										CO2
9	Trigonometric Equations	3	2	8	0	0	8	0	0	0	1	0	CO2
10	Properties of triangles	3	2										CO2
11	Hyperbolic Functions	1	1	0	0	0	0	0	0	0	0	0	CO2
12	Complex Numbers	4	2	3	3	0	0	0	1	0	0	0	CO2
	Unit III : Co-ordinate Geometry												
13	Straight Lines	4	2	3	3	0	0	0	1	0	0	0	CO3
14	Circle	3	2										CO3
15	Conic Sections	8	4	8	0	8	0	0	0	1	0	0	

No.														
	Unit – IV : Differential Calculus													
16	Limits and Continuity	4	2	3	0	3	0	0	0	1	0	0	**CO4**
17	Differentiation	17	10	14	3	11	0	0	1	2	0	0	**CO4**
	Unit - V : Applications of Differentiation													
18	Geometrical Applications	3	2	10	0	0	0	10	0	0	0	1	**CO5**
19	Physical Applications	2	2										
20	Maxima and Minima	3	4										
21	Errors and Approximations	2	1										
	Total	89	61	80	15	39	16	10	5	8	2	1	

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

Engineering Mathematics – I
UNIT TEST SYLLABUS

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

State Board of Technical Education and Training, A. P
First Year
Subject Name: Engineering Mathematics-I
Sub Code: CH-102

Time : 90 minutes   Max.Marks:40

<div align="center">

Part-A   **16Marks**

</div>

Instructions:(1) Answer all questions.
           (2) First question carries four marks and the remaining questions carry three marks each.

1.   Answer the following.

         a.   If $f(x) = x^2$ and domain $= \{-1, 0, 1\}$, then find range.   (CO1)

         b.   If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, then find 3A.   (CO1)

         c.   Write the value of $Sin120^0$ (CO2)

         d.   Write the formula for $\tan 2A$ in terms of $\tan A$ (CO2)

2.   If $f : R \rightarrow R$ is defined by $f(x) = 3x - 5$, then prove that $f(x)$ is onto.   (CO1)

3.   If $A = \begin{bmatrix} 1 & 3 \\ 4 & -9 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 4 \\ -3 & 1 \end{bmatrix}$ then find $2A + 3B$ (CO1)

4.   Prove that $Sin^2 45^0 - Sin^2 15^0 = \dfrac{\sqrt{3}}{4}$ (CO2)

5.   Prove that $\dfrac{\sin 2A}{1 - \cos 2A} = \cot A$ (CO2)

<div align="center">

Part-B   **3×8=24**

</div>

Instructions:(1) Answer all questions. Each question carries eight marks
           (2) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

6.   A)   Resolve $\dfrac{2x}{(x-1)(x-3)}$ into partial fractions.   (CO1)

                 or

     B)   Resolve $\dfrac{x+4}{x^2 - 3x + 2}$ into partial fractions.   (CO1)

7. A) Using cramer's rule to solve

$x - y + z = 2, 2x + 3y - 4z = -4, 3x + y + z = 8$ (CO1)

        or

B) Prove that $\begin{vmatrix} bc & b+c & 1 \\ ca & c+a & 1 \\ ab & a+b & 1 \end{vmatrix} = (a-b)(b-c)(c-a)$ (CO1)

8. A) Find the adjoint of Matrix $\begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 5 \\ 2 & 7 & -4 \end{bmatrix}$ (CO1)

        or

B) If $A = \begin{bmatrix} 2 & 3 & 4 \\ 5 & 7 & 9 \\ -2 & 1 & 3 \end{bmatrix}$; $B = \begin{bmatrix} 3 & 1 & -5 \\ 2 & 1 & 4 \\ 0 & 3 & 1 \end{bmatrix}$, find AB and BA and verify if $AB = BA$.

                                              (CO1)

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State Board of Technical Education and Training, A. P
First Year
Subject Name: **Engineering Mathematics-I**
Sub Code: **CH- 102**

Time : 90 minutes   Max.Marks:40

Part-A   **16Marks**

Instructions: **(1) Answer all questions.**
                (2) First question carries four marks and the remaining questions carry three marks each

1.   Answer the following.

   a. $\sin C + \sin D = 2\cos\left(\dfrac{C+D}{2}\right)\sin\left(\dfrac{C-D}{2}\right)$: State TRUE/FALSE (CO2)

   b.   If $z = 2 + 3i$, then find $|z|$ (CO2)

   c. $\sinh x = \dfrac{e^x - e^{-x}}{2}$: State TRUE/FALSE   (CO2)

   d.   Write the eccentricity of rectangular hyperbola.   (CO3)

2.   Express $(3 - 4i)(7 + 2i)$ in terms of $a + ib$ (CO2)

3.   Find the perpendicular distance from $(1,1)$ to the line $2x + 3y - 1 = 0$ (CO3)

4.   Find the angle between lines $2x - y + 3 = 0$ and $x + y - 2 = 0$ (CO3)

5.   Find the centre and radius of the circle $x^2 + y^2 - 2x + 4y - 4 = 0$ (CO3)

Part-B   **3×8=24**

Instructions: **(1) Answer all questions.Each question carries eight marks**
                (2) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

6.   A)   Prove that $\dfrac{\sin 2\theta + \sin 4\theta + \sin 6\theta}{\cos 2\theta + \cos 4\theta + \cos 6\theta} = \tan 4\theta$.   (CO2)

                              or

   B)   Prove that $\tan^{-1}\dfrac{1}{2} + \tan^{-1}\dfrac{1}{5} + \tan^{-1}\dfrac{1}{8} = \dfrac{\pi}{4}$ (CO2)

7. A) Solve $2\sin^2\theta - \sin\theta - 1 = 0$ (CO2)

or

B) In any ΔABC, If $\lfloor B = 60^0$ then $\dfrac{c}{a+b} + \dfrac{a}{b+c} = 1$ (CO2)

8. A) Find the equation of circle with $(2,3)$ and $(6,9)$ as the end points of diameter and

also find centre and radius of circle.   (CO3)

or

B) Find the equation of ellipse whose focus is $(1,-1)$, directrix is $x - y + 3 = 0$ and

eccentricity is1/2.   (CO3)

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STATE BOARD OF TECHNICAL EDUCATION AND TRAINING, A. P
FIRST YEAR
SUBJECT NAME: ENGINEERING MATHEMATICS-I
SUB CODE: CH-102

Time : 90 minutes   Max.Marks:40

Part-A   **16Marks**

Instructions:(1) Answer all questions.
               (2) First question carries four marks and the remaining questions carry three marks each

1.   Answer the following.

      a. Find $\lim\limits_{x\to 1}\dfrac{x^2+1}{x+5}$ (CO4)

      b. $\lim\limits_{\theta\to 0}\dfrac{\sin 2\theta}{\theta}=2$: State TRUE/FALSE   (CO4)

      c. $\dfrac{d}{dx}\left(3\tan^{-1}x\right)=\,?$ (CO4)

      d. Formula for percentage error in x is _____   (CO5)

2.   Evaluate $\lim\limits_{x\to 2}\dfrac{x^5-32}{x^2-4}$ (CO4)

3.   Find the derivative of $3\tan x-4\log x+7^x$ w.r.t. x   (CO4)

4.   Differentiate $x^2\sin x$ w.r.t. x (CO4)

5.   Find the derivative of $\dfrac{2x+3}{3x+4}$ (CO4)

Part-B   **3×8=24**

Instructions: **(1) Answer all questions. Each question carries eight marks**
               (2) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

6.   A)   Find the derivative of $\sin^{-1}\left(\dfrac{2x}{1+x^2}\right)$ w.r.t. $\tan^{-1}\left(\dfrac{2x}{1-x^2}\right)$.   (CO4)

                        or

   B)   Find $\dfrac{dy}{dx}$ if $y=x^{\cos x}$ (CO4)

7. A) Verify Euler's theorem when $u(x, y) = \dfrac{x^4 + y^4}{x - y}$ (CO4)

or

B) Find the equation of tangent and normal to the curve $3y = x^2 - 6x + 17$ at $(4, 3)$ (CO5)

8. A) Circular patch of oil spreads on water and the area is growing at the rate of $8\, sqcm/\min$. How fast is the radius increasing when radius is $5\, cm$. (CO5)

or

B) Find the maxima and minima values of $f(x) = x^3 - 6x^2 + 9x + 15$. (CO5)

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<u>**TIME : 3 HOURS**</u>   **MODEL PAPER- I**   **MAX.MARKS : 80M**

PART-A

<u>**Answer All questions. Each question carries THREE marks.**</u>   **10x3=30M**

1. If $A = \left\{ 0, \dfrac{\pi}{6}, \dfrac{\pi}{4}, \dfrac{\pi}{3}, \dfrac{\pi}{2} \right\}$ and $f : A \to B$ is a function such that $f(x) = \cos x,$ then find the

    range of f.   **CO1**

2. Resolve the function $\dfrac{x}{(x-1)(x-2)}$ into partial fractions.   **CO1**

3. If $A = \begin{bmatrix} 3 & 9 & 0 \\ 1 & 8 & -2 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 0 & 2 \\ 7 & 1 & 4 \end{bmatrix}$, find $A + B$ and $A - B$.   **CO1**

4. Show that $\dfrac{\cos 16^0 + \sin 16^0}{\cos 16^0 - \sin 16^0} = \tan 61^0.$ **CO2**

5. Prove that $\dfrac{\sin 2\theta}{1 - \cos 2\theta} = \cot \theta.$ **CO2**

6. Find the modulus of the complex number $\left(\dfrac{1-i}{2+i} \right).$ **CO2**

7. Find the distance between parallel lines $x + 2y + 3 = 0$ and $x + 2y + 8 = 0.$ **CO3**

8. Find $\lim\limits_{x \to 0} \dfrac{\sin 77x}{\sin 11x}.$ **CO4**

9. Differentiate $3\tan x - 4\log x - 7x^2$ w.r.t. $x.$ **CO4**

10. If $x = at^2, y = 2at,$ then find $\dfrac{dy}{dx}.$ **CO4**

PART-B

<u>**Answer All questions. Each question carries EIGHT marks.**</u>   **5x8=40M**

11 A) Find the inverse of the matrix $\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}.$ **CO1**

Or

B) Solve the system of equations $x + y + z = 6, x - y + z = 2$ and $2x - y + 3z = 9$ by crammer's rule.   **CO1**

12 A) If $\cos x + \cos y = \dfrac{3}{5}$ and $\cos x - \cos y = \dfrac{2}{7}$, then show that   **CO2**

$$21\tan\left(\frac{x-y}{2}\right) + 10\cot\left(\frac{x+y}{2}\right) = 0.$$

Or

B) If $\tan^{-1} x + \tan^{-1} y + \tan^{-1} z = \pi$ then show that $x + y + z = xyz.$ **CO2**

13 A) Solve $\sqrt{3}\cos\theta - \sin\theta = 1.$ **CO2**

Or

B) In any $\triangle ABC$, Show that $\cot\dfrac{A}{2} + \cot\dfrac{B}{2} + \cot\dfrac{C}{2} = \dfrac{s^2}{\Delta}.$ **CO2**

14 A) Find the equation of the circle with $(4,2)$ and $(1,5)$ as the two ends of its

diameter and also find its centre and radius.   **CO3**

Or

B) Find the centre, vertices, equation of axes, lengths of axes, eccentricity, foci, equations of

directrices and length of latus rectum of the ellipse $4x^2 + 16y^2 = 1.$ **CO3**

15 A) Find the derivative of $\sin^{-1}\left(\dfrac{2x}{1+x^2}\right)$ w.r.t. $\tan^{-1}\left(\dfrac{2x}{1-x^2}\right)$ **CO4**

Or

B) If $u = \tan^{-1}\left(\dfrac{x^3 - y^3}{x+y}\right)$, then prove that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} = \sin 2u.$ **CO4**

PART-C

Answer the following question. Question carries TEN marks.   **1x10=10M**

16 The sum of two numbers is 24. Find them so that the sum of their squares is minimum.   **CO5**

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TIME : 3 HOURS   **MODEL PAPER- II**   **MAX.MARKS : 80M**

PART-A

Answer All questions. Each question carries THREE marks.   **10x3=30M**

1. If $f : R \rightarrow R$ is adjective function such that $f(x) = ax + b$, then find $f^{-1}(x)$.   **CO1**

2. Resolve the function $\dfrac{1}{(x+1)(x-2)}$ into partial fractions.   **CO1**

3. If $A = \begin{bmatrix} 0 & -1 & 3 \\ 1 & 0 & 7 \\ -3 & x & 0 \end{bmatrix}$ is a skew-symmetric matrix, find the value of x.   **CO1**

4. Find the value of $\sin^2 82\dfrac{1}{2}^0 - \sin^2 22\dfrac{1}{2}^0$.   **CO2**

5. Prove that $\dfrac{\cos 3A}{2\cos 2A - 1} = \cos A$.   **CO2**

6. Find the conjugate of the complex number $(3-2i).(4+7i)$ **CO2**

7. Find the equation of the line passing through the points $(1,2)$ and $(3,-4)$.   **CO3**

8. Find $\lim\limits_{x \to 2} \dfrac{x^5 - 32}{x-2}$.   **CO4**

9. Differentiate $\sqrt{x} - \sec x + \log x$ w.r.t. x.   **CO4**

10. If $u(x, y) = x^3 - 3axy + y^3$, then find $\dfrac{\partial u}{\partial x}$ and $\dfrac{\partial u}{\partial y}$.   **CO4**

PART-B

Answer All questions. Each question carries EIGHT marks.   **5x8=40M**

11 A) Show that $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix} = (a-b)(b-c)(c-a)$.   **CO1**

Or

B) Solve the system of equations $x+2y+3z=6, 3x-2y+4z=5$ and $x-y-z=-1$ using matrix inversion method.   **CO1**

12 A) Prove that $\dfrac{\sin 2\theta + \sin 4\theta + \sin 6\theta}{\cos 2\theta + \cos 4\theta + \cos 6\theta} = \tan 4\theta$.   **CO2**

Or

B) Prove that $\tan^{-1}\dfrac{1}{3} + \tan^{-1}\dfrac{1}{5} + \tan^{-1}\dfrac{1}{7} + \tan^{-1}\dfrac{1}{8} = \dfrac{\pi}{4}$.   **CO2**

13 A) Solve $2\cos^2 \theta - 3\cos \theta + 1 = 0$. **CO2**

Or

B) In any $\triangle ABC$, Show that $\sum a^3 \cos(B-C) = 3abc$.   **CO2**

60

14 A) Find the equation of the circle passing through the points $(0,0),(6,0)$ and $(0,8)$. **CO3**

Or

B) Find the equation of the rectangular hyperbola whose focus is $(1,2)$ and directrix is

$3x+4y-5=0.$ **CO3**

15A) If $\sin y = x\sin(a+y)$, then prove that $\dfrac{dy}{dx} = \dfrac{\sin^2(a+y)}{\sin a}.$ **CO4**

Or

B) If $y = \tan^{-1} x,$ then prove that $(1+x^2)y_2 + 2xy_1 = 0.$ **CO4**

PART-C
Answer the following question. Question carries TEN marks. 1x10=10M

16 Show that the semi-vertical angle of the cone of maximum volume and of given slant height

is $\tan^{-1}\sqrt{2}.$ **CO4**

***

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

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

> **Course Objectives**

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

➢ **Course outcomes**

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

➢ **Learning Outcome**
➢ **COs-POs mapping strength (as per given table)**

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

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

> **Model Blue Print with weightages for Blooms category and questions for chapter and Cos mapped**

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

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

LEARNING OUTCOMES

1.0 Concept of Units and dimensions
1.1 Explain the concept of Units ,Physical quantity, Fundamental physical quantities and Derived physical quantities
1.2 Define unit, fundamental units and derived units, State SI units with symbols
1.3   State Multiples and submultiples in SI system, State Rules of writing S.I.units, State advantages of SI units
1.4 Define Dimensions, Write Dimensional formulae of physical quantities
1.5 List dimensional constants and dimensionless quantities
1.6 State the principle of Homogeneity of Dimensions
1.7 State the applications and limitations of Dimension all analysis
1.8 Errors in measurement, Absolute error, relative error, percentage error, significant figures
1.9 Solve problems

2.0 Concept of Elements of Vectors

2.1 Explain the concept of scalars, Vectors and give examples

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

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

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

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

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

2.7 Solve the related numerical problems

3.0 Concept of Dynamics

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

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

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

3.4 Explain projectile motion with examples

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

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

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

3.8 Solve the related numerical problems

4.0 Concept of Friction

4.1 Define friction and classify the types of friction.

4.2 Explain the concept to f Normal reaction

4.3 State the laws of friction

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

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

4.6 List the Advantages and Disadvantages of friction

4.7 Mention the methods of minimizing friction

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

4.9 Solve the related numerical problems

5.0 Concepts of Work, Power, and Energy

5.1 Define the terms Work, Power and Energy. State SI units and dimensionalformulae

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

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

5.4 State and derive Work-Energy theorem

5.5   Derive the relation between Kinetic energy and momentum

5.6 State the law of conservation of energy and Verify it in the case of a freely Falling body

5.7 Solve the related numerical problems

6.0 Concepts of Simple harmonic motion
6.1 Define Simple harmonic motion, Give examples, State the conditions
6.2 Explanation of uniform circular motion of a particle is a combination of two perpendicular SHMs.
6.3 Derive expressions for displacement, velocity, acceleration, Frequency, Time period of a particle executing SHM.
6.4 Define phase of SHM
6.5 Define Ideal simple pendulum and derive expression for Time period of simple pendulum
6.6 State the laws of motion of simple pendulum
6.7 Solve the related numerical problems

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

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

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

10. Concepts of Electricity and Magnetism

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

10.2 Define specific resistance, conductance and state their units

10.3 Explain Kichoff's laws

10.4 Describe Wheat stone's bridge with legible sketch

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

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

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

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

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

10.10 Solve the related numerical problems

11.0 Concepts of Modern physics

11.1 State and Explain Photo-electric effect and Write Einstein's photoelectric equation

11.2 State laws of photo electric effect

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

11.4 Recapitulatere fraction of light and its laws, criticalangle, TotalInternalReflection.

11.5 Explain the principle and working of Optical Fiber, mention different types of Optical Fibre, state the applications

11.6 Define super conductor and superconductivity and mention examples

11.7 State the properties of super conductingmaterials and list the applications

11.8 Nanotechnology definition, non-materials, applications

COURSECONTENT

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 Dimension analysis-Errors in measurement, Absolute error, relative error, percentage error, significant figures-Problems.

2.   Elements of Vectors:

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

3.   Dynamics

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

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

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

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

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

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

9. **Properties of matter**
   Definition of Elasticity –Definition of stress and strain -the units and dimensional formulae for stress and strain-The Hooke's law-Definitions of Modulus of elasticity, Young's modulus(Y), Bulk modulus(K), Rigidity modulus (n),Poisson's ratio (σ), relation between Y, K, n and σ(equations only no derivation)
   Definition of surface tension-Explanation of Surface tension with reference to molecular theory - Definition of angle of contact -Definition of capillarity -The formula for surface tension based on capillarity - Explanation of concept of Viscosity - Examples for surface tension and Viscosity - Newton's formula for viscous force- Definition of co-efficient of viscosity- The effect of temperature on viscosity of liquids and gases - Poiseuille's equation for Co-efficient of viscosity- The related numerical problems

10. **Electricity & Magnetism:**
    Ohm's law and explanation-Specific resistance-Kirchoff's laws- Wheat stone'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-photo electric cell–Applications of photo electric effect- Total internal reflection- fiber optics- - principle and working of an optical fiber -types of optical fibers - Applications of optical fibers-superconductivity–applications-Nanotechnology   definition,   non-materials, applications

REFERENCEBOOKS

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

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

Unit Test	Learning outcomes to be covered
Unit Test – 1	**From 1.1 to 4.9**
Unit Test – 2	**From 5.1 to 8.10**
Unit Test – 3	**From 9.1 to 11.8**

UNIT TEST –I
Model Question Paper (C-20)
ENGINEERING PHYSICS (CH-103)

<u>TIME: 90 minutes</u>   **Total Marks:40**

PART-A   **16 Marks**

Instructions: (1) Answer all questions.First question carries 4 marks and others carry 3 marks each.
(2) Answers for Question Numbers 2 to 5 should be brief and straight to the point and shall not exceed five simple sentences.

1. i)   The dimensional formula of force is _____   (CO1)
    ii) Which of the following is a scalar   [   ]   (CO1)
        a) force b) work c) displacement d) velocity
    iii) We can add a scalar to a vector (Yes / No)   (CO1)
    iv) Friction is a self-adjusting force.   [True / False]   (CO2)
2. Define dot product. Give one example.   (CO1)
3. A force of 150 N acts on a particle at an angle of 30° to the horizontal.
    Find the horizontal and vertical components of force   (CO1)
4. Define projectile. Give two examples.   CO2)
5. It is easier to pull a lawn roller than to push it. Explain   (CO2)

PART—B   **3x8=24**

Instructions:(1) Answer all questions. Each question carries 8marks.
(2) Answer should be comprehensive and the criteria for evaluation is content but not the length of the answer.

6) (A)Derive an expression for magnitude and direction of resultant of two
    vectors using parallelogram law of vectors   (CO1)
                        OR
    (B) Write any four properties of dot product and any four properties ofcross
    product   (CO1)

7) (A) Show that path of a projectile is a parabola in case of oblique Projection.
                                                                         (CO2)
                        OR
    (B) Derive the expression for range and time of flight of a projectile   (CO2)

8) (A) State and explain polygon law of vector addition with a neat diagram   (CO1)
                        OR
    (B) Derive the equation for acceleration of a body on a rough inclined plane   (CO2)

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BOARD DIPLOMA EXAMINATION, (C–20)
FIRST YEAR EXAMINATION
CH–103, ENGINEERING PHYSICS

Time : 3 hours]   **[Total Marks : 80**

PART—A   3×10=30

Instructions : (1) Answer all questions. Each question carries three marks.
(2) Answers should be brief and straight to the point and shall not exceed five simple sentences.

1.   Write the dimensional formula of the following physical quantities   (CO1)

(a) Velocity   (b) Force   (c) Angular momentum

2.   Write any three properties of scalar product.   (CO1)
3.   Define projectile. Give two examples.   (CO2)
4.   It is easier to pull a lawn roller than to push it. Explain.   (CO2)
5.   Define potential energy and kinetic energy.   (CO3)
6.   For a body in simple harmonic motion velocity at mean position is 4m/s, if the time period is 3.14 s, find its amplitude.   (CO3)
7.   State first and second laws of thermodynamics.   (CO4)
8.   Write any three conditions of good auditorium   (CO4)
9.   Define ohmic and non-ohmic conductors.   (CO5)
10.   State Coulomb's inverse square law of magnetism.   (CO5)

PART—B   8 ×5= 40

Instructions : (1) Each question carries eight marks.
(2) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

11. A) Derive an expression for magnitude and direction of the resultant of two vectors using parallelogram law of vectors.   (CO1)

OR

B) Show that path of a projectile is parabola in case of oblique projection and derive expression for maximum height.   (CO2)

12.   A) Derive expression for acceleration of a body sliding downwards on a rough inclined plane.   (CO2)

OR

B) Verify the law of conservation of energy in case of a freely falling body.   (CO3)

13. A) Derive an expression for velocity and acceleration of a particle performing simple harmonic motion.   (CO3)

OR

B) Define ideal gas and derive ideal gas equation.   (CO4)

14. A) Two tuning forks A and B produce 4 beats per second. On loading B with wax 6 beats are produced. If the quantity of wax is reduced the number of beats drops to 4. If the frequency of A is 326 Hz, find the frequency of B. (CO4)

OR

B) Explain surface tension based on molecular theory. Write three examples of surface tension. (CO5)

15. A) Derive an expression for balancing condition of Wheat stone's bridge with a neat circuit diagram. (CO5)

OR

B) Explain principle and working of optical fibers. Write any three applications (CO5)

PART C **1x10 = 10**

16) Derive relationship between C_p and C_v and hence show that C_p is greater than C_v. (CO4)

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Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-104	Inorganic Chemistry	4	120	20	80

S.No.	Chapter/unit title	No. of periods	CO's Mapped
1.	Classification of Elements	12	**CO1**
2.	"s" Block Elements	18	**CO1,CO2,CO3**
3.	"p" Block Elements	34	**CO1,CO2,CO3**
4.	"d" Block Elements	10	**CO1,CO2,CO3**
5.	Solutions	13	**CO1,CO4**
6.	Acids – bases	13	**CO1,CO4**
7.	Oxidation – Reduction	11	**CO1,CO4**
8.	Principles of Metallurgy	09	**CO1,CO2**
Total periods		**120**	

Course objectives

Course objectives	(i)	To know the classification of elements and properties of s, p, d and f block elements
	(ii)	To understand solutions, acids and bases
	(iii)	To know about oxidation and reduction and balancing of chemical reactions and principles of metallurgy

Course Outcomes

CO1	CH-1O4.1	Definitions, Classification, laws, tables, Concepts,
CO2	CH-1O4.2	Physical and chemical properties of elements, Uses , applications
CO3	CH-1O4.3	Preparations, manufacturing processes, chemical reactions
CO4	CH-1O4.4	solved problems

LEARNING OUTCOME
1.0 Classification of Elements
1.1   Need for classification of Elements
1.2   State the modern periodic law
1.3   Periodicity and periodic properties
1.4   Main features of modern periodic table
1.5   Classification of Elements into s,p,d,f blocks

2.0 "s" Block Elements
2.1.1   Elements of Group-IA – General Properties
    a) Electronic configuration
    b) Metallic – Non Metallic character
    c) Ionization potential
    d) Electron affinity
    e) Electro positive nature
2.1.2   Physical Properties
    a) PhysicalState
    b) Metallic Character
    c) Density

        d) Melting Point and Boiling Point
        e) Bonding
2.1.3   Chemical Properties
        a) Oxides
        b) Hydrides
        c) Halides
2.1.4   Compounds of 1st Group elements
        a) Preparation of NaOH (by Castner – Kelner process)
        b) Physical properties Chemical Properties
        c) Chemical properties and uses of Na_2CO_3
2.2   Elements of II A Group Elements – General Properties
        a) Electronic configuration
        b) Metallic – Non Metallic character
        c) Ionization Potential
        d) Electron affinity
        e) Electropositive nature
2.2.1   Physical Properties
        a) Melting Point and Boiling Point
        b) Density
        c) Bonding
2.2.3   Chemical Properties
        a) Oxides
        b) Hydrides
        c) Halides
2.2.4   Chemical Properties and uses of
        a) CaO b) Ca(OH)$_2$ c) CaCl$_2$

3.0 "p" Block Elements
3.1.1   Elements of III A group – General properties
        a) Electronic configurations
        b) Ionization Energy
        c) Electronegative nature
        d) Metallic and Non Metallic character
        e) Electropositive nature
3.1.2   Physical Properties
        a) M.P b) B.P   c) Bonding
3.1.3   Extraction of aluminium (Hall herald process)
3.1.4   Chemical Properties
        a) Oxides
        b) Halides
3.1.5   Chemical Properties and uses of
        a) Boric Acid   b) Potash Alum
3.2   Elements of IV A group – general properties
3.2.1   Describe the properties and uses of carbon & silicon
3.2.2   State the allotropy of carbon and silicon
3.2.3   Describe the properties and uses of oxides of carbon
3.2.4   Describe the allotropic forms of carbon and their uses

3.3.   Elements of V group – General Properties
   a) Electronic Configuration
   b) Ionization potential
   c) Electro negativity
   d) Electropositive nature

3.3.1   Physical and Chemical Properties
   a) M.P. and B.P
   b) Bonding
   c) Oxides and Oxy-acids
   d) Hydroxides
   e) Halides

3.3.2   Preparation of NH_3 by Haber process

3.3.3   Physical properties and chemical properties of NH_3
   a) $NH_3 + CO_2$
   b) $NH_3 + Na$
   c) Basic Nature
   d) Action with halogens
   e) Actions with $CaOCl_2$

3.3.4   Uses of Ammonia

3.3.5   Preparation of HNO_3 (Berkland-Eyde Process)

3.3.6   Physical and Chemical Properties of HNO_3
   a) M.P and B.P
   b) Oxidizing Properties
   c) Action of Metals
   d) Action of Organic compounds
   e) Formation of Aquaregia
   f) Decomposition

3.3.7   Allotropic forms of phosphorus

3.4   VI Group elements – General properties
   a) Electronic configuration
   b) Ionization Potential
   c) Electro negativity
   d) Electro positivity

3.4.1   Physical properties of VI group elements
   a) M.P and B.P b)Bonding.

3.4.2   Chemical properties
   a) Oxides and Oxyacids
   b) Halides
   c) Hydrides

3.4.3   a) Preparation of ozone (Siemen's and Halske's method)
   b) Physical and chemical properties of ozone
   c) Uses of ozone

3.4.4   a) Allotropic forms of "S"
   b) Physical and chemical properties of "S"

3.4.5.   Heavy water properties and uses.

3.5   VII A group elements
   a) General properties of VII group elements
   b) Preparation of fluorine (Whyt law – gray's method)
   c) Preparation of chlorine (Nelson Method)

75

d) Preparation of HCl

e)Physical and Chemical properties and uses of HCl

f)Preparations, properties and uses of bleaching powder (Bachman's Plant)

4.0 "d" Block Elements
4.1   General Properties of transition elements
4.2   General characteristics
4.3   Werner's theory of complex compounds
4.4   Effective atomic numbers

5.0 Solutions
5.1   Definitions of solutions, solute, solvent.
5.2   Aqueous solutions, alcoholic solutions
5.3   Define Molarity, Normality and Mole fractions
5.4   Simple problems based on concentration method
5.5   Buffer solutions, different types of buffer solutions application of buffer solutions
5.6   Define dilute solutions and Raoult's Law
5.7   Define Vapour pressure and determination byOstwald's method
5.8   Solubility of a solid in liquid

6.0 Acids – bases
6.1   Arrhenius concept of acids and bases with examples
6.2   Lowry Bronsted concept with examples
6.3   Lewis concept with examples
6.4   Definition of pH – pH Scale
6.5   Simple problems based on pH
6.6   Theories of Indicators
6.7   Ostwald's theory of acid and base indicator.
6.8   Postulates of Ostwald's theory.
6.9   Action of phenolphthalein and methylorange indicators.

7.0 Oxidation – Reduction
7.1   Oxidation – Reduction based on electronic concept
7.2   Definition of oxidation number
7.3   Rules determining oxidation numbers
7.4   Calculate the oxidation numbers
7.5   Rules determining the balancing of equations by ion electron method
7.6   Balance the following Ionic Equations

$a)Cr_2 0_7^{2-} + No_2^- \rightarrow Cr^{3+} + No_3^-$ (in Acidic Medium)

$b)P_4 + OH^- \rightarrow PH_3 + H_2Po_2$ (in Alkaline medium)

$c)M_n o_4^- + Fe^{2+} \rightarrow M_n^{2+} + Fe^{+3}$ (in Acidic medium)
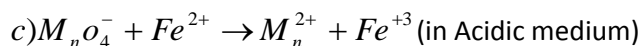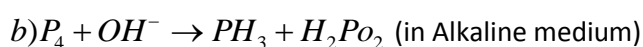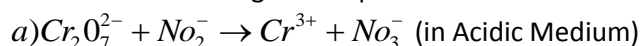
8.0Principles of Metallurgy
8.1   Introduction
8.2   Occurrence of Metals
8.3   Characteristics of metals
8.4   Metallurgy – Metallurgical operations

COURSE CONTENTS

1. **Periodic classification of elements**
   Classification – periodic law – periodicity and periodic properties classification of elements into s, p, d, f blocks.

2. **S – Block elements** (Alkali metals and Alkaline earth metals)
   Elements of group IA – General properties, physical and chemical properties of compounds of I group i.e. $NaOH$, Na_2CO_3 – preparations, properties and uses.

3. **P – Block Elements** (III, IV, V, VI, VII group elements)
   A. III Group: General Properties – Physical properties, chemical properties – compounds of III Group – Boric acid, Potash Alum properties – uses.
   B. IV Group: Describe the properties of carbon, sulphur – state the allotropes of carbon, silicon – properties, uses of oxides.
   C. V Group: General properties, physical and chemical properties, preparation of NH_3, HNO_3 - chemical, physical properties and uses – allotropic forms of "P"
   D. VI Group: General properties – physical and chemical properties preparation of ozone and heavy water – their properties and uses – allotropic form of "S"
   E. VII Group: General properties – preparation and properties of fluorine, chlorine, HCl – preparation of Bleaching powder (by Bachmann's plant) – uses.

4. **D – BLOCK ELEMENTS (Transition Elements)**
   General properties of transition elements – some general characterstics – werner's theory of complex compounds – effective atomic number

5. **Solutions** – Concentration methods, problems – buffer solutions – colligative properties - solubility

6. **Acids and bases** – Arrhenius acid base theory – Lowry Bronsted concept – Lewis concept – pH Problems- theory of indicators.

7. **Oxidation – Reduction** – definition - rules determining – calculation of oxidation numbers – balancing the equations by Ion electron method.

8. **Metallurgy – General Principles**
   Introductions – occurrence of metals – characteristics of metals – metallurgy – various metallurgical operations

REFERENCE BOOKS
1. Intermediate 1st Year Chemistry by Telugu Akademi (2002 Editor)
2. Intermediate 2nd Year Chemistry by Telugu Akademi (2002 Editor)
3. Unified Chemistry for B.Sc. Students, JPNP, Meerut
4. Inorganic Chemistry by P.L. Soni
5. Engineering Chemistry by B.K. Sharma
6. Engineering Chemistry by O.P. Agarwal
7. Engineering Chemistry by Jain & Jain

Model Blue print with weightages for Blooms category and questions for each chapter and COs mapped

S.No	Chapter/unit title	No. of periods	Weightage allocated	Marks wise Distribution of weightage				Question wise Distribution of weightage				CO'sMapped
				R	U	Ap	An	R	U	Ap	An	
1	Classification of Elements	12	8			8				1		CO1
2	"s" Block Elements	18	11		3	8			1	1		CO1,CO2,CO3
3	"p" Block Elements	34	24	3	3	8	10	1	1	1	1	CO1,CO2,CO3
4	"d" Block Elements	10	9	3	3	3		1	1	1		CO1,CO2,CO3
5	Solutions	13	8			8				1		CO1,CO4
6	Acids – bases	13	8			8				1		CO1,CO4
7	Oxidation – Reduction	11	6	3	3			1	1			CO1,CO4
8	Principles of Metallurgy	09	6	3	3			1	1			CO1,CO2
	Total	120	80	12	15	43	10	4	5	6	1	

Unit test NO	Learning out comes to be covered
Unit test-I	Objectives from 1.1 to 3.3.1(e)
Unit test-II	Objective from 3.3.2 to 5.8
Unit test-III	Objective from 6.1 to 8.4

MODEL PAPER 1　　　　　　　　　　　**C-20 CH-104**
STATE BOARD OF TECHNICAL EDUCATION AND TRAINING, A.P
DIPLOMA IN CHEMICAL ENGINEERING-I YEAR
SUBJECT NAME: INORGANIC CHEMISTRY
SUBJECT CODE: CH-104
Unit Test-1

Time : 90minutes　　　　　　　　　　　　　　　　　　**Max Marks: 40**
PART-A　　　　　　　　　　**16marks**

Instructions: (1) Answer all questions.
　　　　　　　　(2) First question carries 4 marks and rest of the questions carriesThree marks

1. (a) State Modern Periodic law.　　　　　　　　　　　　　　(CO1)
   (b) What is the trend of Ionization potential and atomic size in IA group　(CO1)
   　elements.
   (c)Define Allotropy.　　　　　　　　　　　　　　　　　(CO1)
   (d)Write the formulae of Boric acid and potash alum.　　　　　(CO1)
2. What is Periodicity? Mention the periodic properties.　　　　　(CO1)
3. Write the chemical properties of sodium hydroxide.　　　　　(CO2)
4. Write 2 uses of Boric acid and Potash Alum.　　　　　　　(CO2)

PART-B
Instructions: 1) Answer all questions. Each question carries eight marks.
　　　　　　2) Answer should be comprehensive and the criterion for valuation is the
　　　　　　content but not the length of the answer.

5. Describe the main features of modern periodic table.　　　　　(CO1)
　　　　　　　　　　　　　Or
   Describe the classification of elements into s,p,d and f-blocks.　　(CO1)

6. Describe the preparation of sodium hydroxide by Castner-Kelner process with a neat
   labeled diagram.　　　　　　　　　　　　　　　　　(CO3)
　　　　　　　　　　　　　Or
   Describe the chemical properties and uses of　　　　　　　(CO2)
   　　　(a) $Ca(OH)_2$　　(b) CaO (c) $CaCl_2$

7. Describe the extraction of Aluminium by Hall-Herald process with a neat labeled
   diagram.　　　　　　　　　　　　　　　　　　　(CO3)
　　　　　　　　　　　　　Or
   Describe the allotropic forms of carbon and their uses.　　　　(CO1)

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BOARD DIPLOMA EXAMINATIONS
C-20,CH-104, INORGANIC CHEMISTRY- I YEAR
MODEL PAPER- END EXAMINATION

TIME :3 HOURS   MAX.MARKS:80

Part –A   **10x3=30**

Instructions: 1) Answer all questions.Each question carries three marks.
2) Answer should be brief and straight to the point and shall not exceed five simple sentences.

1. What is the Ionization potential? Explain its variation in a group and along period.   (CO1)
2. Write the electronic configurations of III A and V group elements .   (CO1)
3. Write physical properties of HCl.   (CO1)
4. Write the general properties of transition elements.   (CO1)
5. Define effective atomic number and give the formula for the calculation of EAN.(CO1)
6. Write any three important postulates of Werner's theory of metal complex.   (CO1)
7. Define oxidation number and calculate the oxidation number of 'S' in H_2SO_4.   (CO1)
8. What is oxidation and reduction based on electronic concept?   (CO1)
9. Write the characteristics of metals.   (CO2)
10. Define a) Flux and b) Slag.   (CO1)

Part-B

Instructions: 1) Answer all questions. Each question carries eight marks.
2) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

11. State the modern periodic law, periodicity and periodic properties .   (CO1)
                                    Or
    Discuss the salient features of different blocks of elements in the periodic table.(CO1)
12. Explain the preparation of NaOH by Castner-Kelner process.   (CO3)
                                    Or
    Write the chemical properties and uses of $Ca(OH)_2$ (CO2)
                                    Or
13. Explain the preparation of NH_3 by Haber's process   (CO3)
                                    Or
    Write the chemical and physical properties of Sulphur.   (CO2)
14. Define Vapor pressure and determine vapor pressure by Ostwald's method.   (CO1)
                                    Or
    Define Molarity, normality and Mole fraction and buffer solutions.   (CO1)
15. Describe the Bronsted – Lowry theory concept of acids and bases with an example.(CO1)
                                    Or
    Write a note on the theory of indicators and define P^H.   (CO1)

Part –C

Instructions: 1) Answer the question below.It carries 10 marks
2) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

16. Write the chemical properties and uses of the following   (CO2)
    a)HCl   b) CO_2 c) Carbon

***

80

Course code	Course title	No. of periods/week	Total no. of periods	Marks for FA	Marks for SA
CH-105	General Mechanical Engineering	05	150	20	80

S.No.	Chapter/Unit title	No.of periods	CO's Mapped
1	Measuring Instruments & Fitting operations	32	C01,C02,C03,C04,C05
2	Welding, Friction and Lubrication	32	C01,C02,C03,C04,C05
3	Transmission of Mechanical power & I C Engines	31	C01,C02,C03,C04,C05
4	Boilers	25	C01,C02,C03,C04,C05
5	Properties of steam	10	C06
6	Steam Nozzles & Turbines	20	C01,C02,C03,C04,C05
Total periods:		**150**	

COURSE OBJECTIVES

Course Objectives	(i) To familiarize with the knowledge of different tools, equipment and machinery used in the field of Mechanical Engineering (ii) To use various tools for mechanical measurements and to know fabricating methods of mechanical products (iii) To know the different methods of producing and transmitting mechanical power

COURSE OUTCOMES

Course outcomes	CH-105.1	Demonstrate the Introduction/concepts related to mechanical processes
	CH-105.2	Explain the construction & working of mechanical tools & equipment
	CH-105.3	Observe, list and illustrate various mechanical operations
	CH-105.4	Differentiate the working of different tools, equipment and mechanical processes
	CH-105.5	Summarize the uses of various mechanical tools & equipment
	CH-105.6	Solved problems

LEARNING OUTCOME:
Objectives:

1.0   Measuring Instruments.
1.1   Know about Measurement, types of measurement
1.2   Familiarize with the use of checking and measuring Instruments.
1.3   Line diagrams of different measuring tools.
1.4   Specific use of each Instrument
1.5   Least count of different measuring tools.
1.6   Differentiate measuring and checking Instruments.
Fitting operations
1.7   Familiarize with different hand tools
1.8   List and explain different marking tools, cutting tools, striking tools, holding devices and miscellaneous tools
1.9   List different fitting operations
1.10   Differentiate Tapping and dyeing, drilling and Reaming.
1.11   Explain cutting, filing, scraping
1.12   Identify the different types of hammers and their specifications.
2.0 Welding
2.1   Define welding
2.2   State the advantages and limitations of welding
2.3   Give the classification of welding processes.
2.4   State the working principle of Arc welding
2.5   Identify the equipment and tools of arc welding
2.6   Arc welding procedure (sequential operations)
2.7   State the working principle of gas welding (Oxy-acetylene).
2.8   List different Gas welding equipment and explain each.
2.9   Gas welding procedure (sequential operations)
2.10   Differentiate bare electrode and coated electrode
2.11   State the uses of flux in welding
2.12   Differentiate soldering and brazing
2.13   Explain various flame-cutting processes.
2.14   State the advantages and limitations of flame cutting.
Friction and Lubrication
2.15   To appreciate the existence of friction in elements of power transmission
2.16   Understand the concept of friction
2.17   Explain the necessity of lubrication
2.18   Give the classification of lubrication
2.19   Explain the properties of good lubricant
2.20   State different methods of lubrication
2.21   Give the applications of above methods.
3.0 Transmission of mechanical power
3.1   To know the selection criteria of various means of power transmission
3.2   List different methods of power transmission
3.3   Explain Belt drive, open and cross belt drive with line diagram and state its applications, advantages and disadvantages.
3.4   To identify different types of drives in belts.
3.5   State the applications, advantages and disadvantages of belt drives.
3.6   Explain Gear drives, simple, compound, worm and bevel gears and its velocity ratio.

3.7   Know the merits and demerits of Gear drive
3.8   Define shaft and shaft coupling
3.9   Differentiate the Hollow shaft with solid shaft
3.10   List different types of couplings, and give its applications.
I.C. Engine
3.11   Define Heat engine
3.12   Classify Heat engines.
3.13   Give examples for each type.
3.14   Summaries the advantages of I.C.Engines and E.C.Engines.
3.15   Give the classification of I.C.Engines. Draw a neat sketch of an I.C engine and name the various parts.
3.16   Explain the working of 4-stroke petrol engine with a line diagram
3.17   Explain the working of 2 stroke petrol engine with a line diagram.
3.18   Explain the working of a 4-stroke and 2-stroke diesel engine with a line diagram
3.19   Compare two-stroke engine with 4-stroke engine
3.20   Explain with the help of a line sketch ignition system of an SI engine.
3.21   Explain with the help of a line sketch ignition system of an CI engine.
3.22   Explain simple carburettor with a line diagram
3.23   Explain air-cooling and water-cooling.
3.24   Explain the working of Fuel Injector with the help of a line diagram
3.25   Explain fuel pump
3.26   Know about governing
3.27   List different methods of governing
3.28   Compare SI engine with CI engine
4.0 Boilers
4.1   Define Boiler
4.2   Give the classification of Boiler
4.3   Differentiate fire tube and water tube boiler
4.4   Name different types of Boilers
4.5   Explain the construction and working of a simple Vertical Boiler with a line diagram
4.6   Explain Lancashire Boiler with a line diagram.
4.7   Explain the construction and working of a Babcock and Wilcox Boiler with a line diagram
4.8   List the different Boiler mountings.
4.9   State the specific use of each mounting.
4.10   Name the different Boiler accessories
4.11   State the functions of boiler accessories
4.12   List different methods of firing of coal
4.13   Distinguish solid fuel firing with Pulverized fuel firing.
4.14   Know about Boiler draught.
4.15   State different methods of Boiler draught.
5.0 Understand the properties of steam
5.1   Define the various properties of steam
5.2   Compute the enthalpy, Internal energy and entropy of given pressure
5.3   Use the steam tables.
5.4   Interpret the date in steam tables to calculate enthalpy.
5.5   Compute the above values using Mollier chart
6.0 Steam Turbines & nozzles
6.1   State the function of steam nozzle in a turbine
6.2   Name different types of nozzles

6.3   Define steam turbine

6.4   Give the classification of steam turbines

6.5   Explain the working of Impulse turbine with a line diagram.

6.6   Explain the working of a Reaction turbine with a line diagram

6.7   Explain the governing of turbines.

Hyponated Course contents with Reference books:
COURSE CONTENTS:

1. **Measuring Instruments**

   Outside and inside Calipers, spring calipers, Hermaphrodite (odd leg) caliper, Transfer caliper – sizes and uses; Dividers- Sizes and uses; combination square, bevel protractor, universal bevel protractor, sine bar, universal surface gauge, Engineers parallels, slip gauges, feeler gauge, angle gauge blocks, Radius gauge& template gauge, Screw pitch gauge, telescope gauge, plate and wire gauge, ring and plug gauges, snap gauges, specifications and uses. Vernier caliper, vernier height gauges, vernier depth gauge, micrometer -outside & inside, stick micrometer, depth micrometer, vernier micrometer, screw thread micrometer-specification & uses, calculation of least count of the above instruments. Differentiating between measuring and checking instruments.

   Fitting Operations

   Cutting, Filing, Scraping, thread cutting (Tapping and dieing), drilling and reaming (hand) – marking tools, cutting tools, striking tools, holding devices and miscellaneous tools.

2. **Welding**

   Introduction and classification of welding processes (IS:8.12)- Advantages and limitations of welding . Principle of Arc welding and equipment used. Principle of gas welding (Oxy-acetylene) and equipment used. Welding procedures (Arc & Gas) –soldering–various flame cutting processes. Advantages and limitations of flame cutting.

   Friction & Lubrication

   Concept of friction with practical examples. Disadvantages of friction. Necessity for lubrication. Classification of lubricants, properties of good lubricants. Method of lubrication – their application.

3. **Transmission of Mechanical Power**

Methods of power Transmission

   a) Belt drives – types and application, advantages and disadvantages.

   b) Gear drives- simple, compound, worm and bevel gears- Merits and demerits.

Shaft and shaft couplings

   a) Types and uses of shafts (Hollow and solid)-comparison.

   b) Types of couplings. i) Flange ii) Muff iii) Universal.

   c) Application of the above couplings.

   I.C. Engines

   Classification on the basis of a) Cycle of operation b) Types of fuel used c) Methods of ignition d) Methods of Cooling e) Speed of engine f) Arrangement of cylinders.

   Four stroke and two strike cycles (petrol engine)

   a) Principle and operation of 4-stroke and 2-stroke engine –explanation with neat sketch.

   b) Fuel system in S.I engines - Fuel pump – Fuel filter - Air cleaner; Simple carburetor

Four stroke and two-stroke diesel engine.

  a) Principle of operation, explanation with a neat sketch.

 b) components of solid injection system (CI)-fuel feed pump – injection pump – injector – fuel filter.

  c) Governing system i) Quality Governing, (ii) Quantity Governing iii) Hit and miss method.

  d) Cooling system

  e) Scavenging and Super charging importance

4. Boilers

 Classification of boilers a) Fire-tube b) Water tube.

Sketch and description of: a) Simple vertical boiler b) Lancashire boiler c) Babcock and Wilcox boiler.

Boiler Mountings: sketch and description of a) Water level indicator b) Pressure gauge c) Safety valve d) Steam stop valve e) Feed check valve f) Blow of cock, Fusible plug.

Boiler accessories: sketch and description of: a) Steam Trap and separator, b) Economiser (Greens) c) Super heater d) Air-Preheater

Draught a) Natural b) Artificial – Induced, forced, and balanced.

5. Properties of steam

Formation of steam under constant pressure, dryness fraction and degree of super heat, specific volume. Determination of enthalpy, Internal energy, latent heat. Simple direct problems on the above using tables and charts.

6. Steam Turbines

 Steam Nozzles – function & Types-Convergent, Divergent and Convergent & divergent.

 Steam turbines

 a) Classification of steam turbines with examples. Construction and working of i) Impulse

  ii) Reaction iii) Impulse – Reaction. Advantages, disadvantages, comparison

 b) Methods of reducing speed of rotors.

 i)Velocity compounding (CURTIS) ii) Pressure compounding (Rateau) iii) Pressure andVelocitycompounding.

 c) Governing of turbines i) Throttle governing. ii) Nozzle governing.

REFERENCE BOOKS:

1. Workshop Technology, Volume 1 by Raghu Vamsi.
2. Workshop Technology by HazraChowdary.
3. Thermal Engineering by R.S.Kurmi.
4. Heat Engines – Volume I&II by R.C.Patel. 5. Thermal Engineering I & II by Prakirappa

Blue print with weightages for Blooms category and questions for each chapter and COs mapped:

S.No.	Chapter/Unit title	No.of periods	Weightage allocated	Marks wise Distribution of weightage				Question wise Distribution of weightage				CO's Mapped
				R	U	Ap	An	R	U	Ap	An	
1	Measuring Instruments & Fitting operations	32	14	3	3	8	-	1	1	1	-	C01,C02,C03,C04,C05
2	Welding, Friction and Lubrication	32	14	3	3	8	-	1	1	1	-	C01,C02,C03,C04,C05
3	Transmission of mechanical power, I C Engines	31	14	3	-	8	3	1	-	1	1	C01,C02,C03,C04,C05
4	Boilers	25	14		8	3	3	-	1	1	1	C01,C02,C03,C04,C05
5	Properties of steam	10	10			10	-	-	-	1	-	C01,C02,C03,C04,C05
6	Steam Nozzles & Turbines	20	14	3	3	8	-	1	1	1	-	C01,C02,C03,C04,C05
Total:		**150**	**80**	**12**	**17**	**45**	**6**	**4**	**4**	**6**	**2**	**C01,C02,C03,C04,C05**

Model question paper with COs mapped

Unit test No	Learning out comes to be covered
Unit test-I	Objectives from 1.1 to 2.16
Unit test-II	Objective from 2.17 to 3.28
Unit test-III	Objective from 4.1 to 6.7

STATE BOARD OF TECHNICAL EDUCATION AND TRAINING, A.P
DIPLOMA IN CHEMICAL ENGINEERING- IST YEAR
Subject Name: GENERAL MECHANICAL ENGINEERING
SUBJECT CODE: CH-105

Time: 90 minutes	UNIT TEST- I	Max.Marks:40

Part-A   **16 Marks**

Instructions: (1) Answer all questions.
            (2) First question carries four marks; each question of remaining carries three marks

1.
   a) The size of divider is specified by ……….   (CO2)
   b) The spirit level is used for the checking …………… of surface.   (CO1)
   c) The process of cutting an internal thread is called …………   (CO3)
   d) The composition of electrode in welding is same as ………….   (CO3)

2. Write the difference between checking and measuring instruments.   (CO4)

3. What is a flux? What are the uses of flux in welding?   (CO3)

4. State the uses of spanner with neat sketch.   (CO5)

5. Define limiting friction and angle of friction.   (CO1)

Part-B   **3X8=24**

Instructions: (1) Answer all questions.Each question carries eight marks
            **(2) Answer should be comprehensive and the criterion for valuation is the content
                but not the length of the answer.**

6 a) Draw the neat sketch of universal bevel protractor and explain its working.   (CO2)
                                    (or)
   b) Describe the working principle of vernier caliper with neat sketch.   (CO2)

7 a) Explain the principle and procedure of arc welding with neat sketch.   (CO3)
                                    (or)
   b) Explain the principle and procedure of flame cutting.   (CO3)

8 a) Explain various fitting operations.   (CO3)
                                    (or)
   b) Describe and state the uses of various chisels used in fitting shop.   (CO4)

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STATE BOARD OF TECHNICAL EDUCATION AND TRAINING, A.P
DIPLOMA IN CHEMICAL ENGINEERING - IST YEAR
SUBJECT NAME: GENERAL MECHANICAL ENGINEERING
SUBJECT CODE: CH-105

Time: 90 minutes	Unit Test II	Max .Marks:40

Part-A   **16Marks**

Instructions: (1) Answer all questions.
(2) First question carries four marks; each question of remaining carries three marks

1.
   a) The measure of resistance of oil to flow is called……   (CO1)
   b) The type of belt drive used to connect two shafts at right angles is called…. (CO5)
   c) Give an example for rigid compound   (CO4)
   d) Piston rings in IC engine are used to prevent….   (CO2)

2. State the requisites of couplings.   (CO1)

3. Compare solid and hollow shafts.   (CO4)

4. Classify heat engines with examples.   (CO5)

5. What is quality governing of IC engines   (CO3)

Part-B   **3 x 8 = 24**

Instructions: (1) Answer all questions.Each question carries eight marks
(2) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

6   a) Explain different types of belt drives   (CO4)
                              (or)
    b) Explain velocity ratio of compound gear train with neat diagram.   (CO6)

7   a) Draw the neat sketches of different gears and state their uses.   (CO3)
                              (or)
    b) Explain different constructional features of IC engine with neat sketch.   (CO2)

8   a) Describe the working principle of 2- stroke petrol engine with line diagram   (CO2)
                              (or)
    b)Draw the layout of fuel system in diesel engines and state the function ofeach component.   (CO5)

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STATE BOARD OF TECHNICAL EDUCATION AND TRAINING, A.P
DIPLOMA IN CHEMICAL ENGINEERING - Ist YEAR
Subject Name: GENERAL MECHANICAL ENGINEERING
Subject Code: CH-105

Time: 90 minutes	Unit Test III	Max .Marks:40

	Part-A	**16 Marks**

Instructions: (1) Answer all questions.
         (2) First question carries four marks; each question of remaining carries three marks

1.
    a) Give an example for boiler mounting.   (CO1)
    b) The ratio between mass of dry saturated steam to mass of wet steam Is called…….
                                                                    (CO6)
    c) The steam nozzle coverts……. of steam into kinetic energy   (CO3)
    d) The fixed blades act as…… in reaction turbines   (CO3)
2. What is boiler draught? Give different methods of boiler draught   (CO3)
3. Define the terms a) saturation temperature b) degree of super heat   (CO1)
4. State the function and application of steam nozzles   (CO5)
5. How steam turbines are classified?   (CO2)

	Part-B	**3x8=24**

Instructions: (1) Answer all questions.Each question carries eight marks
            (2) Answer should be comprehensive and the criterion for valuation is the content
              but not the length of the answer.

 6 a) Draw a neat sketch of Lancashire boiler and describe its working.   (CO1)
                            (or)
    b) What are boiler accessories? State the functions of few of them?   (CO3)

 7 a) Find the specific volume, enthalpy, work of evaporation, internal latent heat and internal
       energy for wet steam of pressure 9.5 bar and dryness fraction 0.85 by using steam tables.
                                                                    (CO6)
                            (or)
    b) Draw a neat sketch of reaction turbine and describe its working.   (CO4)

 8 a) Explain pressure and velocity compounding of steam turbines.   (CO2)
                            (or)
    b) Explain nozzle control method of governing in steam turbine.   (CO1)

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MODEL QUESTION PAPER WITH COS MAPPED

Q.No	Question	Bloom's category	Marks allocated	CO addressed
PART – A (30 marks)				
1	Define a precision and non- precision instrument.	R	3	C01
2	List any six operations of fitting.	U	3	C02
3	Give the classification of welding methods.	R	3	C01
4	What are the differences between soldering and brazing?	Ap	3	C04
5	State the purpose of mechanical couplings	Ap	3	C01
6	What is scavenging in IC engines? State its importance.	An	3	C03
7	Write down the uses of blow off cock and fusible plug in boilers.	U	3	C05
8	What are the boiler accessories and name them?	R	3	C01
9	Denote the function and applications of steam nozzles?	Ap	3	C05
10	What do you understand by compounding of steam in steam turbines.	An	3	C03
PART –B (40 marks)				
11	Draw a neat sketch of combination set. Explain the use of different parts. (or) Explain tapping and dieing operations in fitting shop.	Ap	8	C02
12	Explain the principle and procedure of arc welding with neat sketch. (or) Explain different properties of good lubricants.	An	8	C03
13	Explain the working of Universal coupling with neat diagram (or) Draw the layout of fuel system in diesel engine and state the function of each component.	An	8	C03
14	Explain the construction and working principle of simple vertical boiler with a line diagram. (or) Draw a neat sketch of Lancashire boiler and describe its working.	Ap	8	C02
15	Explain throttle governing in steam turbines with neat diagram (or) Explain nozzle control method of governing in steam turbines.	Ap	8	C03
PART –C (10 marks)				
16	Find the specific volume, enthalpy, work of evaporation, internal latent heat and internal energy for wet steam of pressure 9. 5 bar and dryness fraction 0.85 by using steam tables.	U	10	C06

Course code	Course title	No. of periods/week	Total no of periods	Marks of FA	Marks for SA
CH- 106	Materials Technology	03	90	20	80

S.No	Chapter / unit title	No. of periods	CO's Mapped
1.	Introduction	03	CO1
2.	Mechanical Properties of metals and testing of materials	12	CO1,CO3
3.	Structure of metals and alloys	08	CO1
4.	Thermal equilibrium diagram	10	CO2
5.	Production of Iron and Steel	13	CO1, CO3, CO4, CO5
6.	Plain Carbon and Alloy Steels	06	CO1, CO4, CO5
7.	Non ferrous metals and alloys	09	CO1, CO4
8.	Miscellaneous materials	15	CO1, CO4, CO5
9.	Corrosion	14	CO1, CO3
	TOTAL	**90**	

COURSE OBJECTIVES

COURSE OBJECTIVES	i. Definition and classification of engineering materials and their applications, mechanical properties and testing of materials, structure of metals and alloys. ii. Thermal equilibrium diagram, cooling and allotropic forms of pure iron, manufacturing methods of iron and steel, classification composition of properties of and applications of plain carbon and alloys steel. iii. Composition properties, and applications of non-ferrous and metals and alloys applications and miscellaneous materials, types of corrosion , prevention methods of corrosion

Course outcomes:

	CO NO	Course Outcomes
CO1	CH-106.1	Describe the basics, definitions, structure, phenomenon of various concepts related to Engineering materials.
CO2	CH-106.2	Illustrate the concepts related to Thermal Equilibrium diagrams.
CO3	CH-106.3	Explain about the construction and working of various testing machines to test the properties, Corrosion prevention methods, manufacturing methods of various Engineering materials with the aid of block diagrams, flow diagrams and neat sketches.
CO4	CH-106.4	Analyse the properties of various Engineering materials.
CO5	CH-106.5	Appraise the applications of various Engineering materials.

CO-PO/PSO MATRIX

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CH-106.1	3							1	3	1
CH-106.2		2							3	
CH -106.3			3						3	1
CH -106.4				2					3	
CH-106.5			2							1
AVERAGE	**3**	**2**	**3**	**2**				**1**	**3**	**1**

    3=STRONGLY MAPPED
    2=MODERATELY MAPPED
    1=SLIGHTLY MAPPED

Learning outcome
CHAPTER – 1
1.1   Definition of Engineering Material.
1.2   Classification of Engineering Materials
1.3   Need of Engineering Materials and their applications.
CHAPTER – 2
2.1   Define the following properties
        a.   Strength of a material
        b.   Ultimate Strength
        c.   Stress
        d.   Strain
        e.   Elasticity
        f.   Tensile and compressive strength
        g.   Ductility
        h.   Hardness
        i.   Toughness
        j.   Brittleness
        k.   Impact strength
        l.   Fatigue and creep strength.
2.2   Distinguish between destructive and non-destructive methods of testing to identify various defects of materials and their applications..
2.3   Explain tensile strength and Compressive strength's by universal testing machine
2.4   Describe the hardness by Brinell hardness testing and Rockwell hardness testing machines.
2.5   Illustrate the determination of impact strength by Izod and Charpy's testing machines.
2.6   Summarize the procedures to detect the internal defects of a metal by radiography and ultrasonic tests.
CHAPTER -3
3.1   Quote Unit cell and space lattice.
3.2   Describe the arrangements of atoms in FCC (Face Centered Cubic), BCC (Body Centered Cubic) and HCP (Hexagonally close packed) systems and give examples.
3.3   State the effect of grain size on mechanical properties.
3.4   Identify the factors promoting grain size.
3.5   Explain the phenomenon of crystallization.

CHAPTER – 4

4.1   Explain Cooling curve and Allotropic forms of pure iron.

4.2   Draw Iron – Carbon thermal equilibrium diagram.

4.3   Locate the peritectic, eutectic, eutectoid points from the iron – carbon diagram.

CHAPTER – 5

5.1   List the various raw materials required for the production of iron.

5.2   Describe the block diagram of various manufacture methods of steel and iron.

5.3   Explain the production of Pig iron by Blast Furnace.

5.4   Explain the production of Cast iron by Cupola Furnace.

5.5   Explain the manufacturing methods of steel.

5.6   List different types of cast iron.

5.7   Mention the properties of cast Iron

5.8   Mention applications of cast iron.

CHAPTER – 6

6.1   List the classification of plain carbon steels.

6.2   Describe the need for alloying the steel with other elements.

6.3   List the composition of alloy steels.

6.4   Mention the properties of alloy steels.

6.5   Mention the industrial applications of alloy steels.

6.6   Select the proper alloy steel for the given engineering application.

CHAPTER - 7

7.1   Explain the importance of various non – ferrous metals and alloys – aluminum, copper, Nickel, lead, Tin, Zinc, titanium, Zirconium.

7.2   List the properties of aluminum, copper, zinc, tin, lead, and their applications.

7.3   Explain the effects of the alloying elements (a) Copper (b) Silica (c) Magnesium (d) Manganese with aluminum.

7.4   List the types of copper alloys (Brasses & Bronzes).

7.5   Mention the properties of copper alloys (Brasses & Bronzes).

7.6   Mention the applications of copper alloys (Brasses & Bronzes).

7.7   List the types of Nickel alloys (Monel, Hastalloy).

7.8   Mention the properties of Nickel alloys (Monel, Hastalloy).

7.9   Mention the applications of Nickel alloys (Monel, Hastalloy).

CHAPTER – 8

8.1   Explain the Importance and types of Glass.

8.2   Mention the applications of Glass.

8.3   Describe the importance of glass and its lining as materials of construction for the process equipment.

8.4   List the properties of carbon and graphite.

8.5   List the applications of carbon and graphite.

8.6   Explain the composition of stoneware.

8.7   Mention the properties of stoneware.

8.8   Mention the applications of stoneware.

8.9   List the application of asbestos, Rubber, Elastomers.

8.10   List the application of polymers.

8.11   Define refractories.

8.12   State the applications of refractories.

8.13   List the applications of Glass ceramics, Ceramites and Glass wool.

CHAPTER – 9

9.1   Define corrosion and explain the causes of corrosion.

9.2   Explain electro chemical theory of corrosion.

9.3   Describe (a) electrode potential (b) passivity (c) electro chemical series (d)polarization.

9.4   Explain briefly about (a) uniform corrosion (b) stress corrosion (c) pitting (d) hydrogen attack(e) Bimetallic corrosion (f) grain boundary corrosion (g) Fatigue corrosion

9.5   Explain briefly about the methods of prevention corrosion by a) proper selection of materials (b) organic coatings (c) inorganic coatings (d) Anodic and cathodic protection (e) Anodic and cathodic inhibitors.

REFERENCE BOOKS:

1.   Engineering Chemistry by Jain & Jain, Dhanapat Rai Publications, New Delhi.
2.   Engineering Metallurgy by D. Swarup
3.   Engineering Metallurgy by Higgins.
4.   Corrosion Engineering by Fontane McGraw Hill.
5.   Engineering Metallurgy by S.P.Naik.
6.   Engineering Metallurgy by D. Swarup.
7.   Material Science by Hazra Chowdhery.
8.   An introduction to Science of corrosion and inhibition by S.N.Benerjee.
9.   Elements of Fuels, furnaces and refractories by O.P.Gupta
10.   Engineering Materials by Pakirappa.
11.   Materials Science and Engineering by Raghavan V
12.   Engineering Materials by R K Rajput

COURSE CODE : CH-106	Cour Title : Materials Technology Number of course Outcomes: 06				No of periods 90
POs	**Pos Mapped with CO No.**	**CO periods addressing PO in column 1**		**Level (1,2,3)**	**REMARKS**
		NO	**%**		
PO1	CO1	40	44	3	>40% level3 Highly addressed 25% level2 Moderately addressed 5 to 25% level1 Low addressed <5% not addressed
PO2	CO2	5	6	1	
PO3	CO3, CO5	33	36	2	
PO4	CO4	12	14	1	
PO5					
PO6					
PO7					

Blue Print:

S.NO	Chapter/ unit title	No. of periods	Weight age Allocated	Marks Wise Distribution of Weight age				Question Wise Distribution of Weight age				Cos Mapped
				R	U	AP	An	R	U	AP	An	
1	Introduction	03	03	3	-	-	-	1	-	-	-	CO1
2	Mechanical properties of metals and testing of materials	12	21	3	-	8	10	1	-	1	1	CO1,CO3
3	Structure of metals and alloys	08	03	3	-	-	-	1	-	-	-	CO1
4	Thermal equilibrium diagram	10	08	-	-	8	-	-	-	1	-	CO2
5	Production of iron and steel	13	11	3	-	8	-	1	-	1	-	CO1, CO3, CO4, CO5
6	Plan carbon and alloy steels	06	06	3	3	-	-	1	1	-	-	CO1, CO4, CO5
7	Non - ferrous metals and alloys	09	11	3	-	8	-	1	-	1	-	CO1, CO4
8	Miscellaneous materials	15	06	3	3	-	-	1	1	-	-	CO1, CO4, CO5
9	Corrosion	14	11	3	-	8	-	1	-	1	-	CO1, CO3
	TOTAL	**90**	**80**									

C-20, CH-106
Subject Name: Materials Technology
I Year
Syllabus split up for Unit Test

Unit test No.	Learning out comes to be covered
Unit test-I	Objectives from 1.1 to 4.4
Unit test-II	Objective from 5.1 to 7.5
Unit test-III	Objective from 8.1 to 9.5

State Board of technical Education and Training, A.P
Diploma in Chemical Engineering
I YEAR
Subject Name: MATERIALS TECHNOLOGY
Subject Code: CH-106

Time: 90 minutes   **Unit Test I**   Max .marks:40

Part-A   **16Marks**

Instructions: (1) Answer all questions.
        (2) First question carries four marks; each question of remaining carries three marks

1. Define the following properties.
   e) Iron is more elastic than rubber(true/false)   `   (CO1)
   f) Abbreviation of UTM is -----------------   (CO1)
   g) Which of the following is more brittle? a)iron , b) rubber , c) stone ware   (CO1)
   h) Name of the test used to determine the Impact strength is ------------------   (CO3)

2. Define engineering materials and classify them.   **(CO1)**

3. Distinguish between destructive and non-destructive tests.   **(CO3)**

4. State the effect of grain size on mechanical properties.   **(CO1)**

5. Write the peritectic and eutectic reaction.   **(CO2)**

Part-B   **3X8=24**

Instructions: (1) Answer all questions.
        (2) Each question carries eight marks
        (3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

 6 a)   Explain the hardness of a material by Brinell hardness testing machine with a neat sketch.
                                                                       (CO3)
                                    (or)
    b)   Write the principle and explain the radiography test with a neat diagram   **(CO3)**

 7 a)   Write about charpy impact and Izod impact testing with the help of diagrams **(CO3)**
                                    (or)
    b)   Explain ultrasonic test with a neat sketch   **(CO3)**

 8 a)   Define unit cell and space lattice draw the structure of BCC and FCC and explain**(CO2)**
                                    (or)
    b)   With a neat sketch explain the iron carbon equilibrium diagrams and identify the various phases in it.   **(CO2)**

MODEL QUESTION PAPER WITH COs MAPPED

PART A: 30 marks 10 questions, 3 marks each NO CHOICE

-60 minutes (6 minutes each)

PART B: 40 marks, 5 questions, 8 marks each, EITHER OR TYPE

-90 minutes (18minutes for each question)

PART C: 10 marks, 1question, 10marks

-30 minutes (higher order question)

Q.no	Questions	Bloom's category	Marks allocated	CO addressed
PART – A (30 marks)				
1.	Define engineering materials	R	3	CO1
2.	Distinguish between destructive non-destructive tests	R	3	CO1
3.	State the effect of grain size on mechanical properties.	R	3	CO1
4.	Write the properties and applications different types of cast iron.	R	3	CO4,CO5
5.	Explain the need for alloying the steel with other elements .	R	3	CO1
6.	List the applications of alloy steels	U	3	CO5
7.	Write the properties of zinc and tin.	R	3	CO4
8.	Write the applications of asbestos.	R	3	CO5
9.	Define refractories and write the applications.	U	3	CO1, CO5
10.	Explain passivity.	R	3	CO1
PART –B (40 marks)				
11.	Explain the Brinell hardness test with a neat sketch (or) Explain the Rockwell hardness testing machines with a neat sketch.	AP	8	CO3
12.	Explain iron carbon equilibrium diagram (or) Explain cooling curves and allotropic forms of pure iron.	AP	8	CO2
13.	Explain the manufacturing method of pig iron by blast furnace (or) Explain the manufacturing method of cast iron by cupola furnace.	AP	8	CO3
14.	Explain the composition properties and applications of	AP	8	CO1, CO4, CO5

	brass(or) Explain the composition properties and applications of nickel alloys.			
15.	Explain electro chemical theory of corrosion (or) Explain preventive methods of corrosion.	AP	8	CO3
PART – C (10 marks)				
16.	Analyse the procedure to detect internal defects of a metal by radiography test	AN	10	CO3

Course code	Course title	No. of periods/week	Total no of periods	Marks of FA	Marks for SA
CH - 107	Engineering Drawing	06	180	40	60

TIME SCHEDULE

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

COURSE OBJECTIVES AND COURSE OUTCOMES

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

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

3: High, 2: Moderate,1: Low

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

1.0   Understand the basic concepts of Engineering Drawing
1.1   State the importance of drawing as an engineering communication medium
1.2   State the necessity of B.I.S. Code of practice for Engineering Drawing.
1.3   Explain the linkages between Engineering drawing and other subjects ofMechanical Engineering
2.0   Use of Engineering Drawing Instruments
2.1   Select the correct instruments to draw the different lines / curves
2.2   Use correct grade of pencil to draw different types of lines and for different purposes
2.3   Select and use appropriate scales for a given application.
2.4   Identify different drawing sheet sizes as per I.S. and Standard Lay- outs.
2.5   Prepare Title block as per B.I.S. Specifications.
2.6   Identify the steps to be taken to keep the drawing clean and tidy.
       Drawing Plate 1: (Having two exercises)
3.0   Write Free Hand Lettering and Numbers
3.1   Write titles using vertical lettering and numerals of 7mm, 10mm and 14mm height
3.2   Write titles using sloping lettering and numerals of 7mm, 10mm and 14mm height
3.3   Select suitable sizes of lettering for different layouts and applications
       Drawing plate 2: (Having 5 to 6 exercises)

4.0   Understand Dimensioning Practice

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

4.5   Dimension a given drawing using standard notations and desired system of dimensioning.
Drawing Plate 3: (Having 08 to10 exercises)

5.0   Apply Principles of Geometric Constructions

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

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

5.2   Draw the conics using general and special methods,

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

5.4   Identify the applications of the above constructions in engineering practice.
Drawing Plate -4: Having problems up to construction of polygon
Drawing Plate -5: Having problems of construction of conics
Drawing Plate -6: Having problems of construction of involute, cycloid and helix

6.0   Projections of points, lines, planes & auxiliary planes

6.1   Explain the basic principles of the orthographic projections

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

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

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

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

6.5   Draw the auxiliary views of a given engineering component
Drawing Plate -7: Having problems up to projection of points and Lines (15 exercises)
Drawing Plate -8: Having problems of projection of planes (6 exercises)
Drawing Plate -9: Having problems on auxiliary planes (Having 4 exercises)

7.0   Draw the Projections of Solids

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

8.0   Appreciate the need of Sectional Views

8.1   Identify the need to draw sectional views.

8.4   Differentiate between true shape and apparent shape of section

8.5   Draw sectional views and true sections of regular solids by applying the principles of hatching.
Drawing Plate–11: Having problems of section of solids (6 exercises)

9.0   Apply principles of orthographic projection

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

9.2   Draw the minimum number of views needed to represent a given object fully.
Drawing Plate 12 : (Having 10 to 12 exercises)

10.0   Prepare pictorial drawings

10.1   identify the need of pictorial drawings.

10.2   Differentiate between isometric scale and true scale.

10.3   Prepare Isometric views from the given orthographic drawings.
Drawing plate 13: (Having 10 to 12 exercises)

11.0 Interpret Development of surfaces of different solids

11.1 State the need for preparing development drawing.

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

11.3 Prepare development of surface of engineering components like i) funnel
ii) 90^0 elbow iii) Tray
Drawing plate No. 14: (Having 05 exercises)

Competencies and Key competencies to be achieved by the student

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

COURSE CONTENTS:

NOTES:

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

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

1.0   The importance of Engineering Drawing

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

2.0   Engineering drawing Instruments

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

3.0   Free hand lettering & numbering

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

4.0   Dimensioning practice

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

5.0   Geometric Construction

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

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

Construction of tangent arcs:

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

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

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

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

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

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

6.0   Projection of points, lines and planes &auxiliary views

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

Projections of points in different quadrants
Projections of straight line -
(a) Parallel to both the planes.
(b) Perpendicular to one of the planes.
(c) Inclined to one plane and parallel to other planes
Projections of regular planes
(a) Plane parallel to one of the reference planes
(b) Plane perpendicular to HP and inclined to VP and vice versa.
Auxiliary views
Need for drawing auxiliary views -Explanation of the basic principles of drawing an auxiliary views explanation of reference plane and auxiliary plane - Partial auxiliary view.

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

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

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

10.0   Pictorial Drawings
Brief description of different types of pictorial drawing viz., Isometric, oblique, and perspective and their use - Isometric drawings: Isometric axes, angle between them, meaning of visual distortion in dimensions - Need for an isometric scale, difference between Isometric scale, and   true scale - difference between Isometric   view and   Isometric projection - Isometric and non-Isometric lines -Isometric drawing of common features like rectangles, circular - shapes, non-isometric lines – Drawing the isometric views for the given orthographic projections -Use of box / offset method

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

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

BOARD DIPLOMA EXAMINATIONS
MODEL QUESTION PAPER
DCHE – I-YEAR
ENGINEERING DRAWING

Instructions:	01.	All the dimensions are in mm
	02.	Use first angle projections only
	03.	Due weightage will be given for the dimensioning and neatness

PART – A   **05 x 04=20**

01.   Answer all the questions
02.   Each question carries FIVE marks

01.   Write the following in single stroke capital vertical lettering of size 10mm
        ORTHOGRAPHIC PROJECTIONS
02.   Redraw the given fig. and dimension it according to SP-46:1988.Assume suitable scale
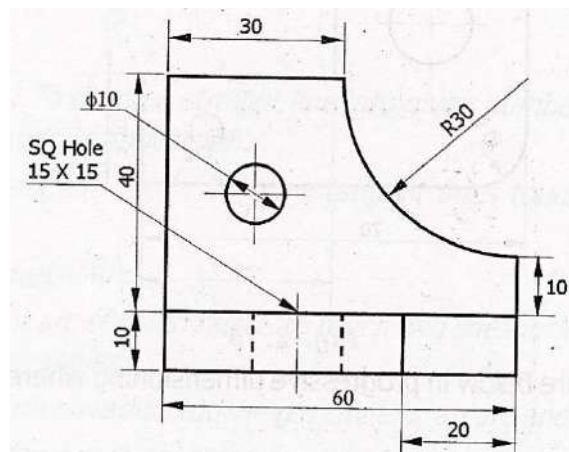
03.   Draw internal common tangents to two unequal circles of radii 26mm and 20mm.The
        distance between the circles is 75mm.
04.   Draw the projections of a regular pentagon of side length 40 mm inclined to the H.P. by 30^0
        and perpendicular to V.P. using auxiliary plane method

PART – B   **10 X 04 = 40**
01.   Answer any FOUR of the following questions
02.   Each question carries TEN marks

05.   Draw the involute of a circle of diameter 30 mm and also draw a tangent to the curve at a
        distance of 60 mm from the centre of the circle.
06.   A right circular cone of height 80 mm and base radius 60 mm is resting in the H.P. on one of
        its generators and its axis is parallel to V.P. Draw the projections of the solid.
07.   A regular hexagonal prism of height 80 mm and base side 40 mm is resting in the H.P. on its
        base. It is cut by an auxiliary inclined plane of 60^{0}inclination passing through the axis at a
        distance of 30 mm from the top base. Draw the sectional views of the solid and the true
        section.

08. A pentagonal pyramid of height 80 mm and base side 40 mm is resting in the H.P. on its base such that one of the sides of the base is perpendicular to the V.P. It is cut by a section plane perpendicular to the V.P. and inclined to the H.P. by 60^0 and passing through the axis at a distance of 25 mm from the base. Draw the development of the lateral surface of the truncated pyramid.

09. Draw the front view, top view and left side view of the object shown in the fig.
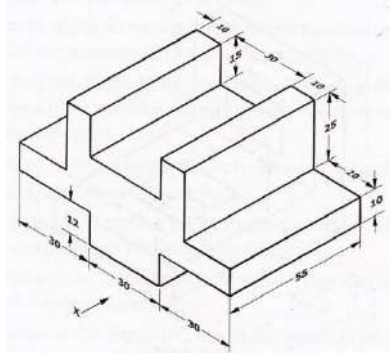
11. Draw the isometric view of the component whose orthographic projections are given below
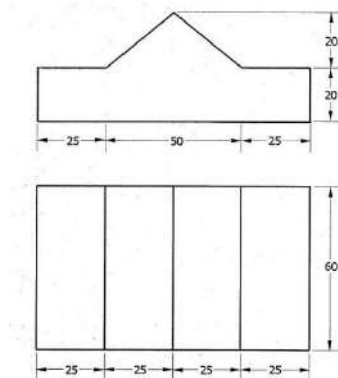
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Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-108	Workshop practice	6	180	40	60

S.No.	Major Topics	No. of periods
1.	Carpentry	24
2.	Fitting and welding	36
3.	Basic machine operations	22
4.	Plumbing	08
	TOTAL	**90**

COURSE TITLE : WORKSHOP PRACTICE		
Course Objectives	(i) To familiarize with the knowledge different materials tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant experiments/exercises	
Course Outcomes	CH-108.1	Demonstrate the skill of planning and organizing experimental set up for a desired purpose
	CH-108.2	Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems
	CH-108.3	Observe various parameters, their variations and graphically represent the same
	CH-108.4	Analyse the experimental results to draw inferences to make recommendations
	CH-108.5	Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

LEARNING OUTCOME

1.0 Use of different tools in Carpentry, Fitting, Welding and Turning section of workshop.
2.0 Prepare various carpentry joints, panel boards and cabinet boxes.
3.0 Hacksaw cutting, grinding, thread cutting for metal conduit; G.I. Pipes and roads etc, in fitting section.
4.0 Handle welding transformer and make lap and butt joints.
5.0 Exercise on lathe like simple turning, step turning, taper turning and knurling.
6.0 Exercise on thread cutting for pipes and rods on Lathes.
7.0 Hand drilling machines and grinding machine.
8.0 Know the basics of plumbing work and applications.
8.1 Know the types of pipe joints.
Understand the symbols.
Know the materials used pipes.
Assembling, threading, joining of pipes.
Able to understand cross, T, L joints etc.

COURSE CONTENT
Following list of experiments are to be made by every student in the workshop

1.   CARPENTRY
1.   Exercises on planning, sawing and chiseling
2.   Prepare a half lap joint
3.   Prepare a Dovetail joint.
4.   Prepare a Mortise joint.
5.   Prepare a 20 cm X 15 cm Teakwood switch board with hinges and bottom hook.
6.   Fix the laminate sheet to the above box and cut suitable holes to mount tone flush type switch, socket.

2.   FITTING AND WELDING
1.   Exercises to cut a metal conduit, G.I. Pipe and solid rod using hack saw.
2.   3 & 4 Thread cutting of G.I.pipe, metal conduit and solid rod using Die set.
     5. & 6. Internal thread cutting using Tap set and cleaning the threads using reamers and make a hexagonal nut from a round rod.

   WELDING
   1. Prepare a job and to make a lap joint and finish it using grinder.
   2. Prepare a job and make a butt joint and finish it with grinder.
   3. Prepare the job and make *'T'* joint.

3.   MACHINE SHOP
   Exercise on turning the given rod to get three different diameters using lathe.
   Make a bolt and cut threads using lathe.
   Cut the threads to G.I. Pipe using lathe.
   Prepare a centre punch and knurl its head.
Make a square plate using power hack saw, remove sharp edges using grinder, make triangle and drill three holes of different diameters at the vertices.

4.   PLUMBING
   Plumbing work and applications
   1. Types of pipe joints.
   2. Symbols
   3. Materials used for pipes
   4. Assembling, Threading, Joining of pipes.
   5. Different fittings such as cross, L, T etc.,

Scheme of Valuation for end Lab Practical Examination :

A.   Writing Aim, Apparatus, Formula, Graph, Precautions carries 10 (Ten) Marks
B.   For Drawing the table, taking Readings, Calculation work,
     Drawing the graph, finding result carries   15 (Fifteen) Marks
C.   Viva Voice   05 (Five) Marks
                                                     ………………………………………
     Total   **30 (Thirty) Marks**
                                                     …………………………………….

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

SubjectCode	SubjectTitle	Periodsperweek	Totalperiodsperyear
CH-109 A	Physics Laboratory	03	45

TIMESCHEDULE

S.No	Name of the Experiment	No.of Periods
1.	Hands on practice on Vernier Calipers	03
2.	Hands on practice on Screw gauge	03
3.	Verification of Parallelogram law of forces and Triangle law of 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) (**Single**)	03
7.	Refractive index of solid using traveling microscope	03
8.	Boyle's law verification	03
9.	Meter bridge	03
10.	Mapping of magnet lines of force and locate null points	03
	DEMONSTRATION EXPERIMENTS	
11.	Surface tension of liquid using traveling microscope	03
12.	Coefficient of viscosity by capillary method	03
	Revision	06
	Test	03
	Total	**45**

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

1.0   Practice with Vernier calipers to determine the volumes and areas of a cylinder and sphere and their comparison etc .
2.0   Practice with Screw gauge to determine thickness of a glass plate, cross sectional area
        of a wire and volumes of sphere and also their comparison etc
3.0   Verify the parallelogram law and Triangle law
4.0   Determine the value of acceleration due to gravity using Simple Pendulum
5.0   Determine the velocity of sound in air at room temperature and its value at zero degree centigrade.
6.0   Calculate the Focal length and focal power of convex lenses using distant object method , U-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   Verify the Boyle's law employing a Quill tube.
9.0   Determine the specific resistance of material of a wirel using Meter Bridge.
10.0   Drawing magnetic lines of force under N-S and N-N methods and locate null points.

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

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

Competencies and Key competencies to be achieved by the student

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

5. Velocity of sound in air –Resonance method (03)	• Arrange the resonance apparatus • Adjust the reservoir level for booming sound • Find the first and second resonanting lengths • Calculate velocity of sound	• Adjust the reservoir level • Find the first and second resonanting lengths • Calculate velocity of sound at room temperature • Calculate velocity of sound at 0^0 C
6. Focal length and Focal power of convex lens (Separate & Combination) (03)	• Fix the object distance • Find the Image distance • Calculate the focal length and power of convex lens and combination of convex lenses • Draw u-v and 1/u – 1/v graphs	• Calculate the focal length and power of convex lens • Draw u-v and 1/u – 1/v graphs
7. Refractive index of solid using traveling microscope(03)	• Find the least count of vernier on microscope • Place the graph paper below microscope • Read the scale • Calculate the refractive index of glass slab	• Read the scale • Calculate the refractive index of glass slab
8. Boyle's law verification (03)	• Note the atmospheric pressure • Fix the quill tube to retort stand • Find the length of air column • Find the pressure of enclosed air • Find and compare the calculated value P x l	• Find the length of air column • Find the pressure of enclosed air • Find the value P x l
9. Meter bridge(03)	• Make the circuit connections • Find the balancing length • Calculate unknown resistance • Find the radius of wire • Calculate the specific resistance	• Find the balancing length • Calculate unknown resistance • Calculate the specific resistance

10. Mapping of magnet lines of force(03)	• Draw magnetic meridian • Placed the bar magnet in NN and NS directions • Draw magnetic lines of force • Locate the neutral points along equatorial and axial lines	• Draw magnetic lines of force • Locate the neutral points along equatorial and axial lines
11. Surface tension of liquid using traveling microscope(03)	• Find the least count of vernier on microscope • Focus the microscope to the lower meniscus & bent pin • Read the scale • Calculate height of liquid rise • Calculate the surface tension of water	• Read the scale • Calculate height of liquid rise • Calculate the surface tension of water
12.. Coefficient of viscosity by capillary method(03)	• Find the least count of vernier • Fix the capillary tube to aspiratory bottle • Find the mass of collected water • Find the pressure head • Calculate rate of volume of liquid collected • Find the radius of capillary tube • Calculate the viscosity of water using capillary method	• Find the pressure head • Calculate rate of volume of liquid collected • Find the radius of capillary tube • Calculate the viscosity of water

Scheme of Valuation for end Lab Practical Examination :

A. Writing Aim, Apparatus, Formula, Graph, Precautions carries 10 (Ten) Marks
B. For Drawing the table, taking Readings, Calculation work,
   Drawing the graph, finding result carries   15 (Fifteen) Marks
C. Viva Voice   05 (Five) Marks
   ………………………………………..
   Total   **30 (Thirty) Marks**
   ………………………………………..

> **Course outcomes**

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

> **COs-PO mapping strength (as per given table)**

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

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

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

Subject Code	Subject Title	Periods per week	Total periods per year
CH-109B	Chemistry Laboratory	03	45

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

PO CO mapping

Course code CH-109B	Chemistry Laboratory No of Cos;5				No Of periods 45
POs	Mapped with CO No	CO periods addressing PO in Col 1 NO	%	Level 1,2,3	remarks
PO1	CO1,CO2,CO3, CO4,CO5	12	26.66	2	>40% level 3 (highly addressed) 25% to 40% level2(moderately addressed 5% to 25% level1 (Low addressed < 5%(not addressed)
PO2	CO1,CO2,CO3, CO4,CO5	9	20	1	
PO3					
PO4	CO1,CO2,CO3, CO4,CO5	12	26.66	2	
PO5	CO2,CO3, CO4,CO5	12	26.66	2	
PO6					
PO7					

COs-POs mapping strength (as per given table)

3=strongly mapped

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

2= moderately mapped

1= slightly mapped

Note:

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

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

TIMESCHEDULE

S.No	Name of the Experiment	No.of Periods	Mapped with COs
1.	a) Recognition of chemical substances and solutions used in the laboratory by senses. b) Familiarization of methods for Volumetric analysis	03	CO1
2.	Preparation of Std Na_2CO_3 and making solutions of different dilution	03	CO1
3.	Estimation of HCl solution using Std.Na_2CO_3 solution	03	CO2
4.	Estimation of NaOH using Std.HCl solution	03	CO2
5.	Estimation of H_2SO_4usingStd.NaOH solution	03	CO2
6.	Estimation of Mohr's Salt using Std.$KMnO_4$	03	CO3
7.	Determination of acidity of water sample	03	CO2
8.	Determination of alkalinity of water sample	03	CO2
9.	Determination of total hardness of water using Std.EDTA solution	03	CO4
10.	Estimation of Chlorides present in water sample	03	CO4
11.	Estimation of Dissolved Oxygen(D.O)in water sample	03	CO5
12.	Determination of pH using pH meter	03	CO5
13.	Determination of conductivity of water and adjusting ionic strength	03	CO5
14.	Determination of turbidity of water	03	CO5
15.	Estimation of total solids present in water sample	03	CO5
	Total:	**45**	

OBJECTIVES:

Upon completion of the course the student shall be able to

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

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

3.0 Conduct titrations adopting standard procedures and using Std. Na_2CO_3solutionfor estimation of HCl

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

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

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

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

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

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

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

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

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

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

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

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

Competencies and Key competencies to be achieved by the student

Name of the Experiment (No of Periods)	Competencies	Key competencies
Familiarization of methods for Volumetric analysis. Recognition of chemical substances And solutions (03)	-	--
Preparation of Std Na_2CO_3 and making solutions of different dilution(03)	▪ Weighing the salt to the accuracy of .01 mg ▪ Measuring the water with volumetric flask, measuring jar, volumetric pipetteand 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
Estimation of HCl solution using Std. Na_2CO_3solution (03) 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)	▪ 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

Determination of alkalinity of water sample (03)		
Determination of total hardness of water using Std. EDTA solution (03)		
Estimation of Chlorides present in water sample (03)		
Estimation of Dissolved Oxygen(D.O) in water sample (By titration method) (03)	▪ Familiarize with 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)		
Estimation of total solids present in water sample (03)	▪ Measuring the accurate volume and weight of sample ▪ Filtering and air drying without losing any filtrate ▪ Accurately weighing the filter paper, crucible and filtrate ▪ Drying the crucible in an oven	▪ Measuring the accurate volume and weight of sample ▪ Filtering and air drying without losing any filtrate ▪ Accurately weighing the filter paper, crucible and filtrate

SCHEME OF VALUATION

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

                     Total   **30M**

Course code	Course Title	No. of Periods/Weeks	Total No. of periods	Marks for FA	Marks for SA
CH-110 (common to all branches)	Computer Fundamentals Lab	3	90	40	60

Time schedule:

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

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

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

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

CO-PO/PSO MATRIX

CO NO.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CH-110.1	3	3	3	3	3	3	3	3	2	3
CH-110.2	3	3	3	3	3	3	3	3	2	3
CH-110.3	3	3	3	3	3	3	3	3	2	3
CH-110.4	3	3	3	3	3	3	3	3	2	3
CH-110.5	3	3	3	3	3	3	3	3	2	3
Average	3	3	3	3	3	3	3	3	2	3

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

LEARNING OUTCOMES:

I.   Computer Hardware Basics
1.   a).To Familiarize with Computer system and hardware connections
       b).To Start and Shut down Computer correctly
       c).To check the software details of the computer
2.   To check the hardware present in your computer
II.   Windows's operating system
3.   To Explore Windows Desktop
4.   Working with Files and Folders
5.   Windows Accessories: Calculator – Notepad – WordPad – MS Paint
III. Practice with MS-WORD
6.   To familiarize with Ribbon layout of MS Word
       Home – Insert- Page layout – References – Review- View.
7.   To practice Word Processing Basics
8.   To practice Formatting techniques
9.   To insert a table of required number of rows and columns
10.   To insert Objects, Clipart and Hyperlinks
11.   To use Mail Merge feature of MS Word
12.   To use Equations and symbols features
IV.   Practice with MS-EXCEL
13.   To familiarize with MS-EXCEL layout
14.   To access and enter data in the cells
15.   To edit a spread sheet- Copy, Cut, Paste, and selecting Cells
16.   To use built in functions and Formatting Data
17.   To create Excel Functions, Filling Cells
18.   To enter a Formula for automatic calculations
19.   To sort and filter data in table.
20.   To present data using Excel Graphs and Charts.
21.   To develop lab reports of respective discipline.
22.   To format a Worksheet in Excel, Page Setup and Print
V.   Practice with MS-POWERPOINT
23.   To familiarize with Ribbon layout features of PowerPoint 2007.
24.   To create a simple PowerPoint Presentation
25.   To set up a Master Slide in PowerPoint
26.   To insert Text and Objects
27.   To insert a Flow Charts

28. To insert a Table
29. To insert a Charts/Graphs
30. To insert video and audio
31. To practice Animating text and objects
32. To Review presentation
VI. Practice with Adobe Photoshop
33. To familiarize with standard toolbox
34. To edit a photograph.
35. To insert Borders around photograph.
36. To change Background of a Photograph.
37. To change colours of Photograph.
38. To prepare a cover page for the book in your subject area.
39. To adjust the brightness and contrast of the picture so that it gives an elegant look.
40. To type a word and apply the shadow emboss effects.

Key competencies:

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

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

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

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

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

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

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

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

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

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

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

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

I YEAR INTERNAL LAB EXAMINATION
UNIT TEST - I
MODEL QUESTION PAPER
COMPUTER FUNDAMENTALS LAB

SCHEME: C-20   SUBJ CODE: CH-110
MAX MARKS:40   Time:90Min

1. Identify the internal hardware components of a PC and assemble them.

2. Identify the external components or peripherals of a PC and connect them.

3. Identify the components on motherboard.

4. Perform the process of placing processor on CPU slot.

5. Perform the process of removing and placing the RAM in the corresponding slot.

6. Identify the CMOS battery and test whether it is working it or not.

7. Find details of following:

    a) Operating System being used.

    b) Processor name

    c) RAM

    d) Hard disk

8. Create a folder by your name, search a file or folder and find its path.

9. Draw the National Flag using MS Paint.

10. Create a word document that contains TEN names of your classmates (boys-5 & girls-5) and

    perform the following tasks:

    a) Save the document to your desktop.

    b) Sort the names in each list alphabetically.

    c) Set line spacing to 1.15.

    d) Use bullet points for the names in both lists separately.

***

I YEAR INTERNAL LAB EXAMINATION
UNIT TEST - II
MODEL QUESTION PAPER
COMPUTER FUNDAMENTALS LAB

SCHEME: C-20   **SUBJ CODE:CH-110**
MAX MARKS:40   **Time:90Min**

1. Write individually addressed letters to your friends about the Republic Day celebration using Mail Merge.

2. Create a Word document about your college and insert page numbers in footer and College Name in header.

3. Create your class time table using Tables in MS Word.

4. Create a 2-page document about your College& insert hyperlinks for courses offered in the college and insert Bookmarks next to College Name.

5. Write individually addressed letters to your friends (at least 5 members) to intimate the External Examination time table using Mail Merge.

6. Write an equation $\frac{(x+y)^2}{(x-y)^2} = \frac{x^2+2xy+y^2}{x^2-2xy+y^2}$ in MS word.

7. Create the organizational structure of your college in MS Word.

8. Create a spreadsheet by totaling marks of 3 or more subjects, then calculate percentage and hence find grade based on boundary conditions of FIVE students:
   Grades O >= 90%, A >=80%, B >=70%, C >=60%, D >=50%, E >=40%, F <40%

9. Create aExcel spreadsheet for the following data, making sure that the cell marked with Category (A1) is pasted in cell A1 in the spreadsheet and perform the questions below.

Category (A1)	Product Name	Quantity	Inventory	Price per Unit	Total Price
Office Supplies	Binder	2	20	12.99	25.98
Office Supplies	Pencil	20	20	0.99	
Electronics	Samsung 4K Smart TV	1	5	399.00	
Electronics	Bluetooth Speakers	4	5	44.49	
Computers	Lenovo X230 12in Laptop	2	2	279.90	

   a). Change the format of the "Total Price" column to "Currency" format.

   b) Calculate Total Price by writing formula.

   c) Turn on filtering for the table.

   d) Sort the table by column "Category" from A to Z.

10. Create a spreadsheet to calculate Cumulative monthly attendance for a period of Three months.

***

SCHEME: C-20   **SUBJ CODE: CH-110**
MAX MARKS:40   **Time:90Min**

1. Create a PowerPoint Presentation about your College in 5 slides only.

2. Create a PowerPoint Presentation on Computer Hardware in minimum 5 slides.

3. Create a PowerPoint Presentation on Computer Fundamentals with *Entrance, Emphasis* effects in minimum 5 slides.

4. Create a PowerPoint Presentation on any topic with special animation effects like *Entrance, Motion Paths &Exit.*

5. Resize the image using Photoshop.

6. Change the background of a Photograph.

7. Edit an image by using

    a) Crop tool.

    b) Resize the image

    c) Save the new image with new name keeping original image as it is.

8. A Picture of two parrots (parrots.jpg) is given to you. Make anyone of one of the parrots in Black & White.

9. Convert a colour image to monochrome and improve quality of photograph.

10. Copy three pictures and fit into the empty frames.
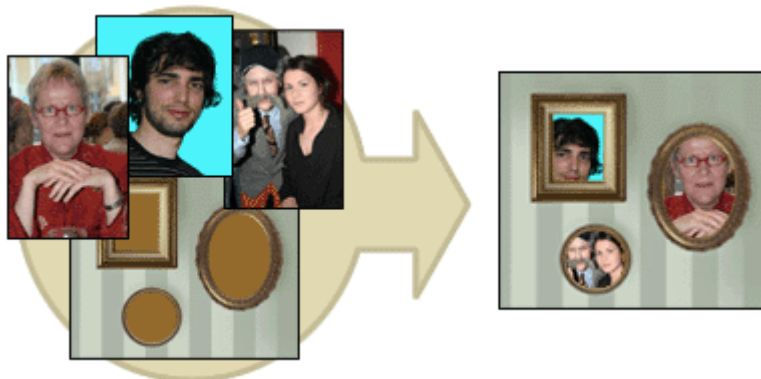
***

SCHEME: C-20   **SUBJ CODE:CH-110**
MAX MARKS:60   **TIME: 3HOURS**

1. Identify the internal hardware components of a PC and assemble them.
2. Identify the external components or peripherals of a PC and connect them.
3. Write the procedure to create the files and folders
4. Write the procedure to access Calculator, Paint and Notepad application
5. Write the procedure to perform the following in MS Word
   (a) Change the Font Size
   (b) Change the Font Style
   (c) Change the Text Size
6. Write the procedure to perform the following in MS Word
   (a)Change the Font Colour.
   (b)Use Various Text Alignment Options.
   (c)Format text in Bold, Italic and Underline.
7. Create the hierarchy of your family in MS Word.
8. Write the procedure to perform the following in MS Word:
   (a) Insert a Table
   (b) Add a Row
   (c) Add a column
   (d) Delete a Row
   (e) Delete a column
9. Write the procedure to use Equation $\frac{(x+y)^2}{(x-y)^2} = \frac{x^2+2xy+y^2}{x^2-2xy+y^2}$ and Symbols.
10. Write the procedure to perform the following in MS Excel
    (a) To Modify Column Width
    (b) To Modify Row Height
    (c) Format text in Bold, Italic, and Underline.
11. Write the procedure to create charts and Graphs in MS Excel.
12. Write the procedure to create simple Power Point Presentation on your college in Three slides.
13. Write the procedure to perform Animation on Text and Objects in your presentation.
14. Take a photographic image. Give a title for the image. Put the border. Write your names. Write the Name of Institution and Place.
15. Prepare a cover page for the book in your subject area. Plan your own design.
16. You are given a picture of a flower and associated background (Extract.jpg).Extract the Flower only from that and organize it on a background. Select your own background for organization.
17. You are given a picture (BrightnessContrast.jpg). Adjust the brightness and contrast of the picture so that it gives an elegant look.
18. You are given a picture (position.jpg). Position the picture preferably on a plain background of a colour of your choice - Positioning include rotation and scaling.
19. Remove the arrows and text from the given photographic image(Filename: photo.jpg).
20. Type a word; apply the following effects. Shadow Emboss.

***

III SEMESTER

DIPLOMA IN CHEMICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
C-20, III Semester (SECOND YEAR)

Subject Code	Name of the Subject	Instruction period / week Mod(non-mod)		Total Period /semester	Scheme of Examination			
		Theory	Practical /Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
CH- 301	Engineering Mathematics – II	4	--	60	3	20	80	100
CH-302	Electrical Technology	4	--	60	3	20	80	100
CH-303	Organic and Physical Chemistry	5	--	75	3	20	80	100
CH-304	Fluid Mechanics	6	--	90	3	20	80	100
CH-305	Mass and Energy Balance	5	--	75	3	20	80	100
PRACTICAL								
CH-306	CAD practice in Chemical Engineering	--	3	45	3	40	60	100
CH-307	Electrical Technology Lab	--	3	45	3	40	60	100
CH-308	Organic & Physical Chemistry Lab.	--	6	90	3	40	60	100
CH-309	Fluid Mechanics Lab	--	6	90	3	40	60	100
TOTAL		**24**	**18**	**630**		**260**	**640**	**900**

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

S.No.	Unit Title	No. of periods	COs mapped
1	Indefinite Integration	22	CO1
2	Definite Integration and its applications	24	CO2
3	Differential Equations of first order	14	CO3
	Total Periods	60	

Course Objectives	(i) To understand the concepts of indefinite integrals and definite integrals with applications to engineering problems.
	(ii) To understand the formation of differential equations and learn various methods of solving them.

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

ENGINEERING MATHEMATICS – II
LEARNING OUTCOMES

Unit-I
C.O. 1 Integrate various functions using different methods.
L.O. 1.1. Explain the concept of Indefinite integral as an anti-derivative.
   1.2. State the indefinite integral of standard functions and properties of Integrals $\int (u + v)\, dx$ and $\int ku\, dx$ where k is constant and u, v are functions of x.
   1.3. Solve integration problems involving standard functions using the above rules.
   1.4. Evaluate integrals involving simple functions of the following type by the method of substitution.

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

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

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

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

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

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

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

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

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

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

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

1.9. Evaluate the integrals of the type

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

1.10. Evaluate integrals using decomposition method.

1.11. Solve problems using integration by parts.

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

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

Unit-II

C.O.2 Evaluate definite integrals with applications.

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

2.2. Explain the concept of definite integral.

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

2.4. State various properties of definite integrals.

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

Syllabus for Unit test-I completed

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

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

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

2.9. Obtain the volumes of solids of revolution.

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

Unit -III

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

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

3.2   Find order and degree of a given differential equation.

3.3   Form a differential equation by eliminating arbitrary constants.

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

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

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

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

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

3.9   Solve simple problems arising in engineering applications.

Syllabus for Unit test-II completed

ENGINEERING MATHEMATICS – II
CO/PO – Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	2				3	1	2
CO2	3	3	3	3				3	3	3
CO3	3	3	3	3				3	3	3
Avg	3	2.6	2.6	2.6				3	2.3	2.6

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

PO5: Appropriate quiz programme may be conducted at intervals and duration as decided by concerned teacher.

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

PO7: Such activities are to be planned that students visit library to refer standard books on Mathematics and latest updates in reputed national and international journals, attending seminars, learning mathematical software tools.

PSO1: An ability to understand the concepts of basic mathematical techniques and to apply them in various areas like computer programming, civil constructions, fluid dynamics, electrical and electronic systems and all concerned engineering disciplines.

PSO2: An ability to solve the Engineering problems using latest software tools, along with analytical skills to arrive at faster and appropriate solutions.

PSO3: Wisdom of social and environmental awareness along with ethical responsibility to have a successful career as an engineer and to sustain passion and zeal for real world technological applications.

ENGINEERING MATHEMATICS – II
PO- CO – MAPPING STRENGTH

PO no	Mapped with CO no	CO periods addressing PO in column I		Level (1,2 or 3)	Remarks
		Number	%		
1	CO1, CO2, CO3	60	100%	3	>40% Level 3 Highly addressed
2	CO1, CO2, CO3	60	100%	3	
3	CO1, CO2, CO3	60	100%	3	
4	CO2, CO3	38	63.3%	3	25% to 40% Level 2 Moderately addressed
5					
6					
7					
PSO 1	CO1, CO2, CO3	60	100%	3	
PSO 2	CO1, CO2, CO3	40	66.6%	3	5% to 25% Level 1 Low addressed
PSO 3	CO1, CO2, CO3	48	75%	3	<5% Not addressed

ENGINEERING MATHEMATICS – II
COURSE CONTENTS

Unit-I
Indefinite Integration.
1. Integration regarded as anti-derivative – Indefinite integrals of standard functions. Properties of indefinite integrals.Integration by substitution or change of variable.Integrals of tan x, cot x, sec x, cosec x. Integrals of the form $\int \sin^m x.\cos^n x \, dx$, where at least one of m and n is odd positive integers.Integrals of suitable powers of tanx.secx and cosecx.cotx by substitution.
   Evaluation of integrals which are reducible to the following forms:

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

   Integration by decomposition of the integrand into simple rational, algebraic functions.
   Integration by parts, Bernoulli's rule and integrals of the form $\int e^x [f(x) + f'(x)] \, dx$.

Unit-II
Definite Integral and its applications:
2. Definite integral-fundamental theorem of integral calculus, properties of definite integrals, evaluation of simple definite integrals. Definite integral as the limit of a sum. Area under plane curves – Area enclosed between two curves. Mean and RMS values of a function on a given interval Volumes of solids of revolution. Trapezoidal rule, Simpson's 1/3 rule to evaluate an approximate value of a define integral.

Unit -III
Differential Equations:
3. Definition of a differential equation-order and degree of a differential equation- formation of differential equations-solutions of differential equations of first order and first degree using methods, variables separable, homogeneous, exact, linear differential equation, Bernoulli's equation.

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

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

BLUE PRINT

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

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

Engineering Mathematics – II
Unit Test Syllabus

Unit Test	Syllabus
Unit Test-I	From L.O 1.1 to L.O 2.5
Unit Test-II	FromL.O 2.6 to L.O 3.9

UNIT TEST MODEL PAPERS
UNIT TEST I
STATE BOARD OF TECHNICAL EDUCATION AND TRAINING, A. P
THIRD SEMESTER
Subject Name: Engineering Mathematics-II
Sub Code: CH-301

<u>Time : 90 minutes</u>   Max.Marks:40

Part-A   **16Marks**

Instructions: **(1) Answer all questions.**
(2) First question carries four marks and the remaining questions carry three marks each.

1.   Answer the following.

   a.   Evaluate $\int x^8 dx$ (CO1)

   b.   Evaluate $\int \dfrac{1}{\sqrt{4-x^2}} dx.$ (CO1)

   c. $\int e^x \left(f(x) + f'(x) \right) dx = e^x f(x) + c$ is true/false   (CO1)

   d.   Evaluate $\int\limits_{0}^{\frac{\pi}{2}} \cos x\, dx$ (CO2)

2.   Evaluate $\int \left(3\cos ec^2 x - 2\tan x \sec x + \dfrac{1}{x} \right) dx.$ (CO1)

3.   Evaluate $\int \dfrac{\sin(\log x)}{x} dx.$ (CO1)

4.   Evaluate $\int e^x \sin 2x\, dx.$ (CO1)

5.   Evaluate $\int\limits_{0}^{\frac{\pi}{2}} \sin^2 x\, dx$ (CO2)

Part-B   **3×8=24**

Instructions: **(1) Answer all questions. Each question carries eight marks**
(2) Answer should be comprehensive and the criterion for valuation
is the content but not the length of the answer.

6.   A) Evaluate $\int \dfrac{1}{5 + 4\cos x} dx.$ (CO1)
            or
      B) Evaluate $\int \sin^4 x \cos^3 x\, dx.$ (CO1)

7. A) Evaluate $\int \cos^{-1}\left(\dfrac{1-x^2}{1+x^2}\right)dx.$ (CO1)

or

B) Evaluate $\int x^4 e^{2x}dx.$ (CO1)

8. A) Evaluate $\displaystyle\int_{0}^{\frac{\pi}{2}} \cos 4x \cos x\, dx$ (CO2)

or

B) Evaluate $\displaystyle\int_{0}^{\frac{\pi}{2}} \dfrac{\sin^{10} x}{\sin^{10} x + \cos^{10} x}\, dx$ (CO2)

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UNIT TEST II
STATE BOARD OF TECHNICAL EDUCATION AND TRAINING, A. P
THIRD SEMESTER
Subject Name: Engineering Mathematics-II
Sub Code: CH-301

Time : 90 minutes   Max.Marks:40

Part-A   **16Marks**

Instructions: **(1) Answer all questions.**
(2) First question carries four marks and the remaining questions carry three marks each.

1.   Answer the following.

   a.   Volume of the curve $y = f(x)$ over the interval $[a,b]$ when rotated about X-axis is
        _____   (CO2)

   b.   Mean value of $f(x)$ over the interval $[a,b]$ is_____   (CO2)

   c.   Order of differential equation $\dfrac{d^2 y}{dx^2} + p^2 y = 0$ is_____   (CO3)

   d.   Integrating factor of $\dfrac{dy}{dx} + Py = Q$ is_____   (CO3)

2.   Find the mean value of $x^2 + 2x + 1$ over the interval $[1,2]$ (CO2)

3.   Find the area enclosed by curve $x^2 = 4y$ between the lines $x = 2$ and $x = 4$ (CO2)

4.   Form the differential equation by eliminating the arbitrary constants from

      $y = A\cos 2x + B\sin 2x.$ (CO3)

5.   Solve $\dfrac{dy}{dx} = \sqrt{\dfrac{1 - y^2}{1 - x^2}}.$ (CO3)

Part-B   **3×8=24**
Instructions: **(1) Answer all questions. Each question carries eight marks**
(2) Answer should be comprehensive and the criterion for valuation
is the content but not the length of the answer.

6.   A) Find the area bounded between the curve $y = x^2 - 5x$ and the line $y = 4 - 2x$ (CO2)
                      Or
      B) Find the R.M.S value of $\sqrt{\log x}$ between the lines $x = e$ to $x = e^2$ (CO2)

7. A) Find the volume of the solid obtained by revolving the ellipse $\dfrac{x^2}{16}+\dfrac{y^2}{25}=1$ about x axis

(CO2)

or

B) Calculate the approximate value of $\displaystyle\int_{0}^{6}\dfrac{1}{1+x}\,dx$ by taking $n=6$ using Trapezoidal rule

(CO3)

8. A) Solve $\left(y^2-2xy\right)dx+\left(2xy+x^2\right)dy=0$. (CO3)

or

B) Solve $x\dfrac{dy}{dx}+\dfrac{y}{x}=x^3y^6$. (CO3)

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STATE BOARD OF TECHNICAL EDUCATION, A.P
ENGINEERING MATHEMATICS CH-301

TIME : 3 HOURS   **MODEL PAPER- I**   **MAX.MARKS : 80M**

PART-A

Answer All questions. Each question carries THREE marks.   **10x3=30M**

1. Evaluate $\int \left(2\sin x - 3e^x + \dfrac{4}{1+x^2} \right) dx.$ **CO1**

2. Evaluate $\int e^x \sin e^x dx.$ **CO1**

3. Evaluate $\int \sin 3x \cos 2x dx.$ **CO1**

4. Evaluate $\int x e^x dx.$ **CO1**

5. Evaluate $\int_0^1 \dfrac{1}{1+x^2} dx.$ **CO2**

6. Find the mean value of $y = x^2$ from $x = 0$ to $x = 1$ **CO2**

7. Find the area of the region bounded by the curve $y = \sin x$ from $x = 0$ to $x = \pi$ **CO2**

8. Find the order and degree of the differential equation $\left(\dfrac{d^3 y}{dx^3} \right)^2 - 3\left(\dfrac{dy}{dx} \right)^2 - x^2 = 1$ **CO3**

9. Solve $\dfrac{dy}{dx} = \dfrac{1+y^2}{1+x^2}$ **CO3**

10. Solve $\left(x^2 + y \right) dx + \left(y^2 + x \right) dy = 0.$ **CO3**

PART-B

Answer All questions. Each question carries EIGHT marks.   **5x8=40M**

11. A) Evaluate $\int \dfrac{3x+1}{(x-1)(x+3)} dx.$ **CO1**

     Or

     B) Evaluate $\int \dfrac{1}{5+4\cos x} dx.$ **CO1**

12. A) Evaluate $\int x \sin 3x \cos x dx.$ **CO1**

     OR

     B) Evaluate $\int x^3 \cos x dx.$ **CO1**

13. A) Evaluate $\int_0^1 \dfrac{x^3}{1+x^8} dx.$ **CO2**

     Or

     B) Evaluate $\int_0^{\frac{\pi}{2}} \dfrac{1}{1+\tan^3 x} dx.$ **CO2**

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14. A) Find the area of the region bounded by the curves $y^2 = 4x$ **and** $x^2 = 4y$.   **CO2**

         Or

   B) Find the R.M.S values of $\sqrt{27 - 4x^2}$ from $x = 0$ to $x = 3$ **CO2**

15. A) Find the volume of the solid generated by revolution of the ellipse $\dfrac{x^2}{16} + \dfrac{y^2}{25} = 1$ about

   X-axis   **CO2**

                 OR

   B) Calculate the approximate value of $\displaystyle\int_{1}^{11} x^3 \, dx$ by using Simpson's 1/3$^{\text{rd}}$ rule by dividing the

   range into 10 equal parts.   **CO2**

PART-C
Answer the following question. Question carries TEN marks.   **1x10=10M**

16. Solve $2 \sin x \dfrac{dy}{dx} - y \cos x = x y^3 e^x$.   **CO3**

***

TIME : 3 HOURS   **MODEL PAPER-II**   **MAX.MARKS : 80M**

PART-A

Answer All questions. Each question carries THREE marks.   **10x3=30M**

1. Evaluate $\int \left(3e^x - 2\cos x + \dfrac{3}{x} \right) dx$.   **CO1**

2. Evaluate $\int \cos^2 2x \, dx$.   **CO1**

3. Evaluate $\int \dfrac{\tan^{-1} x}{1+x^2} dx$.   **CO1**

4. Evaluate $\int x \cos x \, dx$.   **CO1**

5. Evaluate $\int\limits_{0}^{2} \dfrac{1}{\sqrt{4-x^2}} dx$.   **CO2**

6. Find the mean value of $i = a \sin t$ over the complete wave.   **CO2**

7. Find the volume generated by revolving the circle $x^2 + y^2 = 9$ from $x = 0$ to $x = 2$ about x-axis   **CO2**

8. Obtain the differential equation by eliminating the arbitrary constants A and B from the curve $y = Ae^x + Be^{-x}$ **CO3**

9. Solve $\dfrac{dy}{dx} = e^{2x+y}$ **CO3**

10. Solve $\dfrac{dy}{dx} + \dfrac{y}{x} = x$ **CO3**

PART-B

Answer All questions. Each question carries EIGHT marks.   **5x8=40M**

11. A) Evaluate $\int \dfrac{1}{2x^2 + 3x + 5} dx$.   **CO1**

Or

B) Evaluate $\int \sin^3 x \cos^5 x \, dx$.   **CO1**

12. A) Evaluate $\int e^x \left(\dfrac{2+\sin 2x}{1+\cos 2x} \right) dx$.   **CO1**

Or

B) Evaluate $\int e^{2x} x^4 dx$.   **CO1**

13. A) Evaluate $\int\limits_{0}^{1} \dfrac{\sec^2 x}{\left(1+\tan x\right)^2} dx$.   **CO2**

Or

B) Evaluate $\int\limits_{0}^{\frac{\pi}{2}} \log \left(1 + \tan \theta\right) d\theta$.   **CO2**

14. A) Find the area bounded between the curves $y = x^2$ and the line $y = 3x + 4$.   **CO3**

           Or

    B) Find the R.M.S value of $\sqrt{\log x}$ between the lines $x = e$ to $x = e^2$ **CO2**

15. A) Find the volume of right circular cone using integration.   **CO2**

           Or

    B) Find the approximate value of π from $\int\limits_0^1 \dfrac{1}{1+x^2}\, dx$ using Trapezoidal rule by dividing

$[0,1]$ into 5 equal sub-intervals.   **CO2**

PART-C

Answer the following question. Question carries TEN marks.   **1x10=10M**

16.   Solve $xy^2 dy - \left(x^3 + y^3\right) dx = 0$ **CO3**

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Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-302	Electrical Technology	4	60	20	80

S.No.	Chapter/unit title	No. of periods	CO's Mapped
1.	D.C & A.C Circuits	15	**CO1**
2.	Electromagnetism and Electromagnetic Induction	10	**CO2**
3.	D.C & A.C Machines	20	**CO2**
4.	Electrical Measuring Instrument	05	**CO3**
5.	Understand the different equipments & safety procedures used in industry.	05	**CO4**
6.	Electronic Devices	05	**CO5**
	Total periods	**60**	

Course objectives

Course objectives	(i)	To know DC and AC circuits, electromagnetism and electromagnetic induction
	(ii)	To understand classification, application, construction and working principles of AC and DC machines
	(iii)	To understand different components, safety precautions in industries and working of electronic devices

Course Outcomes

Course Outcomes	CO1	Illustrate with example various terminology of electrical circuits and calculate different types of power quantities
	CO2	Analyse the principles of operations required for working of DC and AC machines
	CO3	Recognize different types of measuring instruments.
	CO4	Describe different methods and applications of heating, welding and safety procedures and devices.
	CO5	Explain about semiconductors and various semiconductor devices

Learning Outcome

Chapter-1

1.1   Understand the concepts of Current, Electric potential, potential difference, Resistance, Conductance, Specific resistance and conductivity.

1.2   Laws of resistance & Statement of Ohms Law.

1.3   Calculation of current, Voltage and Resistance in a given dc circuit.

1.4   Calculation of equivalent resistance in a – Series Circuit, parallel Circuit.

1.5   Simple problems on Series, Parallel Circuits.

1.6   State and explain Kirchhoff's of Laws.

1.7   Define the following terms related to alternating quantities.
i) Alternating quantity, ii) wave form iii) Cycle iv) Time period v) frequency vi) instantaneous value vii) RMS value viii) average value ix)form factor x) peak factor.

1.8   Express instantaneous value , RMS value and average value in terms of maximum value.

1.9   Explain phase and phase difference between two alternating quantities.

1.10   State leading and lagging vector quantities.

1.11   State phase relationships between voltage and current in (a) R (b) L (c) C (d) R – L – C in series.

1.12   Define Power factor .

1.13   State equation for i) Active power ii) reactive power iii) apparent power in single phase AC circuits.

1.14   Explain Star and Delta connections in 3 - Φ circuits.

1.15   State phase and line voltages and currents and their relationship in Star and Delta connections.

1.16   State expression for i) Active power ii) reactive power iii) apparent power in 3- phase AC circuits.

1.17   Simple problems on the above.

Chapter-2

2.1   Explain the terms – permeability, magnetic field strength, flux and Flux density – Relation between permeability, flux density and magnetic field strength.

2.2   Express the field strength due to i) straight current carrying conductor ii) on the axis of a solenoid.

2.3   State the following terms related to electromagnetic induction
i.   Faraday's laws of electromagnetic induction
ii.   Fleming's Left Hand Rule
iii.   Statically Induced emf
iv.   Dynamically Induced emf
v.   Self inducedemf
vi.   Mutually Induced emf
vii.   Lenz's Law.

2.4   Give the expression for self inductance, Mutual Inductance and Coefficient of coupling. (No derivation).

2.5   Simple problems on above.

Chapter-3

3.1   List the parts and function of each part of the D.C. Machine.

3.2   Classify the D.C. Machines as D.C. Generators and D.C. Motors – State their working principle.

3.3   State generated emf equation. (No derivation).

3.4   State and explain Back emf. (No derivation).

3.5   State torque equation. (No derivation).

3.6   Solve simple problems on above.

3.7   Explain the necessity of starter and explain 3 point starter with neat diagram.

3.8   Explain speed control of D.C. Shunt motor by armature control and (b) Field control methods.

3.9   State the applications of D.C. Generators and D.C. Motors

3.10   Explain the principle of working of a transformer.

3.11   Classify the types of transformers basing on construction of the transformers. (Core type and shell type).

3.12   State emf equation of a transformer. Solve simple problems. (No derivation).

3.13   State step – up and step – down transformers.

3.14   Explain Auto transformers.

3.15   Classify the three phase induction motors and single phase Induction motors – state the application of each motor.

3.16   Explain the construction and working principles of 3 – phase Induction Motors

3.17   Explain the construction and working principles of 1 – phase Induction Motors

3.18   Explain the necessity of starter in 3-phase induction motor

3.19   Explain i)   DOL starter   ii) Star Delta Starter with neat diagrams.

3.20   State the applications of 1 phase and 3-phase induction motors.

Chapter-4

4.1   Explain the construction and working of moving iron and moving coil instruments.

4.2   State uses of (a) Megger (b) Multi meter and (c) Energy Meter in electrical   circuits.

4.3   Explain Thermocouple instruments for measuring temperatures.

Chapter-5

5.1   Explain the basic principles of electric Heating.

5.2   State applications of electric Heating.

5.3   Explain the basic principles of electric welding.

5.4   Classify the methods of electric welding, state applications of each method.

5.5   Describe the working of DC welding generator with neat diagram.

5.6   Describe the working of welding transformer with neat diagram.

5.7   State the function of the following i) Switch ii) Fuse iii) Circuit breaker iv) Relay
        v) Capacitor banks.

5.8   State safety precautions to be adopted for prevention of electric shock to persons working on electric equipments or live wires.

5.9   State procedures for first aid to a person came into contact with live wires.

Chapter-6

6.1   Classify the materials like conductors, insulators and semi conductors based on i) Valence electrons ii) Conductivity iii) Energy band diagrams.

6.2   Explain the P- type semiconductor and N – type semiconductor.

6.3   Explain P – N Junction diode.

6.4   State the applications of a P – N Junction diode (as a rectifier).

6.5   Explain the P– N – P and N – P – N transistors and their applications.

Course code CH-302	Course title : Electrical Technology Number of course outcomes:05				No. of periods: 60
POs	Mapped with CO No.	CO Periods addressing PO in Column 1		Level (1,2,3)	Remarks
		No	%		›40% Level 3 Highly addressed
PO1	CO1, CO3	45	75	3	
PO2	CO2, CO5	9	15	1	
PO3	CO4	6	10	1	25% to 40% Level 2 Moderately addressed
PO4					
PO5					
PO6					5 to 25% Level 1 Low addressed
PO7					‹5% Not addressed

COURSE CONTENTS

1. Concepts of Current, Electric potential, potential difference, Resistance,Conductance, Specific resistance and conductivity.Ohm's Law – simple problems on D.C.circuits – Equivalent and resistance- Parallel circuits – Kirchoff's Laws – Problems- Single Phase circuits – Definitions related to alternative quantities - Phase and phase difference – leading and lagging quanties – Phase relationships between voltage and current in R, L, C, R-L in series , R-C in series and R-L-C in series – define power factor – Solve simple A.C.circuits – expression– active power and reactive power- apparent power in single phase circuits- star and delta connections in 3-phase circuits - expression– active power and reactive power- apparent power – simple problems on above.

2. Concepts of different terms related to Electromagnetism – electromagnetic induction – expressions for field strength due to straight current carrying conductor and on the axis of solenoid - Dynamically induced emf – statically induced emf – self and mutually induced emf – self inductance and mutual inductance – Simple Problems.

3. D.C & A.C. Machines – working – construction – types of D.C.generators – types of D.C motors – Generated emf – Back emf – torque – equations – 3 – point starter – speed control – Applications of D.C Generators D.C. Motors- Single – phase– Auto transformers – Construction and working principles of 3-phase and single phase induction motors –DOL starter and Star delta starter Applications - Single – phase and Three – Phase induction motors.

4. Electrical Measuring Instruments – Construction and working of moving iron and moving coil instruments – Megger, Multimeter – Single – Phase energy meter – Thermocouple Instruments.

5. Understand the different equipments& safety procedures used in industry basic principles of electric heating and welding methods – classification of methods of electric heating and welding with their applications- D.C.welding generator- welding transformer – functions of switch, fuse, circuit breaker, Relay , Capacitor banks and Motor control centres- safety precautions to prevent shock – safety procedures for first aid against electric shock.

6. Electronic Devices – Semiconductors – P type and N type semiconductor – P – N Junction diode – PNP transistor and NPN transistors with their applications.

REFERENCES BOOKS:

1. Electrical Technology – By B.L. Theraja (Vol – I and Vol – II)
2. Fundamentals of Electrical Engineering and Electronics – By B.L. Theraja.
3. The Art and Science of utilization of electrical energy - By H. Partab.
4. Electrical Technology – By Huges
5. Electrical Technology – By V.K. Mehta

Model Blue print with weightages for Blooms category and questions for each chapter and COs mapped

S.No	Chapter/unit title	No. of periods	Weightage allocated	Marks wise Distribution of weightage				Question wise Distribution of weightage				CO'sMapped
				R	U	Ap	An	R	U	Ap	An	
1	D.C & A.C Circuits	15	**17**	3	6	8	--	1	2	1	--	CO1
2	Electromagnetism and Electromagnetic Induction	10	**11**	--	3	8	--	--	1	1	--	CO2
3	D.C & A.C Machines	20	**24**	3	3	8	10	1	1	1	1	CO2
4	Electrical Measuring Instrument	05	**11**	3	--	8	--	1	--	1	--	CO3
5	Understand the different equipments& safety procedures used in industry.	05	**11**	3	--	8	--	1	--	1	--	CO4
6	Electronic Devices	05	**6**	3	3	--	--	1	1	--	--	CO5
	Total	60	80	15	15	40	10	5	5	5	1	

Part-C question may be taken from CO2 only

C-20, CH-302
Subject Name: Electrical Technology
III semester
Syllabus split up for Unit Test

Unit test NO	Learning out comes to be covered
Unit test-I	Objectives from 1.1 to 3.5
Unit test-II	Objective from 3.6 to 6.5

State Board of Technical Education and Training,A.P
Diploma in Chemical Engineering, DCHE
Third Semester
Subject Name: ELECTRICAL TECHNOLOGY
Subject Code: CH-302

Time: 90 minutes   **Unit Test I**   **Max .Marks:40**

Part-A   **16Marks**

Instructions: (1) Answer all questions.
(2) First question carries four marks,each question of remaining carries three marks.

1 (a)Define form factor.   **CO1**

   (b)Magnetic flux density.

   (c)Applications of D.C generator.

   (d) Back EMF of D.C motor.

2. What is dynamically induced EMF.   **CO2**

3. State the laws of resistance.   **CO2**

4. List the parts of D.C machine.   **CO3**

5. State the methods of speed control of D.C shunt motor.   **CO1**

Part-B   **3X8=24Marks**

Instructions: (1) Answer all questions
(2) Each question carries eight marks
(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

6. (a) i. State and explain Kirchhoff's laws   **CO1**
    ii. State the expressions for active power,reactive power and apparent power.   **CO2**
                        (OR)
    (b) Explain star and delta connection in 3- phase circuits. Write the phase and line voltages and currents and their relationship in star and delta connection   **CO4**

7. (a) i. State the expression for field strength on the axis of a solenoid.   **CO4**
    ii. An air cored solenoid of length of 0.8mhas 800 turns and carries a current of 8A.Calculate field strength.   **CO4**
                        (OR)
    (b) Explain statically induced EMF and dynamically induced EMF.   **CO3**

8. (a) Explain the working of a 3 point starter with diagram.   **CO5**

                        (OR)

    (b) Classify the D.C generators based on the field and armature winding connections.   **CO5**

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BOARD DIPLOMA EXAMINATION
D.CHE. –III SEM EXAMINATION
CH-302 ELECTRICAL TECHNOLOGY

<u>**TIME:3 HOURS**</u>   **MAX MARKS:80**

Part - A   **10 × 3 = 30M**

Instructions: (1) Answer all questions and each question carries 3 marks

(2) Answers should be brief and straight to the point and shall

not exceed 5 simple sentences

1. State Ohm's law.   CO1
2. What is the importance of back emf?   CO2
3. State the uses of (i) Megger(ii)Multi meter (iii) Energy meter.   CO3
4. List the applications of electrical heating.   CO4
5. Define valence electrons.   CO5
6. Calculate the equivalent resistance of two parallel resistors of each 6 ohms
   and 6 ohms when they are connected in series with 7 ohms resistances.   CO1
7. Express the equations of Active Power,Reactive Power,Apparent Power   CO1
8. State Faradys law's of electromagnetic induction.   CO2
9. State the working principle of transformer.   CO2
10. Differentiate P-type and N-type semi conductor.   CO5

PART – B   **5 × 8 = 40marks**

Instructions: (1) Answer any 5 questions and each question carries 8 marks
(2) The answers should be comprehensive and the criteria
for valuation is the content but not the length of answer

11. (A)State phase and line voltages and currents and their relationships in star and delta
    connections.   CO1
                          (or)
    (B)Describe (i) Cycle (ii) time period (iii) Frequency   CO1

12. (A) Explain Statically induced e.m,f and Dynamically induced e.m.f   CO2
        (or)
    (B) Explain the speed control of DC. Shunt motor by armature control method. CO2

13. (A) Explain the construction and working of Moving Iron Instruments .   CO3
                          (or)
    (B) Explain the construction and working of Moving coil Instruments .   CO3

14. (A) Classify the methods of electric welding and give one application of each . CO4
       (or)
    (B) Explain the first aid method of to rescue a person who came into contact with live wires.   CO4

15. (A) Classify the materials as conductors,Insulators, and semi conductors based on energy bands   CO5
                              (or)
    (B) Draw the circuit symbols of PNP and NPN transistors, name the terminals and applications of transistors,   CO5

PART –C

Instructions: **Part C consists of 1 question which carries 10 marks.**

17. Analyse the speed characteristics of armature control and field control methods of DC Shunt motor .

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Course code	Course title	No. of Periods / week	Total number of periods	Marks for FA	Marks for SA
CH-303	Organic and physical chemistry	5	75	20	80

S.No.	Major topics	No. of periods	CO's mapped
1.	Chemistry of Aliphatic compounds-I	12	CO1, CO2, CO3, CO4
2.	Chemistry of Aliphatic compounds-II	20	CO1, CO2, CO3, CO4
3.	Chemistry of Aromatic compounds	09	CO1, CO2, CO3, CO4
4.	Electro Chemistry	13	CO1, CO2, CO5, CO6
5.	Chemical Equilibrium	12	CO1, CO2
6.	Thermo Chemistry	09	CO1
Total		**75**	

COURSE OBJECTIVES:
1. To familiarize with the knowledge of classification, nomenclature, isomerism, preparation and properties of organic compounds.
2. To familiarize with the knowledge of electrochemistry, chemical equilibrium and thermochemistry
3. To understand and reinforce the concept in various chemical processes for better production results.

	CO1	CH-303.1	Appraise basic concepts of thermochemistry, Electrolysis, Physical and organic chemistry,
Course outcomes	**CO2**	CH-303.2	Find the applications of aliphatic and aromatic hydrocarbons, electrochemistry
	CO3	CH-303.3	Explain the Preparation methods of aliphatic and aromatic hydrocarbons
	CO4	CH-303.4	Find the Properties of aliphatic and aromatic hydrocarbons
	CO5	CH-303.5	Solve problems in electro chemistry, thermochemistry and equilibrium

CO-PO/PSO MATRIX

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CH-303.1		2						3		
CH-303.2	3								3	
CH-303.3		2							3	
CH-303.4		3								2
CH-303.5		2							3	
AVERAGE	**3**	**2**						**3**	**3**	**2**

3=STRONGLY MAPPED
2=MODERATELY MAPPED
1=SLIGHTLY MAPPED

LEARNING OUTCOMES

1. 0   Chemistry of Aliphatic Compounds-I.

1.1   Give Introduction to organic chemistry.

1.2   Explain the unique characteristics of carbon.

1.3   Explain hybridization of carbon in organic compounds i.e,. sp^3, sp^2 and sp.

1.4   Give the classification of organic compounds.

1.5   Explain IUPAC nomenclature of organic compounds.

1.6   Explain homologous series and characteristics.

1.7   Explain isomerism: Structural isomerism and Stereo isomerism (Geometrical and optical) with examples.

1.8   Explain the preparation of Alkanes:
Preparation of Methane and Ethane by (i) De-carboxylation (ii) Wurtz reaction (Ethane only) (iii) by reduction of Alkyl Halides.

1.9   Properties of alkanes: (i) Halogenation (ii) Nitration (iii) Combustion of methane and ethane.

1.10. Explain the preparation of alkenes :
Preparation of Ethylene by: (i) Dehydration of ethyl alcohol (ii) Dehydrohalogenation of ethyl bromide (iii) Dehalogation of 1, 2 – dibromo ethane.

1.11   Explain the Properties of Ethylene: Reaction with (i) H_2, (ii) Br_2/CCl_4 (iii) Ozone
 (iv) Oxidation by $KMnO_4$.

1.12   Explain the preparation of alkynes:
Preparation of Acetylene from (i) Calcium carbide (ii) Dehydro halogenation of 1,2 di-bromo ethane (iii) Dehalogenation of 1, 1, 2, 2 –   tetra bromo ethane.

1.13   Explain the Properties of Acetylene: Reaction with (i) H_2 / Ni (ii) Br_2 / CCl_4 (iii) H_2O in presence of 30% H_2SO_4 and 1% $HgSO_4$.

1.14   List the uses of ethane, methane, ethylene and acetylene.

2.0   Chemistry of Aliphatic Compounds-II.

2.1   Explain ethyl chloride preparation from (i) Grove's process (ii) PCl_3 (iii) Ethylene and explain the properties of Ethyl Chloride - Reaction with (i) KOH (ii) KCN (iii) AgCN
(iv) Wurtz Reaction

2.2   Explain Chloroform preparation from (i) Ethyl alcohol (ii) Methane (iii) CCl_4 and
Properties of Chloroform (i)Reimer-Tiemann reaction (ii) Carbylamine or isocyanide test (iii) oxidation (iv) HNO_3

2.3   Alcohols:
Describe classification into primary, secondary and tertiary alcohols.
Distinction of primary, secondary and tertiary alcohols using Lucas reagent.
Explain the Preparation of Ethyl alcohol from
 i) Ester hydrolysis
 ii) Grignard reagent
 iii) Fermentation of molasses
Explain the Properties of Ethyl alcohol: Reaction with
   i)   Acetic acid
   ii)   Conc. H_2SO_4
   iii) Bleaching powder
   iv) PCl_3

2.4　Aldehydes:

Explain Preparation of acetaldehyde from
   i) 　Oxidation of ethyl alcohol
   ii) 　Distillation of calcium acetate and calcium formate.
   iii) 　Acetylene.

Explain Properties of Acetaldehyde
   i) 　Addition of Grignard reagent
   ii) 　Reaction with hydrazine
   iii) 　Aldol condensation
   iv) 　Silver mirror test
   iv) 　Fehling's test

Uses of acetaldehyde.

2.5　Ketones:

Explain the Preparation of acetone from
   i) 　Oxidation of Isopropyl alcohol
   ii) 　Distillation of calcium acetate
   iii) 　Propyne.

Explain Properties of acetone
   i) 　Addition of Grignard reagent
   ii) 　Reaction with hydrazine
   iii) 　Iodoform reaction
   　 Uses of acetone

2.6　Carboxylic Acids:

Explain the Preparation of Acetic acid from
   i) 　Ester hydrolysis
   ii) 　Oxidation of ethyl alcohol
   iii) 　Hydrolysis of methyl cyanide.

Explain the Properties of Acetic acid
   i) 　Reaction with sodium
   ii) 　Reaction with ethyl alcohol
   iii) 　Reaction with Cl_2 / P (Hell – Volhard – Zelinsky reaction)
   　 Uses of Acetic acid.

2.7　Ethers:

Explain the Preparation of diethyl ether
   i) 　Williamson's synthesis
   ii) 　Dehydrating of ethyl alcohol

Explain the Properties of ether
   i) 　Halogenation
   ii) 　Hydrolysis by dil. H_2SO_4
   iii) 　Action HI.
   　 Uses of ether.

2.8　Polymerization: a) Definition and types of polymerization b) Addition polymerization
   ex : Polyethene c) Condensation polymerization ex : Bakelite.

2.9　List the uses of Ethyl chloride, Ethyl alcohol, acetaldehyde, acetone, acetic acid and ether

3.0　Chemistry of Aromatic compounds.

3.1　Explain aromaticity and Huckle's rule.

3.2　Explain the nomenclature of aromatic compounds.

3.3　Explain the preparation, properties and uses of benzene.

3.4   Explain the preparation, properties and uses of nitrobenzene
3.5   Explain the preparation, properties and uses of Aniline
3.6   Explain the preparation, properties and uses of Phenol

4.0   Electro Chemistry.
4.1   Give introduction to electrochemistry.
4.2   Explain about electrolytes and non electrolytes with examples.
4.3   Define electrolytic conduction and metallic conduction
4.4   Differentiate electrolytic conduction and metallic conduction
4.5   Explain about Strong electrolytes and weak electrolytes with examples.
4.6   Explain Faraday's laws of electrolysis.
4.7   Solve simple problems based on Faraday's laws.
4.8   List applications of electrolysis.

5.0   Chemical equilibrium
5.1   Define chemical Equilibrium:
       Reversible and irreversible reactions – examples.Homogeneous and heterogeneous
       Equilibria – examples.
5.2   Explain chemical equilibrium and its characteristics.
5.3   Explain law of Mass Action
5.4   Apply law of mass action to a general reaction i.e. $mA + nB \leftrightarrow pC + qD$
5.5   Explain the effect of (i) concentration (ii) pressure (iii) temperature and (iv) catalyst
       on chemical equilibrium.
5.6   Explain Lechatelier's principle –
5.7   Apply Lechatlier's principle to (i) manufacture of NH_3 by Haber's process
       (ii) Formation of SO_3 in contact process.

6.0   Thermo chemistry.
6.1   Give Introduction to thermochemistry.
6.2   Define 1st law of thermo dynamics and know the equations for "E", "Q", "W" and "H".
6.3   Define Internal energy and Enthalpy.
6.4   Explain exothermic and Endothermic reactions with examples.
6.5   Types of heats of reactions.
         i) Heat of formation   ii) Heat of combustion
         iii) Heat of neutralization   iv) Heat of solution.

COURSE CONTENT:

1.   Introduction – Classification and nomenclature of organic compounds – Isomerism –
      Preparation, properties and uses of Alkanes, Alkenes and Alkynes
2.   Ethyl Chloride, Chloroform, Alcohols, Aldehydes, Ketones, Carboxylic acids, Ethers.
      Polymerization- Addition and Condensation polymerization
3.   Preparation, properties and uses of – Benzene, Nitro benzene, Aniline.
4.   Electrolytes, non electrolytes, Arrhenius theory- Faraday's laws of electrolysis – Problems.
5.   Chemical equilibrium – Law of mass action – Effect of concentration, pressure, temperature and
      catalyst on chemical equilibrium – Lechatelier's principle – Applications.
6.   Internal energy and Enthalpy-First law of Thermodynamics– Exothermic and Endothermic
      reactions – Different heats of reactions.

REFERENCE BOOKS:

1. Intermediate Chemistry – Vol, 1 & 2 published by Telugu Academy (or) Vikram Series.
2. Text book of Applied Science – R.V. Subba Rao published by: Book Traders, Hyderabad.
3. Text Book of Organic Chemistry – Arun Bahl & B.S. Bahl, published by S. Chand &Co, New Delhi.
4. Essentials of Physical Chemistry – Bahl & Tuli, published by S. Chand & Co, New Delhi.

BLUE PRINT

S.No.	Major Topics	No of Periods	Weightage allocated	Marks wise distribution of weightage				Question wise distribution of weightage				Cos mapped
				R	U	Ap	An	R	U	Ap	An	
1.	Chemistry of Aliphatic compounds-I	12	14	11	3			2	1			CO1, CO2, CO3, CO4
2.	Chemistry of Aliphatic compounds-II	20	21	3	8		10	1	1		1	CO1, CO2, CO3, CO4
3.	Chemistry of Aromatic compounds	09	11	3	8			1	1			CO1, CO2, CO3, CO4
4.	Electro Chemistry	13	14	3	11			1	2			CO1, CO2, CO5, CO6
5.	Chemical Equilibrium	12	14	3	11			1	2			CO1, CO2
6.	Thermo Chemistry	09	6	3	3			1	1			CO1
Total		**75**	**80**	**26**	**44**		**10**	**7**	**8**	**1**		

Course code CH-303	Course Title: ORGANIC AND PHYSICAL CHEMISTRY No of Course outcomes 06				No of periods: 75
POs	Mapped with CO No	CO periods addressing PO in Column 1		Level (1, 2, 3)	Remarks
		NO	%		
PO1	CO2	17	22	1	>40%- level 3
PO2	CO1, CO3, CO4 and CO5	58	78	3	25%-40% level 2 5-25% : level 1 <5%: not addressed

C-20, CH-303
Subject Name: Organic and Physical chemistry
III semester

SYLLABUS SPLIT UP FOR UNIT TEST

Unit test No	Learning out comes to be covered
Unit test-I	Objectives from 1.1 to 3.6
Unit test-II	Objective from 4.1 to 6.5

MODEL PAPER-1   **C-20,CH-303**

STATE BOARD OF TECHNICAL EDUCATION AND TRAINING ,A.P
DIPLOMA IN CHEMICAL ENGINEERING
III SEMESTER
Subject Name: Organic and Physical Chemistry
Subject Code: CH-303

Time: 90 minutes   **UNIT TEST I**   Max.Marks:40

Part-A   **16Marks**

Instructions: (1) Answer all questions.
         (2) First question carries four marks; each question of remaining carries three marks.

1. a) Write the chemical formula of acetic acid -----------   (CO1)
    b) Bleaching powder is a perfume or disinfectant -------------------------------   (CO1)
    c) chemical formula of sulfuric acid --------------------   (CO1)
    d) chemical formula of laughing gas is ------------   (CO1)
2. List the uses of ethane, methane, ethylene and acetylene.   (CO2)
3. List the uses of Ethyl chloride, Ethyl alcohol, acetaldehyde, acetone.   (CO2)
4. What is aromaticity and Huckle's rule?   (CO1)
5. Give the classification of organic compounds   (CO2).

Part-B   **3X8=24**

Instructions: (1) Answer all question.
         (2) Each question carries eight marks
         (3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

6. a) Explain the preparation of Methane and Ethane by (i) De-carboxylation (ii) Wurtz reaction (Ethane only) (iii) by reduction of Alkyl Halides.   (CO3)
         OR
    b) Explain the Preparation of Acetylene from (i) Calcium carbide (ii) Dehydro halogenation of
1,2 di-bromo ethane (iii) Dehalogenation of 1, 1, 2, 2 –tetra bromo ethane   (CO3)

7. a) Explain the Preparation of acetone from   (CO3)
         i) Oxidation of Isopropyl alcohol
         ii) Distillation of calcium acetate
         iii) Propyne.
         OR
    b) Explain the Properties and uses of ether by   (CO4)
         i) Halogenation
         ii) Hydrolysis by dil. H_2SO_4
    Iii) Action HI.
8. a) Explain the preparation, properties and uses of nitrobenzene.   (CO4)
         OR
    b)Explain the preparation, properties and uses of Phenol   (CO4)

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End exam Model Question paper:

Q.No	Question	Blooms category	Marks allocated	CO addressed
Part-A(30 marks)				
1.	Explain the unique characteristics of carbon	Remembering	3	CO1
2.	Explain the reaction of acetylene with H_2/Ni, andBr_2/CCl_4	Understanding	3	CO4
3.	Give the classification of alcohols, give an example to each	Understanding	3	CO1
4.	Explain about aromaticity of benzene	Remembering	3	CO1
5.	What current strength in ampere will be required to liberate 10 g of chlorine from sodium chloride solution in one hour?	Remembering	3	CO2
6.	Distinguish between strong electrolyte and weak electrolyte	Understanding	3	CO1
7.	Explain law of mass action	Understanding	3	CO1
8.	Explain reversible and irreversible reactions with examples	Remembering	3	CO1
9.	Explain first law of thermodynamics	Understanding	3	CO1
10.	Define (a)heat of formation (b) heat of combustion	Remembering	3	CO1
Part-B(40 marks)				
1	Explain the preparation of ethane by Decarboxylation and Wurtz reaction. Explain reaction of ethylene with ozone and hydrogen (or) explain two preparation methods and two properties of acetylene.	Remembering	8	CO3/CO4
2	Explain two methods of preparation and two chemical properties of acetic acid (or) (a)Explain the preparation of acetaldehyde from ethyl alcohol and acetylene.(b) explain hydrolysis of ester and methyl cyanide	understanding	8	CO3/CO4

3	Explain two preparation methods and two chemical properties of benzene (or) Explain two preparation methods and two chemical properties of nitro benzene	Understanding	8	CO3/CO4
4	Explain faradays laws of electrolysis (or) (a)Differentiate between electrolyte and non-electrolyte (b) Define about electrolytic conduction and metallic conduction (c) Write the industrial applications of electrolysis.	Understanding	8	CO1
5	Explain lechatlier's principle for Haber's process (or) Explain the effect of temperature, pressure and concentration on equilibrium	Understanding	8	CO1/CO2
Part-C(10 marks)				
6	(a)Explain silver mirror test and fehling's test (b)what happens when acetone reacts with grignard reagent and hydrazine give chemical reactions(c) write a short notes on aldol condensation	analyzing	10	CO4

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Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-304	Fluid Mechanics	6	90	20	80

S.No.	Chapter/unit title	No. of periods	CO's Mapped
1.	Introduction to Fluid flow phenomena	18	**CO1 to CO5**
2.	Basic equations of Fluid flow	16	**CO1, CO3,CO4,CO5**
3.	Flow of incompressible fluids in pipes	20	**CO1,CO4, CO5**
4.	Flow past immersed bodies	12	**CO1 to CO5**
5.	Transportation and Metering of fluids.	24	**CO1 to CO5**
Total periods		**90**	

Course objectives

Course objectives	(i) To understand the fluid flow phenomena and basic equations
	(ii) To know about the flow of incompressible fluids and flow past immersed bodies
	(iii) To know about the flow measurement
	(iv) To know about the transportation of fluids

Course Outcomes

CO No		COURSE OUTCOMES
CO1	**CH-3O4.1**	Explain concepts and definitions of various terms, laws, classifications, properties, types and examplesof fluids/fluid flow
CO2	**CH-3O4.2**	Appraise the principles of working, construction of manometers, pumps, valves, and meters in fluid flow.
CO3	**CH-3O4.3**	Illustrate applications of manometers, pumps, valves, meters etc. in fluid flow
CO4	**CH-3O4.4**	Derive equations to calculate pressure drops, flow rates, frictional losses, pump work, various heads, settling velocities etc. and solve problems related in fluid flow
CO5	**CH-3O4.5**	Draw diagrams of manometers, pumps, valves, meters, experimental setups etc. in fluid flow

CO-PO/PSO MATRIX

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CH-304.1	3							3		
CH-304.2		2		3				3	2	1
CH-304.3				3				3	2	
CH-304.4			3	3				3	2	1
CH-304.5		2		2				3	2	
Average	**3**	**2**	**3**	**3**				**3**	**2**	**1**

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

Note:

PO5: Appropriate quiz program may be conducted at intervals as decided by concerned teacher.
PO6: Seminars on applications of fluid mechanics in chemical engineering are to be planned and conducted.
PO7: Standard books must be referred in library; Latest updates in reputed national and international journals.

LEARNING OUTCOMES

1.0   Introduction to Fluid flow phenomena
1.1   Define fluid and fluid mechanics.
1.2   State and discuss types of fluids , physical properties and their units.
1.3   Explain compressible and incompressible fluids and give examples.
1.4   Explain fluid statics and static pressure and pressure measurement .
1.5   Explain the working of 'U' tube manometer , inverted 'U' tube manometer and inclined manometer.
1.6   State Newton's law of viscosity.
1.7   Explain Newtonian and non -Newtonian fluids and give examples.
1.8   Distinguish Laminar flow and turbulent flow.
1.9   Describe Reynold's experiment.
1.10   Explain the importance of Reynold's number.
1.11   Explain the flow in boundary layers ,Boundary layer separation and its effects on flow.
1.12   Solve simple problems on calculation of Reynolds number and pressure drop while using manometers.
2.0   Basic equations of Fluid flow
2.1   Know about a) mass balance b) Momentum balance.
2.2   Derive continuity equation.
2.3   State Bernoulli's theorem and write Bernoulli's equation without friction
2.4   Derive Bernoulli's theorem without friction
2.5   State the modified Bernoulli's equation for friction flow
2.6   Know about Kinetic energy correction.
2.7   Know the pump work in Bernoulli's equation.
2.8   Solve simple problems on Continuity equation and calculation of various heads using Bernoulli's equation
2.9   Solve simple problems on pump work calculation

3.0   Flow of incompressible fluids in pipes

3.1   Explain flow of incompressible fluids in pipes.

3.2   Explain velocity and shear stress distribution in pipes

3.3   Define friction factor and know the equations connecting friction factor in laminar and turbulent flow.

3.4   Explain laminar flow in pipes.

3.5   Know average velocity and kinetic energy correction factor.

3.6   State Hagen Poiseuille equation.

3.7   Simple problems on Hagen Poiseuille equation for pressure drop calculation.

3.8   Know about the relation between pressure drop and friction factor.

3.9   Know the effect of roughness and the friction factor chart.

3.10   Understand the energy loss due to (a)flow (b) pipe fittings (c) sudden expansion and (d)sudden contraction.

3.11   Know about equivalent length in pipes

3.12   Solve simple problems on friction factor in Laminar & turbulent flow and energy losses in fluid flow through pipes.

4.0   Flow past immersed bodies

4.1   Define Drag and drag coefficient.

4.2   Know about different types of drag.

4.3   Explain the relation between Drag Coefficient and Reynolds number.

4.4   Explain about Stoke's law and solve simple problems on Stoke's Law

4.5   Know about Free & Hindered settling.

4.6   Explain about Packed bed and know the equations to calculate pressure drop in packed beds.

4.7   Explain the process of fluidization and applications of fluidization.

5.0   Transportation and Metering of fluids.

5.1   Know the classification of pipes and tubes.

5.2   Know about Schedule number and gauge for pipes and tubes.

5.3   Know the various types of pipe fittings.

5.4   Explain the classification and working of valves
        (a) gate valve (b) globe valve (c) plug valve (d) check valves and (e) diaphragm valve.

5.5   Explain the classification of Flow meters (a) Head Meters (b) Area meters

5.6   Explain the principle and working of venturimeter, Orifice meter, Pitot tube and rotameter with line diagrams

5.7   Indicate the functions of pump in fluid handling.

5.8   Describe the methods of classification of pumps and differentiate positive displacement and centrifugal pumps.

5.9   Know about the following pumps.
        (i) Reciprocating Pumps (ii) Piston pump (iii) Plunger Pump (iv) Diaphragm Pump
        (v) Gear pump (vi) Screw pump

5.10   Describe with neat sketch the construction and operation of the Centrifugal pump and reciprocating piston pump.

5.11   Explain the following
        (a)Suction head (b) Discharge head (c) Total head (d) NPSH (e) Cavitation (f) Priming (g) Mechanical efficiency (h) Power required.

5.12   Know about characteristic curves of centrifugal pumps.

5.13   Know about the working of (i) Fan (ii) Blower (iii) Vacuum pump (iv) Ejectors.

5.14   Solve problems based on calculation of velocities, volumetric flow rates using venturi and orifice meters, local velocity in pitot tube, calculation of NPSH, power required by a centrifugal pump.

COURSE CONTENT:

1. **Introduction & fluid flow phenomena:** Definition of fluid– Compressible and in compressible fluids– Newtonian and Non-Newtonian fluids– Physical properties of fluids– Density, Viscosity, velocity head, pressure head and static head– Pressure concept– Manometers: U – Tube Manometer, inverted U tube manometer, Inclined manometer– Laminar flow – Turbulent flow– Reynold's experiment- Importance of Reynold's number- Flow in boundary layer- Solve problems on Reynolds number and Pressure drop in manometers, Boundary layer separation and its effects on flow.

2. **Basic equations for fluid flow:** Mass balance- Momentum balance, Continuity equation- Bernoulli's equation– Modified Bernoulli's equation for frictional flow and pump work-kinetic energy correction- Solve problems on various heads using Bernoulli's equation and pump work inBernoulli's equation

3. **Flow of incompressible fluids in pipes:** Flow of incompressible fluids-Shear stress distribution in pipes- Equation for friction factor- Laminar flow in pipes- Average velocity- Kinetic energy factor- Hagen Poiseuille equation- average velocity- Roughness- Friction factor chart- Energy loss for fluids during flow – Expansion and contraction losses in fitting-equivalent length- Solve simple problems on friction factor in Laminar & turbulent flow , Hagen Poiseuille equation and energylosses in fluidflow through pipes

4. **Flow past immersed bodies:** Drag- Types of Drag-Drag coefficient– Stokes law- Drag coefficient VsReynolds number curve- Friction in flow through beds of solids– Packed bed- void fraction- Pressure drop equations- Free settling-hindered settling-equations for terminal velocities for different particle Reynolds number ranges– Fluidization – Fluidization velocities and pressure drops-Applications of fluidization-simple problems on Stoke's law

5. **Metering and transportation of fluids:** Flow meters- Head meters, Area meters-Orifice meter, Venturi meter, Pitot tube ,Rotameter- Schedule number, gauge for pipes-Pipes and tubes – Pipe fitting and joints – Valves – Gate valve, Globe valve, Plug valve, Check valve, Diaphragm valve– Pumps-functions of a pump- Classification- Positive displacement pumps –Reciprocating pumps Piston, Plunger pumps, Diaphragm pumps, - Rotary pumps-Gear pump, screw pump– Centrifugal pumps – Suction head – Discharge head – Total developed head- NPSH– Priming – Cavitation–Characteristic curve – Equipment for gas flow- fans, blowers, Vacuum producing equipment–Ejectors– Solve simple problems on calculation of velocities, volumetric flow rates using Venturi, orifice meters and pitot tube, power required by a centrifugal pump.

 Reference books

(1) Unit operations of chemical Engg. by Warren L.Mc Cabe, Julian C.Smith and Peter Harriott, Fifth edition, Mc Graw Hill Publication.
(2) Introduction to Chemical Engg. by Walter L.Badger & Julius T.Banchero. Mc GRAW Hill Publication.
(3) Chemical engineering Series, Coulson & Richardson, Vol-1,5th edition, Butterworth & Heinmannn Publications.
(4) Unit operations –1, K.A.Ghavane, Nirali Prakashan Publications.
(5) Chemical Engineering Fluid mechanics, Ron Darby, Second edition, Revised and Expanded
(6) PERRY's Chemical Engineers hand book

C-20
FLUID MECHANICS
PO- CO – Mapping strength

PO no	Mapped with CO no	CO periods addressing PO in column I		Level (1,2 or 3)	Remarks
		No	%		
1	CO1	28	50%	3	>40% Level 3 Highly addressed
2	CO2,CO5	13	23%	1	
3	CO4	11	18%	1	
4	CO2, CO3,CO4,CO5	26	42%	3	25% to 40% Level 2 Moderately addressed
					5% to 25% Level 1 Low addressed
					<5% Not addressed

Model Blue print with weightages for Blooms category and questions for each chapter and COs mapped

S.No	Chapter/unit title	No. of periods	Weightage allocated	Marks wise Distribution of weightage				Question wise Distribution of weightage				CO'sMapped
				R	U	Ap	An	R	U	Ap	An	
1	Introduction to Fluid flow phenomena	18	14	3	3	8		1	1	1		CO1 to CO5
2	Basic equations of Fluid flow	16	14	3	3	8		1	1	1		CO1, CO3,CO4,CO5
3	Flow of incompressible fluids in pipes	20	20	6	6	8		2	2	1		CO1,CO4, CO5,
4	Flow past immersed bodies	12	11	3		8		1		1		CO1 to CO5
5	Transportation and Metering of fluids.	24	21	3	8		10	1	1		1	CO1 to CO5
	Total	90	80	18	20	32	10	6	5	4	1	

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

Unit Test	Learning outcomes to be covered
Unit Test-I	From 1.1 to 3.7
Unit Test-II	From 3.8 to 5.14

State Board of Technical Education and Training,A.P
Diploma in Chemical Engineering(DCHE)
Third Semester

Subject Name: **Fluid Mechanics**
Sub Code : **CH-304**

Time: 90 minutes	Unit Test-I	Max. Marks :40

Part A　　　　　　　　　　**16 Marks**

Instructions: (1) Answer **all** questions
　　　　　(2) First question carries **four** marks, each question of remaining carries **three** marks

1.　(a)　Solid is a fluid.(True or False)　　　　　　　　　　(CO1)
　　(b)　Reynolds number can be written as , N_{Re} =_____.　　(CO4)
　　(c)　Write the continuity equation?　　　　　　　　　(CO4)
　　(d)　write Hagen Poiseulli equation　　　　　　　　(CO4)
2.　Differentiate compressible and incompressible fluids.　　(CO1)
3.　Explain boundary layers.　　　　　　　　　　　(CO1)
4.　Write the Bernoullis equation in full form?　　　　　(CO4)
5.　A single U-tube manometer is installed across an orificemeter. The manometer fluid specific gravity is 13.6 the flowing fluid specific gravity is 1.8 . the manometer reading is 150 mm. calculate pressure difference in N/M^2?　　　　　　　(CO4)

Part-B　　　　　　　　　　**3x8=24**

Instructions: (1) Answer **all** questions
　　　　　(2) Each question carries **eight** marks
　　　　　(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

6.　Explain Newtonian and Non-newtonian fluids　　　　(CO1)
　　　　　　　　　　Or
　　Explain U-Tube manometer and inclined manometer.　　(CO1)

7.　Derive Bernoullis theorem without friction?　　　　(CO4)
　　　　　　　　　　Or
　　A pipe 250 m long and 3m height difference has 1.2m diameter at both end and 0.6 m diameter at the low end. Water is flowing at a rate of 80 litre/s. if the pressure at the high end is 70k.Pa.Find the pressure at the low end. Neglect the losses.　　(CO4)

8.　Explain velocity and shear stress distribution in pipes?　　(CO5)
　　　　　　　　　　Or
　　The liquid A is pumped at 2.5kg/s through a pipeline of diameter and 75 m length. Calculate the drop in pressure.
　　The density of the fluid=1850kg/m^3.
　　Viscosity of the fluid=25(m.Ns)/m^2

　　　　　　　　　　　　　　　　(CO4)

***

TIME :3 HOURS   **MAX.MARKS:80**

Part –A   **10x3=30**

Instructions*:* 1) Answer **all** questions.

2) Each question carries **three** marks.

3) Answer should be brief and straight to the point and shall not exceed five simple sentences.

1.   Write any three physical properties of fluids .   (CO1)
2.   State Newton's law of viscocity.   (CO1)
3.   A fluid is flowing with a velocity of 10 m/s through 5 cm diameter pipe .If the diameter is changed to 7 cm diameter, what is the new velocity in this pipe?   (CO4)
4.   Write the modified Bernoulli's equation for frictional flow.   (CO4)
5.   Write briefly about shear stress distribution in pipes.   (CO2)
6.   Write the Hagen Poiselle equation.   (CO4)
7.   Explain friction factor chart.   (CO2)
8.   Write the energy losses due to sudden expansion.   (CO1)
9.   Define Hindered settling.   (CO1)
10.   Write various pumps used in industries.   (CO2)

Part-B

Instructions*:* 1) Answer **all** questions.

2) Each question carries **eight** marks.

3) Answer should be comprehensive and the criterion for valuation is   the content but not the length of the answer.

11.   Write about U tube manometer, inclined manometer to measure pressure difference. (CO5)

Or

Explain Newtonian and Non-Newtonian fluids.   (CO1)

12.   Write Continuity equation and full form of Bernoulli's equation including pump work.   (CO4)

Or

A 15 kW pump with 80% efficiency is discharging oil of specific gravity 0.85 to a over head tank from a storage tank. The surface of the oil in the storage tank from datum line is 5 m and that in the overhead tank from datum line is 30 m. Both the tanks are open to atmosphere. If the losses in the piping system are 1.75 m of flowing fluid, calculate the volumetric flow rate of oil.   (CO4)

13.   Explain friction factor and effect of roughness.   (CO5)

Or

Water is flowing at a flow rate of 5 m^3/hr in a pipe line of 70 mm id. The viscosityof water is $8x10^{-4}$ Pa.s. Calculate the pressure drop and frictional loss over a length of 60 m of pipe line.

(CO4)

14.   Write about Drag, Drag coefficient and Stoke's law.   (CO1)

Or

Explain fluidization process and write its applications.   (CO5)

15. Explain the principle and working of venturimeter with line diagram. (CO4,CO5)

Or

Explain the construction and operation of a centrifugal pump. (CO2)

Part –C

Instructions: 1) Answer the question below. It carries 10 marks

      2) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

16. What is the flow rate in m^3/s if an orifice meter is installed in a pipe line for measurement of flow rate of water. The pressure drop across the meter is 10 cm of mercury.

Data: Diameter of orifice = 25mm

      Diameter of pipe=50mm

      Coefficient of orifice = 0.62

      Density of water = $1000kg/m^3$

      Density of mercury=$13600kg/m^3$ (CO4)

***

Course code	Course title	No.Of Periods / week	Total number of periods	Marks for FA	Marks for SA
CH-305	Mass and Energy Balance	5	75	20	80

S.NO.	Chapter/unit title	No. of periods	Cos mapped
1.	Units and Dimensions	10	CO1, CO2, CO3, CO4, CO5, CO7
2.	Basic Calculations	20	CO1, CO2, CO3, CO4, CO5, CO7
3	Material balance without Chemical Reactions	15	CO1, CO2, CO4, CO7
4.	Material balance with Chemical Reactions	10	CO1, CO3, CO4, CO5, CO7
5	Energy balance	12	CO1, CO3, CO4, CO5, CO6, CO7
6	Combustion	08	CO1, CO4, CO7
Total		**75**	

Course objectives:

1. To familiarize with the terms used in Mass and Energy Balance, Physico-Chemical relations, and Combustion.
2. To calculate Mass Balance Problems and Energy balance problems and evaluating various parameters used in chemical engineering.
3. To understand and reinforce the Physico-Chemical relation concepts in solving material and energy balance problems of chemical engineering for better production results

Course outcomes:

Course outcomes	**CO1**	CH-305.1	Examine the basic concepts of Physico-Chemical relations.
	CO2	CH-305.2	Evaluate problems related to Physico-Chemical relations, mass balances and Energy balances.
	CO3	CH-305.3	Evaluate the procedures adopted for combustion calculations.
	CO4	CH-305.4	Analyse and correlate the mass balance and energy balance solutions of chemical engineering.
	CO5	CH-305.5	Apply the mass and energy balance in the chemical industry in the design aspects.

CO-PO/PSO MATRIX:

CO NO.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CH-305.1	3							3		
CH-305.2		2	2						2	
CH-305.3	2	2							2	
CH-305.4	2	2							2	
CH-305.5	3							2	2	
Average	3	2	2					3	2	

    3=STRONGLY MAPPED
    2=MODERATELY MAPPED
   1=SLIGHTLY MAPPED

Learning outcomes

    After completion of the course, the student will be able to

1.0   Units and Dimensions:
1.1   Know about Physical Quantities
1.2   Know Fundamental and Derived quantities
1.3   Know about Unit and System of units
1.4   Know the Formula, Units in SI system and Dimensional formula of different derived quantities.
1.5   Know the conversion factors for various fundamental quantities (Mass, Length, Time and Temperature) from one system of unit to another system of units.
1.6   Know the conversion factors for the following derived quantities
     a) Force b) Newton's Law conversion factor c) Pressure from one system of unit to another system of units.
1.7   Know the conversion factors for the following derived quantities
     a) Work done b) Heat c) Power from one system of unit to another system of units.
1.8   Know the conversion factors for the following derived quantities
     a) Viscosity b) Heat capacity c) Latent heat d) Specific heatfrom one system of unit to another system of units.
1.9   Know the conversion factors for the following derived quantities
     a) Kinematic Viscosity b) Surface Tension c) Density d) Specific Volumefrom one system of unit to another system of units.
1.10   Know different dimensionless groups
1.11   Know the conversion of a equation from one system of units into another system of units.
1.12   Numerical problems on all the above topics
2.0   Basic Calculations:
     (a) Stoichiometric and composition relationships
2.1   Define Atom, Molecule, Mole, Gram–atom, Gram–molecule, Gram molar volume
2.2   Define Molarity, Normality, Molality, PPM, Weight percent, Volume percent, Mole percent, Analysis on dry basis and wet basis
2.3   Define Density and Specific gravity, different gravity scales, and relation between gravity scale and Specific gravity, and know the Variation of density and specific gravity with temperature

2.4   Numerous problems on all the above topics
(b) Behavior of ideal gases

2.5   Know about Kinetic theory of gases, Gas laws: Boyle's law, Charles law, Gay-Lussac's law, Avogadro's law, Derivation of Ideal gas equation

2.6   Know about Vander Waal's equation of state, Critical properties of substances

2.7   Ideal gas constant–Derive the value of ideal gas constant in different system of units

2.8   State and explain Dalton's law of partial pressures, Amagat's law of partial volumes for gaseous mixtures. Explain the characteristics of an Ideal gas, Differences between Ideal gas and Real gas

2.9   (i) Derive the equation volume % = mole % = pressure % for an ideal gas mixture
(ii) Know about average molecular weight of a gas mixture and the evaluation procedure

2.10   Know the evaluation procedure for the density of a gaseous mixture and numerous problems on all the above topics
(c) Vapour Pressures:

2.11   Define vapour pressure, understand the relation between vapor pressure and boiling point and Know the effect of temperature on vapor pressure and also Know the methods of evaluation of vapor pressure
(a) Antoine equation
(b) Clausius – Clapeyron equation.
(c) Vapor pressure reference substance plots - Cox chart, Duhring's lines

2.12   Ideal solutions and Non-Ideal solutions. Differences between Ideal and Non-IdealSolutions.

2.13   Define (a) Raoult's Law (b) Henry's Law for solutions and Numerous problems on all the above topics
(d) Humidity and Saturation:

2.14   Define and explain the following.
(a) Un-saturation, Saturation
(b) Humidity, Absolute humidity, Relative Humidity, Molal absolute humidity, % Saturation
(c) Dew Point and also Know about Dry and wet bulb temperature

2.15.   Numerous problems on all the above topics

3.0   Material balance without chemical reactions:

3.1   Know Unit operation and Unit Process. Give Examples

3.2   Know about representation of unit operations/unit processes by a process flow chart or a block diagram.

3.3   Know the basis for material balances

3.4   Understand the terms in the general material balance equation

3.5   Define and explain tie substance, key component and inert substance

3.6   Establish the steps to solve material balance problems

3.7   Know about Degrees of Freedom

3.8   Know about steady and un-steady state mass balance

3.9   Solve material balance problems related to Evaporation, Drying, Mixing ,Distillation, Extraction

3.10   Solve material balance problems related to Crystallization

3.11   Know about Recycle, Purge , Bypass in continuous chemical processes with examples

3.12.   Know about Blow-down streams in continuous chemical processes with examples

3.13.   Numerous problems on all the above topics

4.0   Material balance with chemical reactions:

4.1   Know about Stoichiometry, application of stoichiometry, stoichiometric equations, stoichiometric coefficients, and stoichiometric proportions .Give suitable examples

4.2   Define and explain (a) limiting component and (b) excess reactant

4.3   Understand % conversion in a chemical reaction

4.4   Understand % yield in a chemical reaction

4.5   Understand Degree of completion in a chemical reaction

4.6   Know about theoretical quantity of reactant

4.7   Know about selectivity of a chemical process

4.8   Solve problems related to oxidation of sulphur compounds

4.9   Solve problems related to recovery of metals and non-metals from ores

4.10 Solve problems related to all the above concepts

5.0   Energy balance:

5.1   Explain the terms internal energy and enthalpy

5.2   Define Heat and Work

5.3   State and explain 1st law of thermodynamics – problems related to 1st law

5.4   Derive the general energy balance equation for a steady flow process

5.5   Know the terms sensible heat, latent heat of fusion, latent heat of vaporization

5.6   Define Heat capacity and Specific heat

5.7   Explain the importance of mean heat capacity

5.8   Do the problems on heat requirement calculations, using $Q = mc_p \Delta T$ and $Q = nc_p \Delta T$

5.9   Know about exothermic, endothermic, adiabatic and isothermal reaction systems

5.10 Define and explain Heat of Formation , Heat of combustion and Heat of Reaction,

5.11 Know about Heat of Solution, Heat of Neutralization, Heat of mixing and Heat of crystallization

6.0   Combustion process:

6.1   Distinguish between Partial and Complete Combustion

6.2   Define and explain Calorific values (Gross and Net Calorific values)

6.3   Calculate the calorific value of a fuel using Dulong's Formulae

6.4   Know about net hydrogen

6.5   Solve combustion problems related to refuse analysis

6.6   Explain the proximate and ultimate analysis of coal

6.7   Know about the composition of flue gas obtained after combustion of a fuel

6.8   Calculate the air requirement for combustion of a specific fuel

6.9   Know the compositions of fuel and flue gases, and calculate the flue gas analysis using fuel analysis

6.10 Calculate the fuel analysis using flue gas analysis for complete combustion and incomplete combustion

6.11 Solve problems related to combustion

Hyponated course content with Reference books:

1.0   Units and Dimensions:

Physical Quantities-Fundamental and Derived quantities-Unit and System of units-Formula, Units in SIsystem and Dimensional formula of different derived quantities-Area, Volume, Velocity, Acceleration, Density, Specific volume, Work done-Energy-Enthalpy-Power-Heat Capacity-Humidity-Mass flow rate-Momentum-Acceleration due to gravity-Volumetric flow rate-Viscosity-Specific heat-Latent heat-Surface Tension-Kinematic viscosity- Conversion factors for various fundamental quantities-Mass, Length, Time and Temperature from one system of unit to another system of unit-Conversion factors for various derived quantities- Force, Newton's Law conversion factor, Pressure, Work done, Heat, Power, Viscosity, Heat capacity,

Latent heat, Specific heat, Kinematic Viscosity, Surface Tension, Density,Specific volume from one system of unit to another system of unit-Dimensionless groups-Reynoldsnumber, Prandtl number, Nusselt number, Grashof number, Peclet number, Mach number, Schmidtnumber, Graetz number, Lewis number, Sherwood number, Stanton number-Conversion of one system of equation into another system.

2.0 Basic Calculations:
(a) Stoichiometric and composition relationships:
Define Atom, Molecule, Mole, Gram–atom, Gram–molecule, Gram molar volume-Different methods of expressing concentration-Define Molarity, Normality, Molality, PPM, Weight percent, Volume percent, Mole percent, Analyze on dry basis and wet basis-Define Density and Specific gravity, specific gravityscales, Variation of density and specific gravity with temperature-Numerous problems on all the above topics.

(b) Behavior of ideal gases:
Kinetic theory of gases-Gas laws: Boyle's law, Charles law, Gay-Lussac's law, Avogadro's law, Derivation of Ideal gas equation-Vander Waal's equation of state, Critical properties of substances-Idealgas constant–Derive the value of ideal gas constant in different system of units-Define and explain Dalton's law of partial pressures, Amagat's law of partial volumes for gaseous mixtures-Characteristics of on Ideal gas, Differences between Ideal gas and Real gas-Derive the equation volume % = mole % =pressure % for an ideal gas mixture-Average molecular weight of a gas mixture-Density of a gaseous mixture-Numerous problems on all the above topics.

(c) Vapor Pressures:
Vapor pressure, Relation between vapor pressure and boiling point-Effect of temperature on vapour pressure-Methods of vapor pressure determination-Antoine equations, Clausius–Clapeyron equation-Vapor pressure reference substance plots-Cox chart, Duhring's lines-Ideal solutions and Non-Idealsolutions-Differences between Ideal and Non-Ideal solutions-Define (a) Raoult's Law (b) Henry's Lawfor solutions-Numerous problems on all the above topics.

(d) Humidity and Saturation:
Un-saturation, Saturation-Humidity-Absolute humidity-Relative Humidity-Molal absolute humidity-%Saturation-Dew Point-Dry and wet bulb temperature-Numerous problems on all the above topics.

3.0 Material balance without chemical reactions:
Unit operation and Unit Process-Give examples for unit operation and unit processes-Representation ofunit operations/unit processes by a process flow chart or a block diagram-Basis for material balances-Terms in the general material balance equation-Tie substance, key component and inert substance-Stepsto solve material balance problems-Degrees of Freedom-Steady and un-steady state mass balance-Material balance problems related to Evaporation-Material balance problems related to Drying-Materialbalance problems related to Mixing-Material balance problems related to Distillation-Material balanceproblems related to Extraction-Material balance problems related to Crystallization-Bypass in
continuous chemical processes with examples-Recycle in continuous chemical processes with examples-Purge streams in continuous chemical processes with examples-Blowdown streams in continuouschemical processes with examples-Numerous problems on all the above topics.

4.0 Material balance with Chemical Reactions:
Stoichiometry, application of stoichiometry, stoichiometric equations, stoichiometric coefficients, andstoichiometric proportions-Limiting component-Excess reactant- % conversion in a chemical reactionsystem-% yield in a chemical reaction system-Degree of completion in a chemical reaction system-Theoretical quantity of reactant-Selectivity of a chemical process-

Oxidation of sulphur compounds-Recovery of metals and non-metals from ores-Problems related to all the above concepts.

5.0 Energy Balance:

Internal energy and enthalpy-Heat and Work-1st law of thermodynamics-Problems related to 1st law-General energy balance equation for a steady flow process-Sensible heat, Latent heat of Fusion, Latentheat of vaporization-Heat capacity and Specific heat-Importance of mean heat capacity-Problems onheat requirement calculations using $Q = mc_p \Delta T$ and $Q = nc_p \Delta T$- Exothermic, Endothermic, Adiabaticand Isothermal reaction systems-Heat of Reaction, Heat of Formation and Heat of combustion-Heat ofSolution, Heat of Neutralization, Heat of mixing and Heat of crystallization.

6.0 Combustion process:

Distinguish between Partial and Complete Combustion-Calorific values (Gross and Net Calorificvalues)-Calorific value of a fuel using Dulong's Formulae-Net hydrogen-Combustion problems relatedto refuse analysis-Proximate and ultimate analysis of coal-Composition of flue gas obtained aftercombustion of a fuel-Air requirement for combustion of a specific fuel- Compositions of fuel and fluegases, and calculate the flue gas analysis using fuel analysis-Fuel analysis using flue gas analysis forcomplete combustion and incomplete combustion-Problems related to combustion.

REFERENCE BOOKS:

S.No.	Book Title	Author	Publications
1	Chemical Process Principles	1. Olaf A. Hougen 2. Kenneth M.Watson 3. Ronald A.Ragatz	Asia Publishing House
2	Basic Principles and calculations in Chemical Engineering	1. David M.Himmel Bleau	
3	Introduction to Stoichiometry (SI units)	1. K.A.Gavhane	Nirali Prakashan
4	Stoichiometry and Process Calculations	1. K.V.Narayanan 2. B.Lakshmikutty	Prentice Hall of India Pvt Limited, New Delhi
5	Stoichiometry (SI Units)	1. B.I.Bhatt 2. S.M.Vora	Tata McGraw-Hill Publishing company Limited, New Delhi
6.	Process Calculations	1. V.Venkataramani 2. N.Anantharaman	Prentice Hall of India Pvt Limited, New Delhi
7.	Process calculations for Chemical Engineers	1. Ch.Durga Prasada Rao 2. D.V.S.Murthy	MACMillan India Limited

S.No.	Major Topics	No of Periods	Weightage allocated	Marks wise distribution of weightage				Question wise distribution of weightage				COS mapped
				R	U	Ap	An	R	U	Ap	An	
1.	Units and Dimensions	10	11	3		8		1		1		CO1, CO2
2.	Basic Calculations	20	24	6	8		10	2	1		1	CO1, CO2
3.	Material balance without Chemical Reactions	15	11	3	8			1	1			CO2, CO4, CO5
4.	Material balance with Chemical Reactions	10	17	9	8			3	1			CO2, CO4, CO5
5.	Energy balance	12	11	3	8			1	1			CO2, CO4, CO5
6.	Combustion	08	6	3	3			1	1			CO3
Total		75	80	27	35	8	10	9	5	1	1	

Course code CH-305	Course Title: Mass and Energy Balance No of Course outcomes 07				No of periods: 75	
POs	Mapped with CO No	CO periods addressing PO in Column 1		Level (1, 2, 3)	Remarks	
		NO	%			
PO1	CO1, CO3, CO4, CO5	30	40	2	>40%- level 3	
PO2	CO2, CO3, CO4	29	39	2	25%-40% level 2	
PO3	CO2	16	21	1	5-25% : level 1	
PO4					<5%: not addressed	
PO5						
PO6						
PO7						

C-20, CH-305
Subject Name: Mass and Energy Balance
Syllabus split up for Unit Test

Unit test NO	Learning out comes to be covered
Unit test-I	Objectives from 1.1 to 3.13
Unit test-II	Objectives from 4.1 to 6.11

Model paper
State Board of Technical Education and Training, A.P
Diploma in Chemical Engineering DCHE
Subject Name: MASS AND ENERGY BALANCE
SUBJECT CODE: CH-305
Unit Test-1

Time : 90minutes   Max Marks: 40

                                        PART-A   **16** Marks
Instructions: (1)Answer all questions 2X3=6 Marks
                    (2) First question carries 4marks and rest of the questions carries 3marks

1. (a) write the dimensional formulae for force ---   ----   **(CO1)**
    (b)14.7psi = ------------Pa   **(CO2)**
    (c) Units of viscosity in SI system are -----------------------   **(CO1)**
    (d) Name one dimensionless quantity -------------   **(CO1)**
2. Convert 1 BTU/ft^2-hr-^oF into SI units.   **(CO2)**
3. State and explain Raoult's law.   **(CO1)**
4. Find the quantity of H_2SO_4 required to prepare 500ml of 0.1N sulphuric acid solution
                                                                                 (CO2)
5. Explain the terms (a) recycle (b) bypass.   **(CO5)**

                                        PART-B   **8X3=24 Marks**
 Instructions:(1) Answer all questions
                    (2) Each question carries eight marks
                    (3) Answer should be comprehensive and the criterion for valuation is the
content but not the length of the answer

6. (a) A gas mixture has the following composition by volume: Ethylene 30.6%; Benzene 24.5%; Oxygen 1.3%; Methane 15.5%; Ethane 25.0%; Nitrogen 3.1%. Find (i) The average molar mass of the gas mixture,
    (ii)   The composition by mass and
    (iii)   The density of the gas mixture in Kg/m^3 at NTP.   **(CO2)**
            (or)
    (b) A solution of potassium chloride in water contains 384 g KCl per litre of the solution
        at 300K. The specific gravity of the solution is 1.6. Determine the following:
    (i) The concentration in weight percent
        (ii) The mole fraction of KCl
        (iii) The molarity of the solution (d) the molality of the solution.   **(CO2)**

7. (a) the solubility of sodium chloride in water at 290K is 35.8 kg/100kg of water. Express the solubility as the following (i) mass percent of NaCl (ii) mole percent of NaCl (iii) kmol of NaCl per 1000kg of Water   **(CO2)**
            (or)
    (b) Explain various methods to express concentration.   **(CO1)**

8. (a) It is required to make 1000 Kg mixed acid containing 60% H_2SO_4, 32% HNO_3 and 8% water by blending (a) the spent acid containing 11.3% HNO_3, 44.4% H_2SO_4 and 44.3% H_2O (b)aqueous 90% HNO_3, and (c) aqueous 98% H_2SO_4. (All percentages are by mass). Calculate the quantities of each of the three acids required for blending. **(CO2)**

(or)

(b) 10000 Kg/h of a solution containing 20% methanol is continuously fed to distillation column. Distillate (product) is found to contain 98% methanol and waste solution from the column carries 1% methanol. All percentages are by weight. Calculate
(i) the mass flow rates of distillate and bottom product and (ii) the percent loss of methyl alcohol. **(CO2)**

End exam Model question paper

Q.No	Question	Blooms category	Marks allocated	CO addressed
	Part-A(30 marks)			
1.	Convert the following in to SI units? (a) 212 o F (b) 2 Btu/lb-mole	remembering	3	CO2
2.	Define the following terms: (a) Vapour pressure and (b) humidity	Remembering	3	CO1
3.	Write down the standard state condition in SI System?	Remembering	3	CO1
4.	Write briefly about the following items : (a) Ideal solution (b) ideal gas	Remembering	3	CO1
5.	Write short notes on the following : (a) Recycle (b) purge	Remembering	3	CO5
6.	Define the following items? (a) % conversion (b) % excess	Remembering	3	CO4
7.	An alcohol whose molecular weight is 74 analyzes as C =64.87 %, H= 13.51 %, 21.62 % .What is its chemical formula?	Remembering	3	CO1, CO2
8.	What do you know about partial combustion and complete combustion?	Remembering	3	CO3
9.	Define the following terms : (a) Std.heat of reaction (b) Std. Heat of solution	Understanding	3	CO4, CO5
10.	Calculate the heat required to heat the water of mass 3.0kg from 298 (k) to 373 (k) ? Data: heat capacity of water = 4.1868 kj/kg (k)	Remembering	3	CO4, CO5
	Part-B(40 marks)			

11	The atmospheric air has the following composition by volume: N2=79%, O2=21 %. Then calculate (a) the average molecular weight of the air and (b) the weight % composition of the air, (c) density of the air at STP ? (or) A wet flue gas mixture has the following composition by Volume: CO2 =10.6 %, Oxygen=2.4%, nitrogen=84 % ,and H2O=3% Then Calculate the density of the flue gas at 50oC and 1.2 atmg. ?	understanding	8	CO1, CO2
12	. An aq. Solution of Na2CO3 is prepared by dissolving 20 g Na2CO3 in 100 g water at 20oC . The density of the solution is measured to be 1090 Kg/m3. find the molarity, Normality and weight% Na2CO3 of the solution? (or) An aq. Solution of Na2CO3 is prepared by dissolving 106 g Na2CO3 in 100 g water at 20oC . The density of the solution is measured to be 1100Kg/m3. Find the Molarity, Normality and molality of the solution?	understanding	8	CO1, CO2
13	It is required to make a mixed acid containing 50 % H2SO4 , 42 % HNO3 , and 8 % water by blending (a) 200 kg the spent acid containing 19.3 % HNO3, 40.4 % H2SO4 , and 40.3 % water (b) aq. 85 % HNO3 and (c) aq. 98 % H2SO4 . All the Percentages are by weight. Calculate(a) the quantities of nitric acid and sulphuric acids to be added to spent acid and(b)the quantity of mixed acid produced ? (or) It is required to make 2000kg of mixed acid containing 48 % H2SO4, 42 % HNO3, and 10 % water by blending (a) the spent acid containing 19.3 % HNO3, 40.4 % H2SO4 and 40.3 % water (b) aq. 70 % HNO3 and (c) aq. 90 % H2SO4. All the Percentages are by weight. Calculate the quantities of each of the three acids to be mixed.	understanding	8	CO2, CO4, CO5 CO4, CO5
14	Calculate the Total pressure , and composition of vapours in contact with a Solution at 100oC containing 30 %benzene , 47% toluene , and 23% ortho- xylene by weight .	application	8	CO1, CO2

	Data : vapour pressure of benzene at 100oC =1340 mmHg
	  vapour pressure of toluene at 100oC =560 mmHg
	  vapour pressure of ortho-xylene at 100oC =210 mmHg
	(or)
	A wet paper pulp is found to contain 75% water. After drying, it is found that 65 %
	of the original water has been removed . Calculate the following:
	 (a) The composition of the dried pulp
	 (b) The mass of water removed per kilogram of wet pulp
				CO4, CO5

15	In the Deacon process for the manufacture of chlorine, hydrochloric acid gas is Oxidised with air. The reaction taking place is: 4HCl +O2 → 2Cl2 + 2H2O If the air is used in excess of 20 % of that theoretically required, and if the oxidation is 80% complete , calculate the composition by weight of gases leaving the reaction chamber (Or) In the Deacon process for the manufacture of chlorine, hydrochloric acid gas is Oxidisedwith air. The reaction taking place is: 4HCl +O2 → 2Cl2 + 2H2O If the air is used in excess of 20 % of that theoretically required, and if the oxidation is 80% complete , calculate the composition by weight of dry gases leaving the Reaction chamber?	understanding	8	CO4, CO5
Part-C(10 marks)				
16	a)What is the effect of temperature on vapour pressure? b)What is Antonie equation and define the terms in it. c)What is Clasius-Clapeyron equation and elaborate the terms in it.	analysing	10	CO1, CO2

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-306	CAD practice in Chemical Engineering	3	45	40	60

Course Objectives	(i) To familiarize with the knowledge different materials tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant experiments/exercises

CO No		COURSE OUTCOMES
C01	CH-306.1	Demonstrate the skill of planning and organizing experimental set up for a desired purpose
C02	CH-306.2	Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems
C03	CH-306.3	Observe various parameters, their variations and graphically represent the same
C04	CH-306.4	Analyse the experimental results to draw inferences to make recommendations
C05	CH-306.5	Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

LEARNING OUTCOMES

1. Introduction to CAD and its applications
   a. Features of CAD
   b. Starting and exiting
   c. Drawing screen creation , saving and opening a drawing
   d. Using pull down menu
   e. Key board input
   f. Setting of units and limits of a drawing
2. Drawing commands
   a. Understanding the coordinate systems- Absolute coordinates, relative coordinates, polar coordinates
   b. Creation of lines, arcs, rectangle, polygon, ellipse, donut, polylines and text.
   c. Selecting objects, erasing, undo, redo, oops
3. Modifying commands
   a. Copy, mirror, offset, array, move, rotate, scale, stretch, lengthen, trim, extend, break, chamfer, fillet, explode, editing text, hatching
4. Dimensioning
a. Dimensioning commands, setting dimensioning style, linear dimensions, aligned, ordinate, radius, diameter, angular, editing a dimension, align text.

5. Three dimensional modeling

      a.   Viewing in three dimensions

      b.   Types of three dimensional modelling i.e,wire frame models, surface models and solid models

      c.   Editing of solids i.e, joining and substracting of solids.

6. Plotting of an CAD drawing using printer
7. Drawing of symbols for pumps and compressors.
8. Drawing of symbols for vertical and horizontal boiler
9. Drawing of symbols for pipe lines.
10. Flow sheet symbols
      a.   Reducer, venturimeter, orifice meter, rotameter, sight flow indicator, pitot tube, burner , air trap bucket trap, vacuum trap, flat trap, separator, ejector
11. Draw the 2D drawings; Knuckle joint, screw jack.
12. Draw the following chemical equipments using CAD
    a) Double pipe heat exchanger   b) Mixer
13. Drawing of symbols for agitator, absorbers, fractionating column
14. Basic instrument symbols
    a. Basic symbols for instrument with single service and function
    b. For combination to instrument or device with two services or functions for transmitters and for diaphragm valves
15. Draw the plant layout using CAD
    a. Sugar Industry
    b. Cement Industry

Note: Licensed software module is to be used to reduce copyright issues.

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-307	Electrical Technology Lab	3	45	40	60

Course Objectives	(i) To familiarize with the knowledge different materials tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant experiments/exercises	
Course Outcomes	CH-307.1	Demonstrate the skill of planning and organizing experimental set up for a desired purpose
	CH-307.2	Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems
	CH-307.3	Observe various parameters, their variations and graphically represent the same
	CH-307.4	Analyse the experimental results to draw inferences to make recommendations
	CH-307.5	Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

List of experiments in Electrical Technology Lab.

1. Verification of ohms Law and Determination of the resistance of the given resistor.
2. Measurement of power in D.C. Circuit consisting of resistance in a) Series b) parallel c) Series and parallel combination.
3. Calibrate the given 1-phase energy meter (know how to connect the energy meter in a given circuit)
4. Study of starters a) 3-point starters b) D.O.L starters and c) star/Delta starters.
5. Obtain the speed control of D C Shunt Motor by Field control method.
6. Obtain the speed control of D C Shunt Motor by Armature control Method.
7. Measure the line voltage and phase voltage, line current and phase current in a given a) star connected load and b) Delta connected load.
8. Conduct the Load test on Single phase Capacitor type Induction Motor.
9. Measure the primary and secondary voltages of step-up Transformers and step down transformer
10. Single –phase circuit wiring (single-lamp controlled by a single-way switch) Single lamp controlled by two-way switch.

Note:
- Safety precautions to be taken while conducting the practical which are to be displayed in the Electrical Laboratory.
- Earthing to the equipment is to be done.

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-308	Organic &physical chemistry lab	6	90	40	60

S. No.	Major Topics	No. of periods
1.	Determination of Melting point of Solid Organic compounds. Determination of Boiling points of liquid organic compounds	10
2.	Detection of Elements	20
3.	Reactions of Functional groups	20
4.	Systematic identification of functional groups in an Organic Compound	20
5.	Preparation of Organic Compounds.	20
	Total	**90**

Course Objectives	(i) To familiarize with the knowledge different materials tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant experiments/exercises	
Course Outcomes	CH-308.1	Demonstrate the skill of planning and organizing experimental set up for a desired purpose
	CH-308.2	Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems
	CH-308.3	Observe various parameters, their variations and graphically represent the same
	CH-308.4	Analyse the experimental results to draw inferences to make recommendations
	CH-308.5	Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

Learning outcome
List of experiments in Organic and Physical Chemistry Lab.

1.0   Conduct
1.1   Determination of Melting Point of solid Organic Compounds.
1.2   Determination of Boiling Point of liquid organic Compounds.
2.0   Know detection of following elements present in organic compounds.
2.1   Carbon
2.2   Hydrogen
2.3   Oxygen
2.4   Nitrogen
2.5   Sulphur
2.6   Halogens.

3.0   Know Reactions of functional groups present in organic compounds.

3.1   Alcohols

3.2   Acids

3.3   Aldehydes

3.4   Ketones

3.5   Amines

3.6   Amides

3.7   Esters.

4.0   Understand Systematic identification of the functional groups in Organic compounds.

5.0   Understand Preparation of following Organic Compounds

5.1   Preparation of Acetanilide.

5.2   Preparation of Bromoacetanilide.

5.3   Preparation of Nitro Benzene.

5.4   Preparation of Azodye.

5.5   Preparation of Aspirin.

COURSE CONTENT:

1.   Determination of Melting Points and Boiling Point of Organic Compounds.
2.   Detection of elements Carbon – Hydrogen – Oxygen – Nitrogen – Sulphur – Halogens.
3.   Reactions of functional groups – OH, -COOH, -CHO, -CO-R, -NH$_2$, -CONH$_2$, -COOR.
4.   Identification of functional groups in an Organic Compound.
5.   Preparation of organic Compounds – Acetanilide – Bromoacetanilide – Nitro Benzene – Azodye – Aspirin.

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-309	Fluid Mechanics Lab	6	90	40	60

Course Objectives	(i) To familiarize with the knowledge different materials, tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant experiments/exercises in fluid flow.	
Course Outcomes	CH-309.1	Demonstrate the skill of planning and organizing experimental set up for a desired purpose
	CH-309.2	Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems
	CH-309.3	Observe various parameters, their variations and graphically represent the same
	CH-309.4	Analyse the experimental results to draw inferences to make recommendations
	CH-309.5	Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

List of Experiments:

1. Calibration of given Rotameter and to draw calibration curve(Rotameter reading Vs Actual discharge)
2. Identification of laminar & turbulent flow using Reynold's apparatus.
3. Conduct an experiment on Bernoulli's apparatus to verify Bernoulli's theorem.
4. Conduct an experiment on Orifice meter and determine the coefficient of discharge.
5. Conduct an experiment on Venturimeter and determine the coefficient of discharge.
6. Determination of friction factor in various pipes.
7. Determination of frictional losses in various pipe fittings.
8. Determination of Pressure drops in a packed bed for different fluid velocities.
9. Determination of characteristics of a Centrifugal Pump to draw the curves.
10. Determinations of characteristics of a Reciprocating pump to draw the curves.

IV SEMESTER

DIPLOMA IN CHEMICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
C-20, IV Semester (SECOND YEAR)

Subject Code	Name of the Subject	Instruction period / week		Total Period / year	Scheme of Examination			
		Theory	Practical/Tu torial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
CH- 401	Engineering Mathematics-III	3	--	45	3	20	80	100
CH-402	Mechanical Unit Operations	4	--	60	3	20	80	100
CH-403	Inorganic Chemical Technology	4	--	60	3	20	80	100
CH-404	Organic Chemical Technology	4	--	60	3	20	80	100
CH-405	Heat Transfer	4	--	60	3	20	80	100
CH-406	Mass Transfer	5	--	75	3	20	80	100
PRACTICAL								
CH-407	Chemical Technology Lab	--	6	90	3	40	60	100
CH-408	Communication skills	--	3	45	3	40	60	100
CH-409	Mechanical Unit Operations Lab	--	3	45	3	40	60	100
CH-410	Heat transfer Lab	--	3	45	3	40	60	100
CH-411	Mass transfer Lab	--	3	45	3	40	60	100
TOTAL		24	18	630		320	780	1100

ENGINEERING MATHEMATICS-III

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

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

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

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

ENGINEERING MATHEMATICS – III
Learning Outcomes
Unit-I
Differential Equations of higher order

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

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

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

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

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

Unit-II
Laplace Transforms

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

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

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

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

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

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

> Syllabus for Unit test-I completed

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

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

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

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

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

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

Unit-III
Fourier series

C.O. 3 Expand given functions as Fourier series and half- range Fourier Sine and Cosine series

L.O. 3.1 Define the orthogonality of functions in an interval.

3.2 Define Fourier series of a function in the intervals $(c, c+2\pi)$ and $(c, c+2l)$ and write the Euler's formulae for determining the Fourier coefficients.

3.3 Write sufficient conditions for the existence of Fourier series expansion of a function.

3.4 Find Fourier series of simple functions in the range (0 , 2π) and (-π , π)

3.5 Write Fourier series for even and odd functions in the interval $(-\pi, \pi)$ and $(-l, l)$ expandsimple functions.

3.6 Write Fourier series expansion of a function over the interval (0, 2l) and $(-l, l)$ and expand simple functions.

3.7 Write half-range Fourier sine and cosine series of a function over the interval (0, π) and $(0, l)$ and expand simple functions.

> Syllabus for Unit test-II completed

Engineering Mathematics – III
CO/PO - Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	1				2	3	2
CO2	3	3	3	3				3	3	3
CO3	3	3	3	3				3	3	3
Avg	3	2.66	2.33	2.33				2.66	3	2.66

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

Note:

PO5: Appropriate quiz programme may be conducted at intervals and duration as decided by concerned teacher.

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

PO7: Such activities are to be planned that students visit library to refer standard books on Mathematics and latest updates in reputed national and international journals, attending seminars, learning mathematical software tools.

PSO1: An ability to understand the concepts of basic mathematical concepts and to apply them in various areas like computer programming, civil constructions, fluid dynamics, electrical and electronic systems and all concerned engineering disciplines.

PSO2: An ability to solve the Engineering problems using latest software tool, along with analytical skills to arrive at faster and appropriate solutions.

PSO3: Wisdom of social and environmental awareness along with ethical responsibility to have a successful career as an engineer and to sustain passion and zeal for real world technological applications.

PO no	Mapped with CO no	CO periods addressing PO in column I		Level (1,2 or 3)	Remarks
		No	**%**		
1	CO1, CO2, CO3	45	100%	3	
2	CO1, CO2, CO3	37	82.2%	3	>40% Level 3 Highly addressed
3	CO1, CO2, CO3	32	71.1%	3	
4	CO1, CO2, CO3	32	71.1%	3	
5					25% to 40% Level 2 Moderately addressed
6					
7					
PSO 1	CO1, CO2, CO3	37	82.2%	3	
PSO 2	CO1, CO2, CO3	45	100%	3	
PSO 3	CO1, CO2, CO3	36	80%	3	5% to 25% Level 1 Low addressed <5% Not addressed

ENGINEERING MATHEMATICS – III
(Common Subject)
Course Content

Unit I: Differential Equations of higher order
1. Solve Homogenous linear differential equations with constant coefficients of order two and higher with emphasis on second order.
2. Solve Non-homogenous linear differential equations with constant coefficients of the form f(D) y = X where X is in the form k(constant), e^{ax}, sinax, cosax, x^n, where n is a positive integer, finding complimentary function, particular integral and general solution.

Unit II: Laplace Transforms
3. Definition, sufficient conditions for existence of LT, LT of elementary functions, linearity property, state first shifting theorem, change of scale property, multiplication by t^n, division by t, LT of derivatives and integrals, LT of unit step function, state second shifting theorem, inverse Laplace transforms- state shifting theorems and change of scale property, multiplication by s^n and division by s, derivatives, integrals, examples of inverse LT using partial fractions, state convolution theorem with simple examples.

Unit III: Fourier series
4. Orthogonality of trigonometric functions, Representation of a function in Fourier series over the interval $\left(c\ ,\ c+2\pi\right)$ and $\left(c\ ,\ c+2l\right)$, Euler's formulae , sufficient conditions for existence of Fourier series expansion of a function, Fourier series expansion of basic functions limited to k(constant), $x, x^2, \sin ax, \cos ax, e^{ax}$ and their combinations over the

intervals $(0, 2\pi), (-\pi, \pi), (0, 2l), (-l, l)$, Fourier series for even and odd functions over $(-\pi, \pi)$ and $(-l, l)$, Fourier half-range sine and cosine series over $(0, \pi)$ and $(0, l)$

Textbook:

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

Reference Books:

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers
2. M.R. Spiegel, Schaum's Outline of Laplace Transforms, Schaums' Series
3. M.Vygodsky, Mathematical Handbook: Higher Mathematics, Mir Publishers, Moscow.

Blue print

S. No	Chapter/ Unit title	No of Periods	Weightage allotted	Marks wise distribution of weightage				Question wise distribution of weightage				COs mapped
				R	U	Ap	An	R	U	Ap	An	
1	Unit – I Higher order Linear Differential equations with constant coefficients	15	28	11	11	3	3	2	2	1	1	CO1
2	Unit - II Laplace Transforms	18	33	11	11	11	0	2	2	2	0	CO2
3	Unit - III Fourier Series	12	19	3	3	3	10	1	1	1	1	CO3
	Total	45	80	25	25	17	13	5	5	4	2	

R: Remembering Type   : 25 Marks
U: understanding Type   : 25 Marks
Ap: Application Type   : 17 Marks
An: Analysing Type   : 13 Marks

C-20
Engineering Mathematics – III
Unit Test Syllabus

Unit Test	Learning Outcomes to be Covered
Unit Test-I	From LO 1.1 to 2.5
Unit Test-II	From LO 2.6 to 3.7

State Board of Technical Education and Training, A. P
First Year
Subject name: Engineering Mathematics-III
Sub Code: CH-401

Time : 90 minutes   Max.Marks:40

Part-A   **16Marks**

Instructions: **(1) Answer all questions.**
                  (2) First question carries four marks and the remaining questions carry three marks each

1.   Answer the following:

   a.   Write the auxiliary equation for given differential equation $(D^2 + 4) y = 0$ (CO1)

   b.   For given differential equation $f(D) y = 0$, if roots of auxiliary equation are 1,-1,then $y =$ _____   (CO1)

   c. $L\{e^{3t}\} =$ _____   (CO2)

   d. $L\{f(t)\} = \overline{f}(s)$ then $L\{e^{at} f(t)\} = \overline{f}(s+a)$: State TRUE/FALSE   (CO2)

2.   Solve $(D^2 - 2D + 1) y = 0$.   (CO1)

3.   Find the particular integral of $(D^2 + D + 4) y = e^x$ (CO1)

4.   Evaluate $L\{(t-1)^2\}$ (CO2)

5.   Evaluate $L\{t^2 + 2\cos t + 3\sin t\}$ (CO2)

Part-B   **3×8=24**

Instructions*:*   (1) Answer **all questions   (2) Each question carries **eight** marks
                    (3) Answer should be comprehensive and the criterion for valuation
                        is the content but not the length of the answer.

6.   A) Solve $(D^4 - 5D^2 + 4) y = 0$.   (CO1)

          or

     B) Solve $(D^2 + D - 6) y = 1 + e^{-3x}$.   (CO1)

7.   A) Solve $(D^2 + 3D + 2) y = x^2 + \sin x$.   (CO1)

          or

     B) Solve $(D^2 - D) y = 2e^x + 3\cos x$.   (CO1)

8.   A) Evaluate $L\{e^{3t} \cos^2 t\}$ (CO2)

          or

     B) Evaluate $L\{e^t (t+1)^2\}$ (CO2)

Unit Test II

C –20, CH-401

State Board of Technical Education and Training, A. P

First Year

Subject name: Engineering Mathematics-III

Sub Code: CH-401

<u>Time : 90 minutes</u>   **Max.Marks:40**

Part-A   **16Marks**

Instructions: (1) Answer **all** questions.

(2) First question carries **four** marks and the remaining questions carry **three** marks each

1.   Answer the following:

   a. $L\{f(t)\} = \overline{f}(s)$ then $L\{tf(t)\} = -\dfrac{d}{ds}\left(\overline{f}(s)\right)$: State TRUE/FALSE   (CO2)

   b. $L^{-1}\left\{\dfrac{1}{s-3}\right\} = ?$

         (CO2)

   c. $L^{-1}\left\{\dfrac{1}{s^2+a^2}\right\} = ?$

         (CO2)

   d.   Write the Fourier series for the function $f(x)$ in the interval $c < x < c+2\pi$.   (CO3)

2.   Evaluate $L\{te^t\}$.   (CO2)

3.   Evaluate $\displaystyle\int_0^\infty e^{-3t}\sin 4t\,dt$.   (CO2)

4.   Evaluate $L^{-1}\left\{\dfrac{3}{s+4} + \dfrac{2}{s^2+16} - \dfrac{s}{s^2-4}\right\}$.   (CO2)

5.   Evaluate Fourier coefficient a_0 for $f(x)$ in the interval $(-\pi,\pi)$. (CO3)

Part-B   **3×8=24**

Instructions: **(1) Answer all questions.**

(2) Each question carries eight marks

(3) Answer should be comprehensive and the criterion for valuation

is the content but not the length of the answer.

6.   A) Evaluate $L\{te^{-t}\cos t\}$.   (CO2)

                        or

      B) Evaluate $L\left\{\dfrac{\cos at - \cos bt}{t}\right\}$.   (CO2)

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7. A) Evaluate $L^{-1}\left\{\dfrac{s}{(s+1)(s^2+1)}\right\}$. (CO2)

    or

    B) Evaluate $L^{-1}\left\{\dfrac{s}{(s-1)^4}\right\}$. (CO2)

8. A) Obtain the Fourier series for the function $f(x)=e^x$ in the interval $(0,2\pi)$. (CO3)

    or

    B) Obtain the half range Fourier cosine series of $f(x)=x^2$ in $(0,1)$. (CO3)

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TIME : 3 HOURS   MODEL PAPER- I   MAX.MARKS : 80M

PART-A

Answer All questions. Each question carries THREE marks.   **10x3=30M**

1. Solve $\left(D^2 - 3D + 2\right) y = 0$.   **CO1**

2. Solve $\left(D^2 + D + 1\right) y = 0$.   **CO1**

3. Find the particular integral of differential equation $\left(D^2 + 4\right) y = \sin 2x$.   **CO1**

4. Find the particular integral of differential equation $\left(D^2 + 3D + 2\right) y = e^{3x}$.   **CO1**

5. Find $L\left\{2e^{3t} + \sin 3t + \cosh t\right\}$.   **CO2**

6. Find $L\left\{e^t \cos 4t\right\}$.   **CO2**

7. Find $L^{-1}\left\{\dfrac{1}{s^2} + \dfrac{4}{s^2 + 4} + \dfrac{3s}{s^2 - 9}\right\}$.   **CO2**

8. Find the value of a_0 in the Fourier expansion of $f(x) = e^x$ in the interval $(0, 2\pi)$.   **CO3**

9. Find the Fourier coefficients of $f(x)$ in the interval $(-\pi, \pi)$.   **CO3**

10. Find the value of a_1 in the half range cosine series of $f(x) = k$ in the interval $(0, \pi)$.   **CO3**

PART-B

Answer All questions. Each question carries EIGHT marks.   **5x8=40M**

11. A) Solve $\dfrac{dy}{dx} = \dfrac{1 + y^2}{1 + x^2}$ **CO 1**

OR

B) Solve $\left(x^2 + y\right) dx + \left(y^2 + x\right) dy = 0$.   **CO 1**

12. A) Solve $\left(D^2 - 4D + 4\right) y = \sin 3x$.   **CO1**

OR

B) Solve $\left(D^2 + 2D + 2\right) y = x^2 + x + 1$.   **CO1**

13. A) Evaluate $L\left\{te^t \cos t\right\}$.   **CO2**

OR

B) Evaluate $L\left\{t^2 \cos 2t\right\}$.   **CO2**

14. A) Evaluate $L\left\{\dfrac{\sin 5t \sin t}{t}\right\}$.   **CO2**

OR

B) Evaluate $\displaystyle\int_0^{\frac{\pi}{2}} \dfrac{1}{1 + \tan^3 x} \, dx$.   **CO2**

15. A) Find $y^2 = 4x$ **CO2**

                  OR

     B) Using convolution theorem find $x^2 = 4y$ **CO2**

PART-C

Answer the following question. Question carries TEN marks.   **1x10=10M**

16. Find the Fourier expansion of $\sqrt{27 - 4x^2}$ in the interval $\left(-\pi, \pi\right)$ and hence deduce that

$$\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + = \frac{\pi^2}{12}.$$ **CO3**

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TIME : 3 HOURS	MODEL PAPER- 2	MAX.MARKS : 80M

PART-A

Answer All questions. Each question carries THREE marks.   **10x3=30M**

1. Solve $\left(D^2 + 4D + 4\right) y = 0$.   **CO1**

2. Solve $\left(D^2 + 9\right) y = 0$.   **CO1**

3. Find the particular integral of differential equation $\left(D^2 - 4D + 3\right) y = e^{4x}$.   **CO1**

4. Find the particular integral of differential equation $\left(D^2 - 4D - 5\right) y = \cos 2x$.   **CO1**

5. Find $L\left\{2 - e^{-2t} + \sinh 6t\right\}$.   **CO2**

6. Find $L\left\{e^{-2t}t^2\right\}$.   **CO2**

7. Find $L^{-1}\left\{\dfrac{1}{s^2} + \dfrac{4}{s^2+4} + \dfrac{3s}{s^2-9}\right\}$.   **CO2**

8. Find the value of a_0 in the Fourier expansion of $f(x) = x + x^2$ in the interval $(-1,1)$.   **CO3**

9. Write Euler's formula of Fourier expansion of $f(x)$ in the interval $(c, c+2\pi)$.   **CO3**

10. Find the value of a_1 in the half range cosine series of $f(x) = \pi$ in the interval $(0, \pi)$.   **CO3**

PART-B

Answer All questions. Each question carries EIGHT marks.   **5x8=40M**

11. A) Solve $\left(D^3 + 1\right) y = 0$.   **CO1**

    Or

    B) Solve $\left(D^2 + D - 6\right) y = e^{3x} + e^{-3x}$.   **CO1**

12. A) Solve $\left(D^2 - 3D + 2\right) y = \cos 3x$.   **CO1**

    Or

    B) Solve $\left(D^2 + 2D + 1\right) y = 2x + x^2$.   **CO1**

13. A) Evaluate $L\left\{e^{3t} \cos^2 t\right\}$.   **CO2**

    Or

    B) Evaluate $L\left\{t^2 \cos 2t\right\}$.   **CO2**

14. A) Evaluate $L\left\{\dfrac{e^{-at} - e^{-bt}}{t}\right\}$.   **CO2**

    Or

    B) Using Laplace transforms evaluate $\int\limits_{0}^{\infty} \cos 3t\, dt$.   **CO2**

15. A) Find $\sqrt{\log x}$ **CO2**

            Or

    B) Using convolution theorem find $x = e$ **CO2**

PART-C

Answer the following question. Question carries TEN marks.   **1x10=10M**

16. Find the Fourier expansion of $f(x) = (\pi - x)^2$ in the interval $0 \prec x \prec 2\pi$ and hence deduce

    that $\dfrac{1}{1^2} + \dfrac{1}{2^2} + \dfrac{1}{3^2} + - - - = \dfrac{\pi^2}{6}$.   **CO3**

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Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-402	Mechanical unit operations	4	60	20	80

S.No.	Chapter/unit title	No. of periods	CO's Mapped
1.	Introduction and screening	09	CO1,CO4,CO5
2.	Storage and conveying	07	CO1, CO2
3.	Mixing	08	CO1,CO2
4.	Size Reduction	14	CO1 to CO5
5.	Mechanical Separations	12	CO1 to CO4
6.	Filtration	10	CO1,CO2,CO5
	Total periods	60	

Course objectives

Course objectives	(i)	To know importance of size, shape, screening, storage and conveying of solids
	(ii)	To understand the objectives of mixing, mixing equipment, size reduction laws and equipment
	(iii)	To understand various mechanical separartions, principles of filtration and its equipment

Course Outcomes

CO No		COURSE OUTCOMES
CO1	CH-4O2.1	Appraise the concepts, definitions and importance of mechanical unit operations
CO2	CH-4O2.2	Describe the working principles and draw diagrams of mechanical unit operationsEquipment.
CO3	CH-4O2.3	Explain various laws of mechanical unit operations
CO4	CH-4O2.4	Derive various equations and solve problems in mechanical unit operations
CO5	CH-4O2.5	Analyse various mechanical unit operations and their applications

CO-PO/PSO MATRIX

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CH-402.1	2							3		1
CH-402.2		3						3	2	
CH-402.3			1					3		1
CH-402.4			1					3		
CH-402.5				1				3	2	
Average	2	3	1	1				3	2	1

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

Note:

PO5: Appropriate quiz programs may be conducted at intervals as decided by concerned teacher.

PO6: Seminars on applications of mechanical unit operations in chemical engineering are to be planned and conducted.

PO7: Standard books must be referred in library. Latest updates in reputed national and International journals, attending seminars.

LEARNING OUTCOMES

1.0   Introduction and screening

1.1   Importance of mechanical operations in chemical industries.

1.2   State the importance of size, shape, density and sphericity of particle, specific surface, average particle size and particle population.

1.3   Know about the mixed particle sizes and size analysis.

1.4   Specify various standard screening sieves viz. Taylor standard series & Indian standard series.

1.5   Know about differential screen analysis and cumulative screen analysis to evaluate specific surface, average particle size and particle population.

1.6   Distinguish between differential and cumulative screen analysis

1.7   Know about actual & ideal screens, screen effectiveness and screen capacity.

1.8   Solve problems on screen analysis and screen effectiveness.

2.0   Storage and conveying

2.1   Know about storage of solids.

2.2   Understand the bulk storage of solids.

2.3   Know about bin storage- Flat bottomed bins, sloped bottomed bins, silos and hoppers.

2.4   List out various conveyors.

2.5   Explain the working of following conveyors with diagrams
(a) Belt conveyor
(b) Chain conveyor
(c) Screw conveyors and
(d) Pneumatic conveyors

3.0 Mixing

3.1   Know the importance of mixing.

3.2   Explain the mixing of various systems like (a)liquid-liquid (b) solid-liquid (c) gas-liquid and (d)solid-solids.

3.3   Explain the working principle of mixing equipments with diagrams used for liquid-liquid mixing-
(a) propellers (b) paddles and (c)turbines.

3.4   Know the difference between mixing, agitation and blending.

3.5   Explain about vortex formation and its significance.

3.6   Describe the working principle of mixing equipments with diagrams used for solid- solid mixing – (a) Ribbon blenders (b) tumbling mixers.

3.7   Describe the working principle of mixing equipments with diagrams used for viscous masses-
(a) Banbury mixer (b) kneading machine (c) pug mill.

4.0   Size Reduction

4.1   Explain the principle involved in Size Reduction.

4.2   Know about mechanical efficiency and crushing efficiency.

4.3   State and explain (a) Rittinger's Law (b) Kick's Law (c)Bond's crushing law and work index.

4.4   Evaluate the power requirement for crushing and grinding.

4.5   Classify the size reduction equipment.
4.6   Distinguish between crushing and grinding
4.7   Explain the working principles of following crushing equipment: Jaw crusher, Gyratory crusher, Roll crusher.
4.8   Explain the working principles and line sketches of following grinding equipment: Roll mill, Ball mill and ultrafine grinder.
4.9   Evaluate angle of nip in crushing rolls and the critical speed of Ball mill.
4.10   Mention the applications of various crushers and grinders.
4.11   Distinguish between closed circuit grinding and open circuit grinding.
4.12   Solve simple problems based on Rittinger's Law, Kick's Law and Bond's crushing Law, evaluating critical speed and angle of nip.
5.0   Mechanical Separations
5.1   List out the industrial screens and mention their applications.
5.2   Know about Grizzlies, Trommels, Shaking and vibrating screens.
5.3   Know about hydraulic classifiers-Mineral jig , Wilfley table
5.4   Explain frothflotation.
5.5   Know about magnetic separation and electrostatic separation.
5.6   Know about air separation methods – Air separator, Cyclone separator, Bag filter
5.7   Know about the working principles of Electrostatic precipitator and Scrubber.
5.8   Draw a neat sketch of cyclone separator.
5.9   Discuss the process of batch sedimentation and identify various zones.
5.10   Explain the Stoke's law and Newton's law.
5.11   Know about free settling and hindered settling
5.12   Define terminal velocity.
5.13   Explain the principle of working of industrial thickener with diagram.
5.14   Solve simple problems on terminal velocity.
6.0   Filtration
6.1   State the principles of cake filtration.
6.2   State the principles of constant rate filtration and constant pressure filtration.
6.3   Know about working principle of Plate and frame filter press and leaf filter
6.4   Draw a neat sketch of rotary drum filter.
6.5   Know about working principle of continuous rotary drum vacuum filter.
6.6   Know the various types of filter medium used and its requirements.
6.7   Know the function of filter aid and mention various filter aids.
6.8   Know about sand filters and use of coagulant
6.9   State the principles of centrifugal filtration.
6.10   Know the application and selection of various filters
6.11   Draw the neat sketches of centrifugal filters.
6.12   Explain the working principle of Batch and Continuous centrifugal filters

COURSE CONTENTS:

1.   **Introduction and screening:** Particle size, shape, density and sphericity- mixed particle sizes and size analysis- specific surface, average particle size and particle population-Standard screening sieves viz Taylor standard series & Indian standard series- differential & cumulative screen analysis- actual & Ideal screens- Screen effectiveness.
2.   **Storage and conveying of solids:** Various types of storage of solids-Bin storage- flat bottomed bin, sloped bottomed bin, silos, hoppers and bulk storage- Conveying-types of conveyers – Working principles – Belt conveyor, Chain conveyor, screw conveyor and pneumatic conveyor.

3. **Mixing:** Objectives of mixing, Liquid-liquid mixers- paddles, turbines, propellers, agitators- Solid-liquid mixers, mixer for viscous masses- Banbury mixer, ribbon blenders, tumbling mixers.

4. **Size Reduction**: Principles of communication- Size Reduction laws- Efficiencies in size reduction- Size reduction equipments- Description and working of jaw crusher, gyratory crusher, roller crusher, hammer mill, ball mill, ultrafine grinder- Evaluation of angle of nip- critical speed of ball mill - Closed circuit grinding and open circuit grinding- simple problems on size reduction laws.

5. **Mechanical Separations:** Industrial screens -Their applications- Grizzlies, Trommels, Shaking, vibrating screens, classifiers- hydraulic classifiers, jigging, tabling, froth flotation- Magnetic separation and electrostatic separation- Air separation- cyclone separator, bag filters, electrostatic seperators.

6. **Filtration:** Sand filters- Coagulants-Application of filters- Classification of filters- Selection of filters- Plate and frame filter press, leaf filters, continuous rotary filters- Filter aids- Constant pressure and constant rate filtration- Centrifugal filtration- Batch, semi continuous, continuous centrifuges.

REFERENCE BOOKS:

1. Unit operations of chemical Engg. by Warren L.Mc Cabe, Julian C.Smith and Peter Harriott, Fifth edition, Mc Graw Hill Publication.
2. Introduction to Chemical Engg. by Walter L.Badger & Julius T.Banchero. Mc GRAW Hill Publication.
3. Chemical engineering Series, Coulson & Richardson, Vol-1,5th edition, Butterworth & Heinmannn Publications.
4. Unit operations –1, K.A.Ghavane, Nirali Prakashan Publications.
5. Mechanical operations, Kiran D Patil, Nirali Prakashan
6. PERRY's Chemical Engineers hand book

C-20
MECHANICAL UNIT OPERATIONS
PO- CO – Mapping strength

PO no	Mapped with CO no	CO periods addressing PO in column I		Level (1,2 or 3)	Remarks
		No	%		
1	CO1	26	44%	3	>40% Level 3 Highly addressed
2	CO2	27	45%	3	
3	CO3,CO4	5	8%	1	
4	CO5	2	3%	Not addressed	25% to 40% Level 2 Moderately addressed
					5% to 25% Level 1 Low addressed
					<5% Not addressed

Model Blue print with weightages for Blooms category and questions for each chapter and COs mapped

S.No	Chapter/unit title	No. of periods	Weightage allocated	Marks wise Distribution of weightage				Question wise Distribution of weightage				CO'sMapped
				R	U	Ap	An	R	U	Ap	An	
1	Introduction and screening	09	14	3	3	8	--	1	1	1	--	CO1,CO4,CO5
2	Storage and conveying	07	11	3	--	8	--	1	--	1	--	CO1, CO2
3	Mixing	08	6	3	3	--	--	1	1	--	--	CO1,CO2
4	Size Reduction	14	24	3	3	8	10	1	1	1	1	CO1 to CO5
5	Mechanical Separations	12	14	3	3	8	--	1	1	1	--	CO1 to CO4
6	Filtration	10	11	3	--	8	--	1	--	1	--	CO1,CO2,CO5
	Total	**60**	**80**	**18**	**12**	**40**	**10**	**6**	**4**	**5**	**1**	

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

Unit Test	Learning outcomes to be covered
Unit Test-I	From 1.1 to 4.6
Unit Test-II	From 4.7 to 6.12

State Board of Technical Education and Training,A.P
Diploma in Chemical Engineering(DCHE)
Fourth Semester
Subject Name: Mechanical Unit operations
Sub Code : CH-402

Time: 90 minutes	Unit Test-I	Max. Marks :40

Part A   **16 Marks**

Instructions: (1) Answer **all** questions
        (2)First question carries **four** marks, each question of remaining carries **three** marks

1. (a) Define Sphericity.   CO1

    (b) What is Bulk storage of solids?   CO1

    (c) Draw the diagram of a paddle.   CO2

    (d) Formula for crushing efficiency is _____   CO1

2. Write about differential screen analysis.   CO1

3. Write about Pneumatic Conveyer.   CO2

4. Write the working principle of Banbury Mixer?   CO2

5. State and Explain Rittinger's Law?   CO3

PART-B

Instructions: 1) Answer all questions.
            2) Each question carries eight marks.
            3) Answer should be comprehensive and the criterion for valuation is the content but
               not the length of the answer.

6. Explain screening operation and standard screening sieves?   CO1
                                Or
    Explain screen effectiveness and screen capacity   CO1
7. Explain storage of solid and bin storage?   CO1
                                Or
    Explain Belt conveyors and screw conveyors.   CO1
8. Explain Kick's Law and Bond's Law?   CO3
                                Or
    What will be the power required to crush 130 tons per hour of limestone it 80 percent of the
    feed passes through 50 mm screen and 80 percent of the product through 3.125 mm screen?
    Work index of limestone=12.74.   CO4

***

BOARD DIPLOMA EXAMINATIONS
C-20,CH-402, MECHANICAL UNIT OPERATIONS
IV SEMESTER
MODEL PAPER-SEMESTER END EXAMINATION

TIME :3 HOURS   **MAX.MARKS:80**

Part –A   **10x3=30**

Instructions: 1) Answer all questions.
                 2) Each question carries three marks.
                 3) Answer should be brief and straight to the point and shall not exceed five simple sentences.

1. Write the importance of mechanical operations in Chemical industries.   (CO1)
2. Define Actual and Ideal screens   (CO1)
3. Write about Bulk storage of solids   (CO1)
4. Write briefly about Propellers.   (CO2)
5. Draw neat diagram of Banbury mixer.   (CO2)
6. Define Mechanical efficiency and crushing efficiency.   (CO1)
7. Differentiate open circuit grinding and closed circuit grinding.   (CO2)
8. Write about froth floatation.   (CO1)
9. What is free settling?   (CO1)
10. Write the principles of cake filtration.   (CO2)

Part-B

Instructions: 1) Answer all questions.
                 2) Each question carries eight marks.
                 3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

11. Explain differential screen analysis and Cumulative screen analysis.   (CO5)

                                    or

    A quartz mixture having a certain screen analysis is screened through a standard 10 mesh screen. Calculate a) The ratio of over flow and underflow to feed.   (CO4)
                b)The effectiveness of the screen. Given data:
                D_{pc}=1.651mm, x_F=0.47,x_D=0.85,x_B=0.195

12. Explain bin storage of solids.   (CO1)

                                    Or

    Explain the working of Belt conveyors and Pneumatic conveyers and explain.   (CO2)

13. Write Rittinger's law and Kick's law   (CO3)

                                    Or

    What will be the power required to crush 120 tons per hour of limestone , if 80% of the feed passes 50 mesh screen and 80% of the product passes through 3.125 mm screen. The work index of limestone = 12.7.   (CO4)

14. Explain Grizzlies , Trommels, shaking and vibrating screens   (CO2)

Or

Explain batch sedimentation and draw neat sketch of a cyclone separator.   (CO1,CO2)

15. Explain the working principle of Plate and frame filter press.   (CO2)

Or

Explain the working principle of Rotary drum filter with a neat sketch   (CO2)

Part –C
Instructions: 1) Answer the question below.It carries 10 marks
2) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

16. Why the closed circuit grinding is preferred over open circuit grinding?   (CO2)

***

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-403	Inorganic Chemical Technology	4	60	20	80

S.No.	Chapter/unit title	No. of periods	CO's Mapped
1.	Water and basic chemical industries	11	**CO1 to CO3**
2.	Industrial acids and gases	11	**CO1 to CO3**
3.	Nitrogenous fertilizers & Phosphate industries	14	**CO1 to CO3**
4.	Miscellaneous inorganic chemicals	8	**CO1 to CO3**
5.	Silicate products	8	**CO1 to CO3**
6.	Paints, pigments and varnishes	8	**CO1 to CO3**
	Total periods	**60**	

COURSE OBJECTIVES

Course objectives	(i)	To familiarize with important inorganic chemical products, unit operations and processes used in chemical industries
	(ii)	To know the use of unit operations in the chemical manufacturing processes
	(iii)	To understand and reinforce the unit operation concepts in various chemical processes for better production results

COURSE OUTCOMES

CO1	CH-403.1	Identify various sources of raw materials for chemical process industries, types of inorganic products
CO2	CH-403.2	Describe manufacturing, treatment processes for various inorganic chemicals, draw process flow diagrams, illustrate chemical reactions involved in production of various inorganic chemical products.
CO3	CH-403.3	Find the properties, uses and applications of various inorganic chemical products

CO-PO/PSO MATRIX

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CH-403.1	2			2				3	2	
CH-403.2		2	3					3	2	1
CH-403.3	2			2				3		
Average	2	2	3	2				3	2	1

3= strongly mapped

2= moderately mapped

1= slightly mapped

Note:

LEARNING OUTCOMES

1.0   Water and basic chemical industries

1.1   Understand the sources of water as rainwater, surface water and spring water.

1.2   Analyze the impurities in water such as gases, dissolved solids and dissolved minerals and undissolved solids.

1.3   Describe the process of water treatment by municipal water treatment, ion exchange process, lime soda process.

1.4   Explain the process of osmosis and reverse osmosis.

1.5   Understand the various sources of common salt.

1.6   Understand the preparation of common salt from seawater by solar evaporation and vacuum pan evaporation system.

1.7   Describe the production of soda ash by modified Solvay processes.

1.8   Describe the manufacture of caustic soda and chlorine by electrolytic cell methods (diaphragm and mercury cells) from brines.

1.9   Describe the constructional details of mercury cell and diaphragm cell.

1.10   Prepare bleaching powder by the action of chlorine with calcium hydroxide.

2.0   Industrial acids and gases
         Industrial acids.

2.1   Describe the production of hydrochloric acid by synthesis process.

2.2   Explain the ammonia oxidation process for nitric acid manufacture.

2.3   Explain the extraction methods for sulphur from mines.

2.4   Describe the method of manufacture of sulfuric acid by contact & double contact double absorption process.
         Industrial gases (O_2, N_2, H_2, CO_2 and acetylene)

2.5   Discuss the hydrogen production by steam reforming of hydrocarbon process.

2.6   Separation of oxygen and nitrogen a by liquefaction process of Linde cycle.

2.7   Separation of oxygen and nitrogen a by liquefaction process of modified Linde Frankle cycle.

2.8   Production of carbon dioxide by molasses fermentation .

2.9   Recovery of CO_2 from various sources.

2.10   The production of acetylene from Calcium carbide.

3.0   Nitrogenous fertilizers &Phosphate industries

3.1   Discus various feed stocks for ammonia production.

3.2   Explain the method of manufacture of ammonia by steam reforming process of hydrocarbon feed.

3.3   Describe the manufacture of urea by partial recycle and total recycle process.

3.4   Explain the production of ammonium sulphate by neutralization method and also from gypsum.

3.5 Understand the manufacture of ammonium chloride by direct neutralization method and dual salt process.

3.6 Origin of Phosphate rock and dressing.

3.7 Describe the method of manufacture of phosphoric acid by wet process.

3.8 Explain how single super phosphate and triple super phosphate are produced.

4.0 **Miscellaneous inorganic chemicals**

4.1 Describe the manufacture of potassium fertilizers i.e., potassium chloride and NPK fertilizers.

4.2 Explain the process of Production of Graphite by electric furnace.

4.3 Explain the process of Production of Alum from bauxite by reacting with H_2SO_4.

4.4 Explain the Production of Silicon carbide from coke, sand and sand dust using electric arc furnace.

4.5 Description of quick lime process for Calcium carbide production.

5.0 **Silicate products**

5.1 Discuss different types of Portland cements.

5.2 Describe the production of Cement by wet and dry processes.

5.3 Discuss various types of glasses .

5.4 Describe the manufacture of Glass with various operations.

5.5 Explain various silicate products.

5.6 Know about electronic grade silica

6.0 **Paints, pigments and varnishes**

6.1 Discuss various constituents of a paint.

6.2 Explain the manufacture of paint by mixing method.

6.3 Describe the production of pigments like lithophone, iron oxide and titanium dioxide.

6.4 Explain the preparation of varnishes by oxidation and polymerization of drying oils.

6.5 Discuss rubber and plastic paints.

COURSE CONTENTS:

1. **Water:**Sources of water – causes of scale formation – removal – water softening methods – Municipal water treatment – Lime soda process – Zeolite process – osmosis – reverse osmosis., Common salt **:** Solar evaporation or vacuum pan evaporation system –Soda ash: solvey process – modified solvey process of soda ash, – Caustic soda and chlorine by electrolytic cell method – diaphragm – mercury and membrane cells – bleaching powder.

2. **Industrial acids and gases:** Hydrochloric acid and synthesis process - Nitric acid by ammonia oxidation process –Extraction of sulphur - Sulphuric acid by Contact process & DCDA process. HydrogenElectrolytic method – steam hydrocarbon reforming process, Oxygen and Nitrogen – liquefaction method – Linde Frankle cycle method – modified Linde Frankle cycle method-Carbon dioxide-manufacture by different methods, acetylene from Calcium Carbide.

3. **Nitrogeneous fertilizers & Phosphate Industries :** Ammonia by steam reforming of hydrocarbons – Urea by partial and total recycle process –Ammonium chloride – direct neutralization – Dual salt process.

 Phosphorous– Phosphoric acid –Thermal and wet process, Super phosphate – single super phosphate – triple super phosphate

4. **Miscellaneous Inorganic Chemicals:** Potassium permanganate -Potassium chloride, NPK fertilizers – Alum form Bauxite – silicon carbide by electric arc furnace – calcium carbide by quick lime process.

5. **Silicate products :** Cement by dry and wet process -Types of cement and its applications – Glass- types of glasses and its applications – glass manufacture. silicate products and Electronic Grade Silica

6. **Paints, pigments and varnishes:** Paints –Constituents-manufacture by mixing method-pigments-Different coloured pigments-manufacture of Lithophone, Tio_2 and chromium oxide varnishes by oxidation and polymerization of drying oils. Rubber and plastic paints.

Reference books

1. CHEMTECH VOL-II Published by CH.E.E.D.C., I I T Madras
2. A textbook of Chemical Technology – Shukhla and Pandey
3. Engineering Chemistry – Jain & Jain.
4. Chemical Process Industries – Shreve & Brink., McGraw –Hill Publications
5. Outline of Chemical Technology by Dryden.
6. Chemical Technology From principles to products, Andreas Jess and Peter Wasserscheid
7. Encyclopedia of chemical technology, Kirk-Othmer

C-20
INORGANIC CHEMICAL TECHNOLOGY
PO- CO – Mapping strength

PO no	Mapped with CO no	CO periods addressing PO in column I		Level (1,2 or 3)	Remarks
		No	%		
1	CO1,CO2	56	93%	3	
2	CO2	37	62%	3	>40% Level 3 Highly addressed
3	CO2	37	62%	3	
4	CO1, CO3	23	38%	2	
					25% to 40% Level 2 Moderately addressed
					5% to 25% Level 1 Low addressed
					<5% Not addressed

Model Blue print with weightages for Blooms category and questions for each chapter and COs mapped

S.No	Chapter/unit title	No. of periods	Weightage allocated	Marks wise Distribution of weightage				Question wise Distribution of weightage				CO'sMapped
				R	U	Ap	An	R	U	Ap	An	
1	Water and basic chemical industries	11	**14**	3	3	8		1	1	1		**CO1 to CO3**
2	Industrial acids and gases	11	**14**	3	3	8		1	1	1		**CO1 to CO3**
3	Nitrogenous fertilizers & Phosphate industries	14	**19**	6	3		10	2	1		1	**CO1 to CO3**
4	Miscellaneous inorganic chemicals	8	**11**	8	3			1	1			**CO1 to CO3**
5	Silicate products	8	**11**	3		8		1		1		**CO1 to CO3**
6	Paints, pigments and varnishes	8	**11**	3		8		1		1		**CO1 to CO3**
	Total	**60**	**80**	**26**	**12**	**32**	**10**	**7**	**4**	**4**	**1**	

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

Unit Test	Learning outcomes to be covered
Unit Test-I	From 1.1 to 3.4
Unit Test-II	From 3.5 to 6.5

State Board of Technical Education and Training,A.P
Diploma in Chemical Engineering(DCHE)
Forth Semester
Subject Name: Inorganic Chemical Technology
Sub Code : CH-403

Time: 90 minutes   **Unit Test-I**   Max. Marks :40

Part A   **16 Marks**

Instructions: (1) Answer **all** questions
        (2)First question carries **four** marks, each question of remaining carries **three** marks

1. Explain briefly the manufacture of ammonium chloride by dual salt process.   (CO2)

2. List out various sources of water.   (CO1)

3. Draw the line diagram of diaphragm cell.   (CO2)

4. Write the chemical reactions involved in production of CO_2 through fermentation. (CO2)

5. Discuss various feed stocks for ammonia production.   (CO1)

Part-B   **3X8 =24**

Instructions: (1) Answer **all** questions
            (2) Each question carries **eight** marks.
            (3) Answer should be comprehensive and the criterion for valuation is
                the content but not the length of the answer.

6. (a) Describe the process of municipal water treatment with a neat diagram.   (CO2)
                        (Or)
    (b) Describe the manufacture of caustic soda by electrolytic cell method with a neat
        diagram.   (CO2)

7. (a) Explain the manufacture of sulphuric acid by contact process with a neat
    Diagram.   (CO2)
                        (Or)
     (b) Describe the process of air liquefaction of air by modified Linde Frankle cycle.   (CO2)

8.   (a) Explain the method of manufacture of ammonia by steam reforming of hydrocarbons
        with a neat flow diagram.   (CO2)
                        (Or)
    (b) Describe the manufacture of phosphoric acid by wet process with a neat diagram (CO2)

***

Model question paper with COs mapped:

Q.No	Question	Bloom's category	Marks allocated	CO addressed
PART – A (30 marks)				
1	Differentiate between temporary and permanent hardness.	An	3	C01
2	Explain briefly the preparation of bleaching powder.	U	3	C02
3	Mention any three industrial applications of H_2SO_4.	Ap	3	C01
4	Explain briefly the production of CO_2 from molasses by fermentation method.	U	3	C04
5	Write the method of making ammonium sulphate from gypsum.	U	3	C01
6	List out the types of feed stocks used for ammonia production.	R	3	C03
7	Write briefly about the nitrogen fertilizers.	U	3	C05
8	What is meant by NPK fertilizer?	U	3	C01
9	Write short note on electronic grade silica.	R	3	C05
10	What is varnish? What are the different types of varnish?	U	3	C03
Part –B (40 marks)				
11	Discuss the process of softening water by lime-soda and zeolite method. (or) Describe the production of soda ash by solvey process with a neat flow diagram.	U	8	C02
12	Describe the making of hydrochloric acid by synthesis process with neat flow diagram and mention the applications. (or) Describe the process of manufacturing oxygen and nitrogen gas by Linde-Frankle cycle method with a neat flow diagram.	U	8	C03
13	Explain the process of making graphite using electric arc furnace and mention the applications. (or) Describe the production of silicon carbide by quick lime process with a neat sketch.	U	8	C03
14	Write the different types of Portland cement and describe the process of making cement by wet method with a neat flow sheet. (or) Mention the raw materials and describe the manufacture of glass using a pot furnace with a neat diagram.	U	8	C02

15	Explain the manufacture of varnish by oxidation and polymerization of drying oils. (or) Explain the process of making titanium dioxide pigment with a neat sketch and mention its applications.	U	8	C03
Part –C (10 marks)				
16	Why single super phosphate and triple super phosphate are used in preference of ammonia and urea.Give reasons.	An	10	C06

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-404	Organic Chemical Technology	4	60	20	80

S.No.	Chapter/unit title	No. of periods	CO's Mapped
1.	Introduction and Coal chemicals	11	CO1 to CO3
2.	Petroleum refining & Petrochemicals	15	CO1 to CO3
3.	Oils, fats and soaps	4	CO1 to CO3
4.	Plastic industries	6	CO1 to CO3
5.	Pulp and paper industries	6	CO1 to CO3
6.	Sugar and Fermentation Industries	9	CO1 to CO3
7.	Synthetic fibres and Rubber industries	9	CO1 to CO3
Total periods		**60**	

Course objectives

Course objectives	(i)	To familiarize with important organic chemical products, unit operations and processes used in chemical industries
	(ii)	To know the use of unit operations in the chemical manufacturing processes
	(iii)	To understand and reinforce the unit operation concepts in various chemical processes for better production results

Course Outcomes

CO1	CH-404.1	Identify various sources of raw materials for chemical process industries, types of organic products
CO2	CH-404.2	Describe the manufacturing and treatment processes for various organic chemicals, draw process flow diagrams, discuss chemical reactions involved in production of various organic chemical products
CO3	CH-404.3	Identify the properties, uses and applications of various organic chemical products
CO4	CH-404.4	Appraise the concepts and principles of Inorganic Chemistry.

CO-PO/PSO MATRIX

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CH-404.1	2							3		1
CH-404.2		3	2	1				3	2	
CH-404.3	2							3	1	1
CH-404.4	2		1							
Average	2	3	2	1				3	2	1

3= strongly mapped

2= moderately mapped

1= slightly mapped

Note:

PO5:   Appropriate quiz program may be conducted at intervals as decided by concerned teacher.

PO6:   Seminars on applications of Organic Chemical Technology in chemical engineering are to be planned and conducted.

PO7:   Standard books must be referred in library. Latest updates in reputed national and international journals.

LEARNING OUTCOMES

Learning Outcome

1.0   Introduction and Coal chemicals

1.1   Know about the general requirement of a process plant.

1.2   Know about water demineralization

1.3   Know about compressed and instrument air

1.4   Explain the steam generation in boiler.

1.5   Explain the working principles of a cooling tower and its uses in a process plant.

1.6   Understand the steps in the process development.

1.7   Understand the principles of formation of coal.

1.8   Know about the uses of coal.

1.9   Distinguish between low and high temperature carbonization process.

1.10   Draw the flow diagram containing coking of coal and how the coal chemicals recovered.

1.11   Describe the LTC , HTC and explain the recovery of coal chemicals.

1.12   Describe the coal tar distillation process with a flow diagram.

2.0   Petroleum refining & Petrochemicals

2.1   Know the origin of crude petroleum and classification of crude petroleum, product boiling ranges.

2.2   Write the uses and properties of products of refining.

2.3   Describe the atmospheric distillation and vacuum distillation of crude petroleum.

2.4   Explain the Cracking process.

2.5   Differentiate between thermal and fluid catalytic cracking

2.6   Describe the thermal cracking process and fluid catalytic cracking process with neat sketchs.

2.7   Know about the catalytic reforming of crude.

2.8   Know about the petroleum refining processes.
          a) Polymerization
          b) Isomerization
          c) Alkylation
          d) Hydro dealkylation

2.9   Know about the purification steps used in petroleum refining.

2.10   Describe the following unit operations used in petroleum refining.
          a) Distillation b) Absorption c) Extraction

2.11   Describe the following
          a) Adsorption b) Crystallization c) Humidification and dehumidification

2.12   Describe the processing methods of the following petrochemicals.
          a) Formaldehyde
          b) Methanol
          c) Chloromethane
          d) 1, 2 – dichloro ethane
          e) Vinyl chloride
          f) Ethylene oxide

3.0   Oils, fats and soaps
3.1   List the important vegetable and animal oils and fats.
3.2   Describe the mechanical expeller process and solvent extraction process.
3.3   Know about the hydrogenation of oils and explain the steps in the vanaspathi process.
3.4   Describe the continuous soap manufacturing process.
3.5   List the detergent builders.
3.6   Explain the glycerin recovery process.
3.7   Describe the manufacture of linear alkyl Benzene & detergents

4.0   Plastic industries
4.1   Get familiar with esterfication and oxidation as unit processes.
4.2   Know about addition polymerization & condensation polymerization, suspension &co-polymerization
4.3   Differentiate between thermosetting and thermoplastic resins with examples.
4.4   Describe the phenol- formaldehyde-molding powder.
4.5   Know about HDPE and LDPE.
4.6   Explain the production of HDPE.
4.7   Describe the manufacture of PVC.
4.8   Manufacturing process of phenol and formaldehyde.

5.0   Pulp and paper industries
5.1   Know the chemistry of wood.
5.2   Know the classification of mechanical, chemical and semi chemical pulps.
5.3   Explain the process details of mechanical pulp.
5.4   Describe the Kraft process for the manufacture of sulfate pulp.
5.5   Define paper and know about the paper processing.
5.6   Know about the additives used in paper making.
5.7   Know the bleaching techniques of pulp in the paper industry.
5.8   Explain the chemical recovery process from the black liquor.

6.0   Sugar and Fermentation Industries
6.1   Understand the sugar (raw) manufacturing process.
6.2   Know about the by-products obtained from sugar industries.
6.3   Explain the steps involved in cane sugar refining.
6.4   Know about the grading of sugar crystals.
6.5   Draw the neat sketches of various centrifuges used in sugar industries.
6.6   Know about "Inversion of sugar" and methods to eliminate it.
6.7   Differentiate between aerobic and anaerobic fermentation processes.
6.8   Know the industrial alcohol manufacturing process from molasses.
6.9   Understand the term denaturing.
6.10   Know about potable spirits.
6.11   Explain the anhydrous alcohol manufacturing process.

7.0   Synthetic fibres and Rubber industries
7.1   Describe the manufacture of Nylon 6, 6.
7.2   Explain the manufacturing process of Nylon – 6 from caprolactum.
7.3   Understand the manufacture of Dacron polyester.
7.4   Know the end uses of nylon 6, 6 and nylon – 6.
7.5   Know the importance of blended polyesters.
7.6   List the specific uses of various rubbers.

7.7   Explain the butadiene manufacturing process.

7.8   Explain the styrene manufacturing process.

7.9   Describe the SBR manufacturing processes.

7.10   Know the additional processing used in rubber industry.

COURSE CONTENTS:

1.0   Introduction to chemical technology & Coal chemicals.

General requirements of a process plant.—water demineralization, compressed and instrument air, steam generation in boiler, working principles of cooling tower. Principles of formation of coal.--List of chemicals obtained from coal.— Distinguish between low and high temperature carbonizations of coal---General composition of coal tar.---Coal tar distillation.---Uses of coal.—

2.0   Petroleum refining and Petro-chemicals.

Origin of crude petroleum.--Petroleum products – uses – properties. Atmospheric distillation and vacuum distillation of crude.---Cracking – thermal and catalytic cracking. ---Reforming process --Other unit processes: Polymerization, isomerization, alkylation and hydro alkylation.---Purification of crude and petroleum end products.Various raw materials for petrochemicals-Petrochemicals from methane – formaldehyde – methanol – chloromethane --Petrochemicals from ethylene –1,2 dichloro ethane – vinyl chloride –ethylene oxide –unit operations in petroleum refining..

3.0   Oils, fats and soaps: Physical and chemical properties of oils.

Important vegetable oils and fats and animal fats.--Mechanical expeller process – solvent extraction process – overall processing of crude vegetable oil – hydrogenation of oils. Soap and glycerin manufacture – uses of soap and glycerin. Manufacture linear alkyl Benzene & detergents

4.0   Plastic Industries.

Esterification – Oxidation - Plastic Industries: Resins and plastics – classification – thermo setting and thermo plastics with example - Phenol – formaldehyde molding powder preparation - Production of polyethylene (HDPE) – PVC – Manufacturing process – uses of LDPE and HDPE and PVC - Production of phenol and formaldehyde.

5.0   Pulp and Paper Industries :

Raw materials – wood chemistry – mechanical, chemicals and semi-chemical pulps – processing of sulphate pulp and ground wood pulp - manufacture of paper –additives in maker making- bleaching techniques of pulp – chemicals recovery from black liquor.

6.0   Sugar and Fermentation industries:

Properties and uses of sugar – raw sugar manufacturing process – cane sugar refining – inversion of sugar byproducts from sugar industries, grading of sugar crystals and uses-neat sketches of centrifuges in sugar industries. Fermentation industries: Properties and uses of ethyl alcohol – fermentation – aerobic and anaerobic fermentation – ethyl alcohol (industrial) manufacturing process – denaturing – potable spirits – anhydrous alcohol manufacturing process.

7.0 Synthetic fibres:

Advantages of synthetic fibres – manufacture of nylon – 6, 6 and nylon – 6 – manufacture of Dacron polyester – importance of blended polyesters – uses of nylon – 6, 6 and nylon 6, Classification of rubbers – butadiene manufacturing process – styrene manufacturing process – specific uses of various rubbers – SBR manufacturing process – additional processing of rubber.

REFERNCE BOOKS:

1. A textbook of Chemical Technology Volume II by Shukla and Pandey.
2. Chemtech – II (Second volume of Manual of Chemical Technology, I.I.T, Madras.)
3. Chemical Process Industries by Shreve
4. Outline of Chemical Technology by Dryden.
6. Chemical Technology From principles to products, Andreas Jess and Peter Wasserscheid
7. Encyclopedia of chemical technology, Kirk-Othmer

C-20
ORGANIC CHEMICAL TECHNOLOGY
PO- CO – Mapping strength

PO no	Mapped with CO no	CO periods addressing PO in column I		Level (1,2 or 3)	Remarks
		No	%		
1	CO1,CO3,CO4	27	45%	3	>40% Level 3 Highly addressed 25% to 40% Level 2 Moderately addressed 5% to 25% Level 1 Low addressed <5% Not addressed
2	CO2	32	60%	3	
3	CO2,CO4	40	66%	3	
4	CO2	32	53%	3	

Model Blue print with weightages for Blooms category and questions for each chapter and COs mapped

S.No	Chapter/unit title	No. of periods	Weightage allocated	Marks wise Distribution of weightage				Question wise Distribution of weightage				CO'sMapped
				R	U	Ap	An	R	U	Ap	An	
1.	Introduction and Coal chemicals	11	**14**	3	3	8	-	1	1	1	-	**CO1 to CO4**
2.	Petroleum refining & Petrochemicals	15	**22**	6	6		10	2	2		1	**CO1 to CO3**
3.	Oils, fats and soaps	4	**6**	3	---	3	-	1	--	1	-	**CO1 to CO3**
4.	Plastic industries	6	**8**	--	--	8	-	--	--	1	-	**CO1 to CO3**
5.	Pulp and paper industries	6	**8**	--	--	8	-	--	--	1	-	**CO1 to CO3**
6.	Sugar and Fermentation Industries	9	**11**	3	--	8	-	1	--	1	-	**CO1 to CO3**
7.	Synthetic fibres and Rubber industries	9	**11**	3	--	8	-	1	-	1	--	**CO1 to CO3**
	Total	**60**	**80**	**18**	**9**	**43**	**10**	**6**	**3**	**6**	**1**	

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

Unit Test	Learning outcomes to be covered
Unit Test-I	From 1.1 to 3.7
Unit Test-II	From 4.1 to 7.10

State Board of Technical Education and Training, A.P
Diploma in Chemical Engineering
IV Semester
Subject Name**: Organic Chemical Technology**
subject code**: CH-404**

Time : 90minutes	Unit Test-1	Max Marks: 40

PART-A   **16** Marks

Instructions: 1) Answer **all** questions.
             2) First question carries **four** marks and rest of the questions carries **three** marks.

1.	a) What is pyrolysis of coal?	(CO4)
	b) Write the temperature of HTC.	(CO2)
	c) Write the names of any four petroleum end products?	(CO3)
	d) Define saponification of an oil .	(CO3)
2.	Write the uses of coal.	(CO3)
3.	Differentiate between LTC and HTC of coal.	(CO2)
4.	Mention the significance of Petroleum refining process.	(CO4)
5.	List out the names of any six important vegetable oils.	(CO1)

PART-B   **8X3=24 Marks**

Instructions: 1) Answer **all** questions.
             2) Each question carries **eight** marks.
             3) Answer should be comprehensive and the criterion for valuation is the content but
                not the length of the answer.

6. a) Explain how the coal chemicals recovered by coke oven process.   (CO2)
                              ORb)Explain in detail about the distillation of coal
   tar with neat sketch.   (CO2)

7. a) Explain about fluid catalytic cracking with a neat diagram.   (CO2)
                              OR
   b) Write a short notes on any two of the following .   (CO4)
       (i) Vinyl Chloride
       (ii)Ethylene oxide
       (iii) Methanol
       (iv) Formaldehyde.

8. a) Describe overall process of vegetable oil with a neat flow sheet.   (CO2)
                              or
   b) Describe the continuous soap manufacturing process with a neat sketch. (CO2)

                              ***

TIME :3 HOURS   **MAX.MARKS:80**

Part –A   **10x3=30**

Instructions: 1) Answer **all** questions.
2) Each question carries **three** marks.
3) Answer should be brief and straight to the point and shall not exceed
five simple sentences.

1.   Discuss the general requirements of a plant in Chemical Industries.   (CO4)

2.   Write about the general requirement of process plant.   (CO1)

3.   Discuss about the properties of products of refining.   (CO3)

4.   Write about the formation of Crude petroleum.   (CO2)

5.   Distinguish between atmospheric and vacuum distillation of crude petroleum?   (CO4)

6.   What are the purification steps used in petroleum refining.   (CO2)

7.   Describe briefly about the mechanical expeller process in Oil.   (CO2)

8.   Mention the uses of Glycerine.   (CO3)

9.   Discuss the by-products obtained from sugar industries.   (CO2)

10. List end uses of Nylon.6.   (CO3)

PART – B   **5x8=40**

Instructions: 1. Answer any **Five** questions.
2. Each question carries **EIGHT** marks.
3. Answer should be comprehensive and the criteria for valuation
is the content but not the length of the answer.

11. (a) Explain in detail about the coking of coal with a flow diagram.   (CO2)
OR
(b)Describe about the coal Tar distillation with a flow   diagram.   (CO2)

12 . (a) Describe the manufacture of LDPE and HDPE.   (CO2)
OR
(b) Describe the manufacturing process of formaldehyde.   (CO2)

13. (a)   Explain the paper processing with a neat diagram.   (CO2)
OR
(b) Explain the chemical recovery process from black liquor.   (CO2)

14. (a) How is industrial alcohol manufactured and explain the process with a neat diagram. (CO2)

OR

(b) Explain in detail about the production of Ethyl Alcohol from molasses with a neat flow diagram. (CO2)

15. (a) Explain the styrene manufacturing process with a neat diagram. (CO2)

OR

(b) Explain in detail about the additional processing used in rubber industry. (CO2)

PART – C   **1x10=10**

Instructions: 1. Answer the following compulsory question.
   2. This question carries **Ten** marks.
       3. Answer should be comprehensive and the criteria for valuation
          is the content but *not the length of the answer.*

16) What is the difference between petroleum refinery and petrochemical industry in terms of unit operations, processes, uses of products? (CO2)

***

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-405	Heat Transfer	4	60	20	80

S.No.	Chapter/unit title	No. of periods	CO's Mapped
1.	Heat transfer by conduction.	9	**CO1 to CO4**
2.	Principles of heat flow in fluids.	14	**CO1 to CO5**
3.	Heat transfer to fluids without & with Phase change	7	**CO1,CO3, CO4**
4.	Radiation.	6	**CO1,CO3, CO4**
5.	Heat Exchange equipment	10	**CO5**
6.	Evaporation	14	**CO1 to CO5**
Total periods		**60**	

Course objectives

Course objectives	(i)	To understand the modes of heat transfer and equations governing them
	(ii)	To know the construction and working of heat exchange equipment
	(iii)	To understand the process of evaporation and evaporators

Course Outcomes

CO1	CH-405.1	Explain modes of heat transfer, laws governing them, definitions, dimensionless groups involved, properties of materials in respect to heat transfer
CO2	CH-405.2	Derive several equations for heat transfer rates, LMTD, overall heat transfer coefficient etc.
CO3	CH-405.3	Solveproblems involving calculation of heat transfer rates, areas, LMTD etc.
CO4	CH-405.4	Illustrate the concepts of lagging, fouling factors, thermal boundary layer, condensation and boiling mechanism, view factor, boiling point elevation etc.
CO5	CH-405.5	Classify heat exchange equipment, know their construction and working, Draw the diagrams of heat exchange equipment and various plots

CO-PO/PSO MATRIX

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CH-405.1	3							3		1
CH-405.2	3							3	2	
CH-405.3		1						3	2	
CH-405.4	1							3		1
CH-405.5			2	2				3		
Average	3	1	2	2				3	2	1

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

Note:
PO5: Appropriate quiz program may be conducted at intervals as decided by concerned teacher.
PO6: Seminars on applications of heat transfer in chemical engineering are to be planned and conducted.
PO7: Standard books must be referred in library; Latest updates in reputed national and international journals.

LEARNING OUTCOMES

1.0   Heat transfer by conduction.
1.1   Understand various mechanisms of heat flow such as conduction, convection and Radiation.
1.2   Define conduction, convection and Radiation.
1.3   Define steady state and unsteady state heat flow
1.4   Explain the Fourier's law of heat flow by conduction
1.5   Define and explain thermal conductivity of a substance and state its units.
1.6   Derive the equation for conduction through a single wall, composite wall and cylindrical wall.
1.7   Know the compound resistances in series.
1.8   Explain the significance of lagging and economic lagging thickness.
1.9   Know different heat insulating materials and heating fluids.
1.10   Solve simple problems on calculation of rate of heat flow in case of flat wall, cylindrical wall and composite walls also on finding intermediate temperatures.
2.0   Principles of heat flow in fluids.
2.1   Define convection, natural convection and forced convection
2.2   Know the working of heat exchanger.
2.3   Define counter current and parallel current flows in a heat exchanger.
2.4   Understand temperature variations along the length of the exchange in both cases above.
2.5   Explain enthalpy balances in heat exchangers and in total condensers.
2.6   Explain heat flux, Average temperature of fluid stream and logarithmic mean temperature difference (LMTD)
2.7   Know the film concept in heat transfer by convection.
2.8   Define and explain the film coefficient (Individual heat transfer coefficient) and compare it with thermal conductivity.
2.9   Define Nusselt number and Prandtl number
2.10   Derive an equation for calculation of overall coefficients from individual coefficients.
2.11   Explain the Resistance form of overall coefficient.

2.12   Know about fouling factors and their role.
2.13   Solve simple problems on calculation of LMTD and overall coefficients.
3.0   Heat transfer to fluids without & with Phase change
3.1   Understand regimes of heat transfer in fluids.
3.2   Explain about thermal boundary layer
3.3   Explain the heat transfer by forced convection in laminar flow and turbulent flow.
3.4   Define Graetz and Peclet numbers
3.5   Know the various empirical equations used to calculate h_i such as
        1.Dittus – Boelter Equation 2. Sieder – Tate Equation.
        Colburn equation.
3.6   know the mechanism of heat transfer from condensing vapors.
3.7   Define and explain dropwise and film type condensation.
3.8   Know the heat transfer mechanism to boiling liquids.
3.9   Explain a pool boiling, nucleate boiling and film boiling.
3.10   Solve simple problems to calculate various numbers and heat transfer coefficient using
        various equations.
4.0   Radiation.
4.1   Define absorptivity, Reflectivity and Transmitivity.
4.2   Explain emission of Radiation, Wavelength and emissive power.
4.3   Define black body emmisivity.
4.4   State and Explain Stefan Boltzmann Law, Planck's law and Wiens displacement law.
4.5   Explain Reflectivity and Absorptivity of opaque solids.
4.6   State and Explain Kirchoff's law.
4.7   Know the process of radiation between surfaces.
4.8   Know angle of vision and view factor.
4.9   Understand the combined heat transfer by conduction, convection and Radiation and
        explain an equation for it.
4.10.   Solve simple problems on Stefan's law and view factor.
5.0   Heat Exchange equipment
5.1   Classification of heat exchangers**.**
5.2   Know the working principle of Double pipe heat exchanger.
5.3   Describe the working principle of a shell and tube heat exchanger in detail with a neat
        diagram.
5.4   Explain the working principle of a floating head heat exchanger with a neat sketch.
5.5   Explain the working principle of a multipass heat exchange.
5.6   Explain temperature patterns in multipass exchanges with sketches.
5.7   Know about the extended surface heat exchangers i.e., i). Fin Type and ii) Plate type with a
        neat diagram.
5.8   Know the function of a condenser.
5.9   Know about a) Kettle type boilers b) Calandrias with a neat sketch.

6.0   Evaporation
6.1   Understand the term evaporation
6.2   Know the different liquid properties considered in evaporation.
6.3   Know the different types of evaporators.
6.4   Describe with neat sketches the construction and working of following type of evaporators.
        a) Standard vertical tube evaporator.
        b) Falling film and climbing film evaporators.
        c) Forced circulation evaporators.

6.5   Know about evaporator accessories
          a) Steam traps   b) Condensers   c) Entrainment separators.
          d) Barometric leg   e) Ejectors   f) Salt removal systems.
6.6   Know the performance of an evaporator
6.7   Define and understand the terms economy and capacity of an evaporator.
6.8   State and Explain boiling point elevation, and the effect of hydrostatics head.
6.9   State and Explain Duhring's rule.
6.10   Write enthalpy balances for single effect evaporator and understand the equations.
6.11   Know about enthalpy concentration diagram.
6.12   Solve problems on calculation of the heat transfer area and steam requirement and economy in case of a single effect evaporator.
6.13   Explain the working principle of the multiple effect evaporator system with a sketch.
6.14   State and explain the methods of feeding the Multiple effect evaporator system with relative advantages and disadvantages
6.15   Explain the capacity and Economy of Multiple effect evaporators.

COURSE CONTENT:

1. **Heat transfer and its applications-Heat transfer by conduction**-Mechanisms of heat flow-Fourier's law-Thermal conductivity-Steady state conduction- Compound resistances in series-Heat flow through a Cylinder- Problems.

2. **Principles of heat flow in fluids**: Typical heat exchange equipment – Counter current and parallel-current flows – Energy balances –– Average temperature of fluid stream– LMTD – Individual heat transfer coefficients – Calculation of Overall heat transfer coefficients from Individual coefficients – Fouling factors – Classification of Individual heat transfer coefficients and its magnitude – Simple problems.

3. **Heat transfer to Fluids without and with phase change**: Regimes of heat transfer in fluids – Thermal boundary layer – Heat transfer by forced convection in laminar flow – Graetz and Peclet numbers – Heat transfer by forced convection in Turbulent flow – Empirical equations – Heat transfer from condensing vapors – Drop wise and film wise condensation – Heat transfer to boiling liquids-pool boiling, nucleate boiling and film boiling.

4. **Radiation Heat transfer**: - Fundamentals - Emission of Radiation wave length of radiation Emissive power – Black body radiation – Emissivities of solids – laws of Black body radiation – Absorption of radiation by opaque solids – Reflectivity and absorptivity – Kirchoff's law – Radiation between surfaces – Angle of vision – view factor – combined Heat transfer by conduction – convection and radiation.

5. **Heat Exchange equipment**: Types of heat exchangers principles and operation of Double pipe heat exchangers – shell and tube – single, multipass, floating head – Temperature patterns in multipass exchangers – extended surface heat exchangers – Fin type and plate type condensers – dehumidifying type – contact condensers –- Heat insulating materials and heating fluids

6. **Evaporation**. Liquid characteristics – some important properties – Types of evaporators – standard vertical tube, long tube, falling film – forced circulation evaporators – evaporator accessories – steam traps – condensers – Entrainment separators – Barometric leg – Ejectors – salt removal from evaporators. Performance of tubular evaporators – Evaporator capacity – boiling point elevation and Duhrings rule – Evaporator Economy – Enthalpy balances for single effect evaporator – Simple problems – Multiple effect evaporators .

REFERRENCE BOOKS

1. Unit operations of chemical Engg by Wareen L.Mc Cabe, Julian C.Smith and Peter Harriott, Fifth edition, Mc Graw Hill Publication.
2. Introduction to Chemical Engg by Walter L.Badger & Julius T.Banchero. Mc GRAW Hill Publication.
3. Process Heat Transfer by Donald Q. Kern, Mc GRAW Hill Publication.
4. Heat Transfer by D.P. Tiwari, Umesh publications, New Delhi.
5. PERRY's Chemical Engineers hand book
6   Fundamentals of Heat and Mass transfer, R C Sachdeva

C-20
HEAT TRANSFER
PO- CO – Mapping strength

PO no	Mapped with CO no	CO periods addressing PO in column I		Level (1,2 or 3)	Remarks
		No	%		
1	CO1, CO2, CO4	41	68%	3	>40% Level 3 Highly addressed 25% to 40% Level 2 Moderately addressed 5% to 25% Level 1 Low addressed <5% Not addressed
2	CO3	5	8%	1	
3	CO5	13	22%	1	
4	CO5	13	22%	1	

Model Blue print with weightages for Blooms category and questions for each chapter and COs mapped

S.No	Chapter/unit title	No. of periods	Weightage allocated	Marks wise Distribution of weightage				Question wise Distribution of weightage				CO'sMapped
				R	U	Ap	An	R	U	Ap	An	
1.	Heat transfer by conduction.	9	**11**	--	3	8	--	--	1	1	--	**CO1 to CO4**
2.	Principles of heat flow in fluids.	14	**17**	3	6	8	--	1	2	1	--	**CO1 to CO5**
3.	Heat transfer to fluids without & with Phase change	7	**11**	--	3	8	--	--	1	1	--	**CO1,CO3, CO4**
4.	Radiation.	6	**6**	3	3	--	--	1	1	--	--	**CO1,CO3, CO4**
5.	Heat Exchange equipment	10	**14**	3	3	8	--	1	1	1	--	**CO5**
6.	Evaporation	14	**21**	3	8	--	10	1	1	--	1	**CO1 to CO5**
	Total	**60**	**80**	**12**	**26**	**32**	**10**	**4**	**7**	**4**	**1**	

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

Unit Test	Learning outcomes to be covered
Unit Test-I	From 1.1 to 3.10
Unit Test-II	From 4.1 to 6.15

State Board of Technical Education and Training, A.P
Diploma in Chemical Engineering
IV Semester
Subject name: Heat Transfer
Subject code: CH-405

Time: 90 minutes   **Unit Test-1**   Max marks:40

Part-A   **16Marks**

Instructions: (1) Answer **all** questions
            (2) First question carries **four** marks, each question of remaining carries **three** marks

1. Air is heated in an air heater from 303 K to 383 K by hot gases. The hot gases thus cool from 483 K to 418 K. Calculate LMTD for a) parallel flow and b) counter flow.   (CO3)
2. Define thermal conductivity and its SI units.   (CO1)
3. Draw parallel and counter flow patterns for a double pipe heat exchanger.   (CO5)
4. Discuss briefly about thermal boundary layer.   (CO4)
5. Differentiate between drop wise and film type condensation.   (CO4)

Part-B   **3X8 =24**

Instructions: (1) Answer **all** questions
            (2) Each question carries **eight** marks.
            (3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

6. (a) A furnace is constructed with 20 cm of silica brick, 10 cm of insulating brick and 12.5 cm of building brick. The temperature of the inner surface of the wall is 950°C and that at outer surface is 70°C. Find the heat loss per unit area and the temperature at the interfaces between different kinds of bricks.
    Data: Thermal conductivity of silica brick= 1.75 W/m^{o}K
    Thermal conductivity of insulating brick= 0.124 W/m^{o}K
    Thermal conductivity of building brick= 0.744 W/m^{o}K   (CO3)
            (Or)
(b) Derive an equation to evaluate heat transfer rate by conduction through a cylindrical wall.   (CO2)

7. (a) Derive the relationship between individual and overall heat transfer coefficients .   (CO2)
            (Or)
(b) Define LMTD and derive an expression to calculate LMTD for a heat exchanger. (CO2)

8. (a) Determine the heat transfer coefficient using Dittus – Boelter equation for water flowing in a tube of 16mm diameter at a velocity of 3m/s. The temperature of the tube is 297 K and the water enters at 353 K and leaves at 309K. Properties of water at 331 K at arithmetic mean bulk temperature are:
    Density = 984.1 kg/m^3
    Specific heat C_P = 4187 J/(kg.K)
    Viscosity μ = 485 x 10^{-6} Pa.s
    Thermal conductivity k = 0.657 W/ (m.K)
    Viscosity of water at 297 K, μ_w = 920 x10^{-6} Pa.s   (CO3)
            (Or)
(b) Explain the mechanism of pool boiling of a saturated liquid with a neat diagram. (CO4)
***

Model question paper with COs mapped:

Q.No	Question	Bloom's category	Marks allocated	CO addressed
	PART – A (30 marks)			
1	Explain the Fourier's law of heat conduction.	R	3	C01
2	Explain briefly enthalpy balance in a condenser.	U	3	C02
3	What is meant by co-current and counter-current flow in a heat exchanger?	R	3	C01
4	What is the role of fouling factors?	Ap	3	C04
5	Discuss briefly about thermal boundary layer.	U	3	C01
6	Define black body.	U	3	C03
7	What is Wein's displacement law?	U	3	C05
8	Write short note on extended surface heat exchangers.	U	3	C01
9	Write the classification of heat exchangers.	An	3	C05
10	Define capacity and economy of an evaporator.	U	3	C03
	Part –B (40 marks)			
11	Derive an equation to evaluate heat transfer rate by conduction through rectangular composite wall. (or) A furnace is constructed with 20 cm of silica brick, 10 cm of insulating brick and 12.5 cm of building brick. The temperature of the inner surface of the wall is $950^{O}C$ and that at outer surface is $70^{O}C$. Find the heat loss per unit area and the temperature at the interfaces between different kinds of bricks. Data: Thermal conductivity of silica brick= 1.75 W/m^{O}K Thermal conductivity of insulating brick= 0.124 W/m^{O}K	Ap	8	C02
12	Derive an equation for calculation of overall heat transfer coefficient from individual coefficients. (or) Calculate the overall heat transfer coefficient from the following data : Inside heat transfer coefficient = 5500 W/(m^2 .K) Outside heat transfer coefficient = 1750 W/(m^2 .K) Outside diameter of tube = 30 mm Inside diameter of tube = 20 mm Thermal conductivity of metal wall = 55 W/(m .K)	Ap	8	C03
13	Determine the heat transfer coefficient using Dittus – Boelter equation for water flowing in a tube of 16mm	Ap	8	C03

	diameter at a velocity of 3m/s. The temperature of the tube is 297 K and the water enters at 353 K and leaves at 309K. Properties of water at 331 K at arithmetic mean bulk temperature are: Density = 984.1 kg/m^3 Specific heat C_P = 4187 J/(kg.K) Viscosity μ = 485 x 10^{-6} Pa.s Thermal conductivity k = 0.657 W/ (m.K) Viscosity of water at 297 K, μ_w = 920 x10^{-6} Pa.s (or) Explain the mechanism of pool boiling of a saturated liquid with a neat diagram.			
14	Describe the working and construction of a floating head heat exchanger with a neat diagram. (or) Draw neat line sketches of 1-2 and 2-4 Shell and tube heat exchangers and also draw the temperature versus length profiles in each case.	U	8	C02
15	Describe with neat sketch the construction and working of forced circulation evaporator. (or) Explain the various methods of feeding the multiple effect evaporator with neat line diagrams.	U	8	C03
Part –C (10 marks)				
16	What is the economy and the area of heat transfer of the evaporator to concentrate a feed from 5% solute to 20% solute(by weight) at a rate of 5000 Kg/hr. Dry saturated steam at a pressure corresponding to the saturation temperature of 399 K is used. The feed is at 298 K and BPE is neglected. The overall heat transfer coefficient is 2350 W/m^{2}K. Data: Latent heat of steam at 399 K is 2185 KJ/Kg Latent heat of vaporization of water at 373 K is 2257 KJ/Kg. Specific heat of feed = 4.187KJ/Kg K	Ap	10	C06

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-406	Mass Transfer	5	75	20	80

S.No.	Chapter/unit title	No. of periods	CO's Mapped
1.	Introduction & Diffusion	10	CO1,CO3,CO4
2.	Distillation	15	CO1 to CO4
3.	Absorption & Adsorption	13	CO1 to CO4
4.	Leaching and Extraction	10	CO1,CO2,CO4, CO5
5.	Humidification and Membrane separation	15	CO1 to CO4
6.	Drying and Crystallization	12	CO1, CO2,CO3,CO4,CO5
	Total periods	75	

Course objectives

Course objectives	(i) To know about unit process, unit operation diffusion, mass transfer operation, distillation- various distillation equipments (ii) To know about absorption, adsorption, extraction, leaching, humidification, membrane separation and their equipments (iii) To understand drying and crystallization operations and their equipments

Course Outcomes

CO1	CH-406.1	Illustrate the concepts, definitions and importance of mass transfer with examples, classify mass transfer operations
CO2	CH-406.2	Appraise the working principles of equipments, and draw diagrams pertaining to various mass transfer operations
CO3	CH-406.3	Explain the laws and equations pertaining to various mass transfer operations
CO4	CH-406.4	Solve the problems pertaining to various mass transfer operations
CO5	CH-406.5	Compare the industrial applications pertaining to various mass transfer operations.

CO-PO/PSO MATRIX

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CH-406.1	3							3		
CH-406.2		1		1				3	2	1
CH-406.3	3							3	1	
CH-406.4			1					3		1
CH-406.5	3							3		
Average	3	1	1	1				3	2	1

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

Note:

PO5: Appropriate quiz program may be conducted at intervals as decided by concerned teacher.

PO6: Seminars on applications of mass transfer in chemical engineering are to be planned and conducted.

PO7: Standard books must be referred in library; Latest updates in reputed national and international journals.

1.0   Introduction & Diffusion

1.1   Define, classify and distinguish various mass transfer operations.
1.2   Know about the unit process, unit operation
1.3   Identify the different terms and symbols involved in different operations.
1.4   Understand the meaning of equilibrium between phases.
1.5   Understand the process of diffusion
1.6   Explain the process of molecular diffusion and eddy diffusion and distinguish with examples.
1.7   Define Fick's First Law of diffusion.
1.8   Identify the unit operations that depend on diffusion.
1.9   Know the various fluxes and their units.
1.10   Understand diffusion in single phase.
1.11   Diffusion in gases and liquids for the cases (i) equimolar counter diffusion and (ii) diffusion of a through non diffusion (Derivations not required).
1.12   Simple problems on molecular gas phase diffusion.
1.13   Understand Interphase mass transfer and two resistance theory.
1.14   Define mass transfer coefficients and Write the relation between individual and overall Mass Transfer coefficient (Derivations not required).
1.15   Know the phase rule.
1.16   Know the concept of ideal stages multistage contact and continuous contact.

2.0   Distillation
2.1   Define distillation
2.2   Define Raoult's law, Henry's law and ideal solution.
2.3   Define relative volatility and its significance.
2.4   Know about equilibrium and boiling point diagrams.
2.5   Define and explain equilibrium distillation, batch distillation and continuous distillation.
2.6   State Rayleigh's equation.
2.7   Understand steam distillation.
2.8   Explain the process of continuous distillation with rectification and stripping.
2.9   Discuss Bubble cap and sieve tray columns.
2.10   Analyze the effect of feed conditions and feed plate location.
2.11   Define reflux ratio and explain minimum and optimum reflux ration.
2.12   State Mc.Cabe Thiele assumptions and determine the no. of stages for a binary mixture using Mc. Cabe – Thiele   method.
2.13   Solve problems in distillation and calculation of no. of ideal stages using Mc. Cabe –Thiele method.
2.14   Define and explain stage efficiency and overall plate efficiency and factors influencing them.
2.15   Know about constant boiling mixture, high boiling and low boiling azeotropic mixture.
2.16   Explain the azeotropic distillation and its applications.

3.0 Absorption & Adsorption

3.1 Explain absorption and stripping operation.

3.2 Describe absorption towers and tower packings.

3.3 Apply material balances for absorption tower.

3.4 Understand minimum liquid to gas flow rate ratio.

3.5 Know the concept of number of transfer units and HTU.

3.6 Problems based on principles of absorption.

3.7 Understand the gas and liquid velocities in absorption towers and their limitations such as loading, flooding velocities and channeling.

3.8 Define adsorption with examples and know about equilibrium in adsorption

4.0 Leaching and Extraction

4.1 Application of phase rule to extraction and leaching operations

4.2 Equilibrium relation (Binodal curve) for complete immiscible system.

4.3 Distinguish the process of extraction and leaching.

4.4 Know different examples of leaching.

4.5 Describe single stage equipment used for extraction and leaching.

4.6 Explain mixer – settler.

5.0 Humidification and Membrane separation

5.1 Define various terms involved in humidification operations

5.2 Discuss adiabatic saturation temperature.

5.3 Explain the wet bulb and dry bulb temperatures.

5.4 Determine the humidity of a gas system.

5.5 Understand the reading of the psychometric chart.

5.6 Describe the humidification equipment – cooling towers.

5.7 Describe air conditioning.

5.8 Simple problems without using psychrometric chart

5.9 Know about membrane separations

5.10 Understand Reverse osmosis and Electro dialysis

6.0 Drying and Crystallization

6.1 Know the equilibrium relationship in drying operation and apply phase rule to drying operation.

6.2 Define various terms involved in drying operation.

6.3 Explain batch-drying process under constant drying condition.

6.4 Explain the rate of drying curves and factors influencing.

6.5 Calculate rate of drying and time of drying for batch drying process.

6.6 Classification of driers.

6.7 Know about tray driers, vacuum driers, rotary dryers, drum driers, spray driers, fluidized bed driers and flash driers.

6.8 Problems on calculation of time drying.

6.9 Define Crystal geometry, nucleation and crystal growth

6.10 Explain the various methods for attaining the super saturation.

6.11 Describe the classification of crystallizers.

6.12 Describe the crystallization equipment.

6.13 Explain caking of crystals, prevention and critical humidity.

COURSE CONTENTS:

1. Mass transfer operation – unit process – unit operation – classification of Mass Transfer Operations – terms and symbols involved – distinguish various Mass Transfer Operations – understand equilibrium between phases, Principles of diffusion – molecular diffusion – Fick's first law – eddy diffusion – Distinguish between molecular and eddy diffusions – operations that depend on diffusion – various fluxes – diffusion in single phase – diffusion in gases and liquids – Equimolal diffusion – diffusion of "A" through non – diffusing "B" – problems.Interphase mass transfer – various mass transfer coefficients – relation between individual and overall Mass Transfer Coefficient – two resistance theory – ideal stage – multistage and continuous contacts – Phase rule.

2. Application of phase rule to distillation – Raoult's law – Henry's law – ideal solution – relative volatility – its significance – equilibrium and boiling point diagrams – equilibrium distillation – Batch distillation – continuous distillation – Rayleigh's equation – steam distillation – continuous distillation with rectification and stripping – feed conditions reflux ratio – minimum reflux and optimum reflux ratio – McCabe and Thiele assumptions – Mc. Cabe & Thiele method – stage efficiency – overall efficiency – factors influencing stage efficiency – bubble cap and sieve tray columns – constant boiling mixtures – high boiling and low boiling azeotropic mixture – azeotropic distillation – problems on principles and Mc. Cabe Thiele method.--

3. Phase equilibrium in absorption – stripping operation – absorption tower – tower packings – gas and liquid velocities – limitations – loading and unloading velocities – channeling – material balance – minimum liquid to gas rate ratio – number of transfer units – HTU – Problems.Adsorption—definition – examples – equilibrium – Adsorbents.

4. Phase rule applicable to extraction and leaching – Binodal curve – Process of extraction and leaching examples – single stage equipments mixer settles

5. Humidification – various terms involved – adiabatic saturation temperature – wet bulb temperature – dry bulb temperature – humidity – psychrometric chart – humidification equipment – cooling towers – air conditioning. Membrane separations - Reverse osmosis and Electrodialysis

6. Drying – equilibrium diagrams – various terms – batch drying – constant drying conditions – rate of drying curve – factors influencing the rate – time of drying classification of driers – know different driers – problems.Crystallization – crystal – Crystal growth – methods of super saturation – classification of crystallizers – equipment – caking of crystals – prevention – critical humidity – problems.

REFERENCE BOOKS:

1. Mass transfer operations by Robert E. Treybal, McGraw-Hill publication.
2. 'Unit operations of Chemical Engineering' by Warren L. McCabe, Julian C.Smith, Peter Harriot. Mc. Graw Hill Publication, Fifth Edition
3. Introduction to chemical engineering by Walter L. Badger & Julius T. Banchero, McGraw-Hill publication
4. PERRY's Chemical Engineers hand book, 6th edition.
5. Coulson and Richardson's Chemical Engineering Volume I, 6th edition.
6. Coulson and Richardson's Chemical Engineering solutions to the problems in Volume I.

C-20
MASS TRANSFER
PO- CO – Mapping strength

PO no	Mapped with CO no	CO periods addressing PO in column I		Level (1,2 or 3)	Remarks
		No	%		
1	CO1,CO3,CO5	61	81%	3	>40% Level 3 Highly addressed
2	CO2	14	18%	1	
3	CO4	7	9%	1	
4	CO2	14	18%	1	
					25% to 40% Level 2 Moderately addressed
					5% to 25% Level 1 Low addressed
					<5% Not addressed

Model Blue print with weightages for Blooms category and questions for each chapter and COs mapped

S.No	Chapter/unit title	No. of periods	Weightage allocated	Marks wise Distribution of weightage				Question wise Distribution of weightage				CO's Mapped
				R	U	Ap	An	R	U	Ap	An	
1.	Introduction & Diffusion	10	**11**	3	--	8	--	1		1	--	**CO1,CO3,CO4**
2.	Distillation	15	**24**	3	3	8	10	1	1	1	1	**CO1 to CO4**
3.	Absorption & Adsorption	13	**14**	3	3	8	--	1	1	1	--	**CO1,CO2, CO3 CO4**
4.	Leaching and Extraction	10	**6**	3	3	--	--	1	1	--	--	**CO1,CO2,CO4, CO5**
5.	Humidification and Membrane separation	15	**14**	3	3	8	--	1	1	1	--	**CO1,CO2, CO3, CO4**
6.	Drying and Crystallization	12	**11**	--	3	8	--	--	1	1	--	**CO1, CO2,CO3,CO4,CO5**
	Total	**75**	**80**	**15**	**15**	**40**	**10**	**5**	**5**	**5**	**1**	

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

Unit Test	Learning outcomes to be covered
Unit Test-I	From 1.1 to 3.8
Unit Test-II	From 4.1 to 6.13

State Board of Technical Education and Training, A.P
Diploma in Chemical Engineering
Subject Name: Mass Transfer
subject code: CH-406
Unit Test-1

Time : 90minutes   **Max Marks: 40**

PART-A   16 Marks

Instructions: 1) Answer **all** questions.   2X3=6 Marks
                    2) First question carries **four** marks and rest of the questions carries **three**
marks.

1. (a) Define mass transfer operation.   (CO1)

    (b) Define reflux ratio.   (CO1)

    (c) Apply phase rule to distillation.   (CO5)

    (d) List out the different tower packings.   (CO2)

2. Differentiate between molecular and eddy diffusion.   (CO1)

3. State Mc.Cabe –Thiele assumptions.   (CO1)

4. Define relative volatility and mention its significance.   (CO1)

5. What do you mean by absorption? Give an example.   (CO1)

PART-B   **8X3=24 Marks**

Instructions: 1) Answer **all** questions.
                2) Each question carries **eight** marks.
                3) Answer should be comprehensive and the criterion for valuation is the content but
                    not the length of the answer.

6. a) Explain the classification of Mass Transfer operations.   (CO1)
    Or
    b) Explain the process of continuous distillation with rectification and stripping.   (CO2)

7. a) A Continuous fractionating column is to be designed to separate 1500 gm moles/hr of a
       mixture of 40% A and 60% of B. The overhead product contain 90% of A and bottom
       product contain 95% of B. These percentages are mole percentages. The feed is at its
       bubble point and the vapour leaving the column is condensed completely. Calculate a)
       moles of overhead and bottom product. b) The actual number of plates required for the
    separation if the efficiency of the tower is 70% using Mc Cabe-Thiele method, if α=2.4 and
    R=1.7Rmin.   (CO4)
                        Or
    b) Write about the material balances for absorption tower and minimum liquid to gas flow
       rate ratio.   (CO3)

8. a) A 5000 kg/hr of SO_2-air mixture containing 5% by volume of SO_2 is to be scrubbed with 200000 kg/hr of water in packed tower. The exit concentration of SO_2 is reduced to 0.15%. The tower operates at 1atm with the equilibrium relationship is given by $Y=30 X$ where Y is moles of SO_2 in gas phase. X is moles of SO_2 in water. If the packed height of the tower is 420 cm. Estimate the height of the transfer unit.   (CO4)

Or

b) Oxygen (A) is diffusing through carbon monoxide (B) under steady state conditions, with the carbon monoxide non diffusing. The total pressure is $1x10^5$ N/m^2, and the temperature 0^{0}C. The partial pressure of oxygen at two planes 2.0 mm apart is, respectively 13000 and 6500 N/m^2. The diffusivity for the mixture is $1.87x10^{-5}$ m^2/s. Calculate the rate of diffusion of oxygen in kmol/s through each square meter of two planes.   (CO4)

***

TIME :3 HOURS   **MAX.MARKS:80**

Part –A   10x3=30

Instructions: 1) Answer **all** questions.
2) Each question carries **three** marks
3) Answer should be brief and straight to the point and shall not exceed five simple sentences.

1.   Define mass transfer operation. Give any two examples.

2.   Define relative volatility and mention its significance.

3.   Define distillation. Give two examples.

4.   Define Absorption and Stripping.

5.   What are the different types of adsorptions?

6.   List out different equipments used for extraction and leaching.

7.   Draw the line diagram for multistage cross current operation.

8.   Define Relative Humidity.

9.   Define total enthalpy of a system?

10.   Define Bound Moisture Content and Unbound Moisture Content.

PART – B   **5x8=40**

Instructions: 1. Answer any **Five** questions.
2. Each question carries **EIGHT** marks.
3. Answer should be comprehensive and the criteria for valuation
is the content butnot the length of the answer.

11) (a) Oxygen (A) is diffusing through carbon monoxide (B) under steady state conditions with the carbon monoxide non diffusing. The total pressure is $1x10^5$ N/m^2 and the temperature 0°C. The partial pressure of oxygen at two planes 2.0 mm apart is 13000 and 6500 N/m^2 respectively. The diffusivity for the mixture is $1.87x10^{-5}$ m^2/s. Calculate the rate of diffusion of oxygen in kmol/s through each square meter of two planes.
OR
(b) Write about the classification of mass transfer operations withexamples.

12) (a) Explain how Rayleigh's equation can be verified.
OR
(b) A mixture of 35 mole % A and 65 mole % B is to be separated in a fractionating column. The concentration of A in the distillate is 93 mole% and 96% of all product A is in the distillate. The feed is half vapor and the reflux ratio is to be 4.0. The relative volatility of A to B is 2.0. Calculate the number of theoretical plates in the column and locate the feed plate.

13) (a) Differentiate between packed tower & plate column.

OR

(b) A 5000 kg/hr of SO_2 - air mixture containing 5% by volume of so; is to be scrubbed with 200000 kg/hr of water in packed tower. The exit concentration of SO_2 is reduced to 0.15%. The tower operates at 1 atm with the equilibrium relationship given by Y=30 X where Y is moles of SO_2 in gas phase, X is moles of SO_2 in water. If the packed height of the tower is 420 cm. Estimate the height of the transfer unit.

14) (a) Explain about the working of Boll man agitator with a neat diagram.

OR

(b) Write about single stage cross current operation for extraction/leaching.

15) (a) Explain about any four terms involved in humidification operations.

OR

(b) Explain the procedure to obtain the various terms from thePsychometric chart with the help of psychrometric chart.

PART – C   **1x10=10**

Instructions: 1. Answer the following compulsory question.
2. This question carries **Ten m**arks.
3. Answer should be comprehensive and the criteria for valuation is the content but not the length of the answer.

16) A Continuous fractionating column is to be designed to separate 1400 gm moles/hr of a mixture of 40% A and 60% of B. The overhead product contains 95% of A and bottom product contains 6% of A. These percentages are mole percentages. The feed is 30%liquid and 70% vapor and the vapor leaving the column is condensed completely. Calculate a) moles of overhead and bottom product. b)The actual number of plates required for the separation if the efficiency of the tower is 75% using McCabe Thiele method, if α=2.3 and R=1.55R_{min}.

***

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-407	Chemical Technology lab	6	90	40	60

S. No.	Major Topics	No. of Periods
1.	Water analysis	18
2.	Analysis of Common Salt	18
3.	Analysis of Bleaching powder	06
4.	Analysis of Portland cement	12
5.	Analysis of Vegetable Oil a) Acid value b) Saponification Value c) Iodine Value	12
6.	Preparation of chemical products	06
7.	Instrumental analysis	18
	Total	**90**

Course Objectives	(i) To familiarize with the knowledge different materials tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant experiments/exercises	
Course Outcomes	CH-407.1	Demonstrate the skill of planning and organizing experimental set up for a desired purpose
	CH-407.2	Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems
	CH-407.3	Observe various parameters, their variations and graphically represent the same
	CH-407.4	Analyse the experimental results to draw inferences to make recommendations
	CH-407.5	Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

Learning outcome

1.0 Know the analysis of water.
1.1 Determination of alkalinity of a given water sample
1.2 Determination of acidity of a given water sample
1.3 Determination of total solids in ppm in tap water/Sea water.
1.4 Estimation of dissolved solids in p.p.m in tap water/sea water
1.5 Determination of the total hardness & permanent hardness in water by EDTA method

1.6   Determination of the total hardness and permanent hardness in water by soap solution method

2.0   Know the analysis of common salt

2.1   Estimation of chloride content present in common salt.

2.2   Determination of sulphate content in a given sample.

3.0   Know the analysis of Bleaching powder

3.1   Determine the available chlorine in the given sample of Bleaching powder.

4.0   Analysis of Portland cement

4.1   Estimate the percentage loss on ignition in sample of Portland cement

4.2   Determination of SiO_2 and CaO contents in a sample of Portland cement

5.0   Know the analysis of vegetable oils.

5.1   Determination of acid value of coconut oil / vegetable oil.

5.2   Estimation of Saponification value of the given sample.

5.3   Determination of iodine value of given vegetable oil.

6.0   Preparation of Chemical products

6.1   Preparation of Phenol formaldehyde resin (Bakelite)

6.2   Preparation of   soap by cold process

7.0   Know the functions and applications of the following instruments to analyze the various parameters

7.1   Determination of pH of the given sample of solution by using pH meter.

7.2   Estimation of sugar content in a given sample by using Polari meter.

7.3   Determination of conductivity of the give sample of solution by Conductivity meter.

7.4   Determination of absorbency/ transmittancy of a given sample by Spectrophoto meter/Spectrometer.

7.5   Determination of the colour of given sample by Colourimeter.

COURSE CONTENTS:

Analysis of different types of water for various parameters and characters.

Analysis of common salt.

Analysis of bleaching powder.

Estimation of percentage loss on ignition and SiO_2, CaO in a sample of Portland cement

Analysis of vegetable oil.

Preparation of chemical products

Know the functioning and application of the following instruments:

pH meter

Polari meter

Conductivity meter

Spectrophotometer

Colouri meter

Communication Skills

Course Code	Course Title	No. of Periods/Week	Total No. of Periods	Marks for FA	Marks for SA
CH-408	Communication Skills	3	45	40	60

S. No.	Unit Title	No of Periods	COs Mapped
1	Listening Skills	6	CO1
2	Introducing Oneself	3	CO1, CO2, CO3
3	Short Presentation (JAM)	6	CO1, CO2, CO3
4	Group Discussion	6	CO1, CO2, CO3
5	Preparing Resume with Cover Letter	3	CO3
6	Interview Skills	9	CO1, CO2, CO3
7	Presentation Skills	9	CO1, CO2
8	Work place Etiquette	3	CO1, CO2
	Total Periods	**45**	

Course Objectives	To comprehend the features of communication needed for professional success and display the use of these competently
	To present ideas, opinions in group discussions and presentations on topics of general and technical interest
	To prepare for job selection processes

CO No.	Course Outcomes
CO1	Interacts in academic and social situations by comprehending what is listened to when others speak.
CO2	Demonstrates effective English communication skills while presenting ideas, opinions in group discussions and presentations on topics of general and technical interest.
CO3	Exhibits workplace etiquette relevant in classroom situations for easy adaptation in professional setting in the future.

CO-PO Matrix

Course Code CH-408	Course Title: English Number of Course Outcomes: 4				No. of Periods: 45
POs	Mapped with CO No.	CO Periods Addressing PO in Column 1		Level of Mapping (1,2,3)	Remarks
		Number	Percentage %		
PO1		Not directly applicable for Communication Skills Course however interactive activities that use content from science and technology relevant to the Programme taken up by the student shall be exploited for communication in the Course.			
PO2					
PO3					
PO4					
PO5	CO1, CO2, CO3	11	25%		>60%: Level 3
PO6	CO1, CO2, CO3	27	60%		16 -59%: Level 2
PO7	CO1, CO2, CO3	7	15%		Up to 15%: Level 1

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

Mapping Course Outcomes with Program Outcomes:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1					✓	✓	✓
CO 2					✓	✓	✓
CO3					✓	✓	✓

Blue Print for evaluation based on Course Outcomes for SA:

Note: Every Question based on CO has to be given marks for the following parameters of communication in the rubric.
- Fluency and Coherence
- Lexical Resource (Vocabulary)
- Grammatical Range and Accuracy

*Rubric Descriptors 'Good/ Competent / Fair /Poor' for Communication

LEVEL OF COMPETENCE	Fluency and Coherence	Lexical Resource (Vocabulary)	Grammatical Range and Accuracy
GOOD (9-10*)	Speaks at length without noticeable effort or loss of coherence. May demonstrate language-related hesitation at times, or some repetition and/or self-correction.	Uses vocabulary resources flexibly during discussion. Uses paraphrase effectively.	Uses a range of complex structures with some flexibility.
	Uses a range of connectives and discourse markers with some flexibility. **Articulates and adapts to near naturalization.**	Uses some less common vocabulary and shows some awareness of style and collocation	Mostly produces error-free sentences.
COMPETENT (6-8)	Is willing to speak at length, though may lose coherence at times due to occasional repetition, self-correction or hesitation.	Has enough vocabulary to discuss topics and make meaning clear in spite of inappropriacies.	Uses a mix of simple and complex structures, but with limited flexibility.
	Uses a range of connectives and discourse markers but not always appropriately.	Generally paraphrases successfully	May make mistakes with complex structures though these rarely cause comprehension problems.
FAIR (3-5)	Tries to maintain a flow of speech but t uses repetition, self correction and/or slow speech to keep going.	Manages to talk about familiar and unfamiliar topics but uses vocabulary with limited flexibility.	Produces only basic sentence forms, however, errors persist.
	Produces simple speech fluently, but more complex communication causes fluency problems.	Attempts to use paraphrase but with mixed success.	Uses a limited range of more complex structures, but these usually contain errors and may cause some comprehension problems
POOR (0 *-2)	Speaks with long pauses. Pauses lengthy before most words. **Merely imitates**	Uses simple vocabulary to convey personal information	Attempts basic sentence forms but with limited success, or relies on apparently memorized utterances
	Has limited ability to link simple sentences	Has insufficient vocabulary for less familiar topics	Makes numerous errors except in memorized expressions
	Gives only simple responses and is frequently unable to convey basic message	Only produces isolated words or memorized utterances	Struggles to produce basic sentence forms

s*10 marks to be awarded only if competence level shows flawless expertise in English.
 *0 marks to be awarded when student shows incoherence and gives irrelevant responses.

Blue Print for evaluation based on Course Outcomes for SA of each student:
Note: Marks are awarded for each student as per the Rubric descriptors.

Blue Print for evaluation based on Course Outcomes for Formative Assessment:

S. No.	Questions based on Course Outcomes	Periods Allocated for practical work	Marks Wise Distribution of Weightage	Marks allotment for each Student in the Rubric*				Mapping of COs
				Poor 0-2	Fair 3-5	Competent 6-8	Good 9-10	
1	Describe the given object in a minute	6	10					CO 2
2	Exchange ideas/ views in a group discussion on _____ issue (academic, technical or social)	6	10					CO1, CO 2
3	Present your ideas /opinions on the given issue/ topic (individual to an audience)	9	10					CO1, CO2, CO 3
4	Role play an imaginary work-place situation	6	10					CO1, CO2, CO 3
5	Individual interaction with the Examiner duly submitting Resume (Facing the Interview) – Introducing oneself and answering questions	12	10					CO1, CO2, CO 3
6	*Listen to and comprehend any audio communication/ content	6	10					CO1, CO2, CO 3
	TOTAL	**45**	**60**					

*Listen to and comprehend the given audio content: Giving the Students time to read the questions (Fill in the Blanks, Select from Alternatives, True or False, Table fill, etc.) in chunks before listening to audio inputs also played in chunks.

Note: Every Question based on CO has to be given marks for the following parameters in the rubric.
- Fluency and Coherence
- Lexical Resource
- Grammatical Range and Accuracy

S. No.	Questions based on Course Outcomes	Periods Allocated for practical work	Marks Wise Distribution of Weightage	Poor 0-2	Fair 3-5	Competent 6-8	Good 9-10	Mapping of COs
-9: **Formative Assessment - 1**								
1	Describe the given object in a minute	3	10					CO 2
2	Exchange ideas/ views in a group discussion on _____ issue (academic, technical or social)	6	10					CO1, CO 2
3	Present your ideas /opinions on the given issue/ topic (individual to an audience)	6	10					CO1, CO2, CO 3
4	*Listen to and comprehend any audio communication/ content	3	10					CO1, CO2, CO 3
	Total	**18**	**40**					
-9: **Formative Assessment -2**								
1	Present your ideas /opinions on the given issue/ topic (individual to an audience)	3	10					
2	Role play an imaginary work-place situation	6	10					CO1, CO2, CO 3

3	Individual interaction with the Examiner duly submitting Resume (Facing the Interview) – Introducing oneself and answering questions	15	10					CO1, CO2, CO 3
4	*Listen to and comprehend any audio communication/ content	3	10					CO1, CO2, CO 3
	TOTAL	27	40					

Learning Outcomes

1. **Listening Skills:**
1.1 Listen to audio content (dialogues, interactions, speeches, short presentations) and answer questions based on them
1.2 Infer meanings of words / phrases / sentences / after listening to audio content as mentioned above
2. **Introducing Oneself:**
2.1 Prepare a grid different aspects for presentation about a person / oneself
2.2 Present a 1 or 2 minute introduction of oneself for an audience
3. **Short Presentation:**
3.1 Define an object
3.2 Describe an object, phenomenon, event, people
3.3 Speak on a topic randomly chosen
4. **Group Discussion:**
4.1 Practice Group Discussion. Techniques
4.2 Participate in group discussions
5. **Resume Writing and Cover Letter:**
5.1 Prepare resumes of different sorts – one's own and others.
5.2 Write an effective cover letter that goes with a resume
6. **Interview Skills:**
6.1 Prepare a good Curriculum Vitae
6.2 Exhibit acceptable (Greeting, Thanking, Answering questions with confidence)
7. **Presentation Skills:**
7.1 Prepare Posters, Charts, PPT's on issue of general and technical interest
7.2 Present one's ideas before an audience with confidence using audio visual aids and answer questions that are raised.
8. **Workplace Etiquette:**
8.1 Show positive attitude & adaptability / appropriate body language to suit the work place
8.2 Display basic of etiquette like politeness, good manners

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-409	Mechanical unit operations lab	3	45	40	60

Course Objectives	(i) To familiarize with the knowledge different materials tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant experiments/exercises
Course Outcomes	CH-409.1 — Demonstrate the skill of planning and organizing experimental set up for a desired purpose
	CH-409.2 — Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems
	CH-409.3 — Observe various parameters, their variations and graphically represent the same
	CH-409.4 — Analyse the experimental results to draw inferences to make recommendations
	CH-409.5 — Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

List of Experiments :

1. Verification of the various laws of crushing by using Jaw crusher.
2. Verification of various crushing laws using roll crusher.
3. Determination of angle of nip in roll crusher.
4. Determination of critical speed & energy consumed in size reduction using ball mill / rod mill.
5. Perform screen analysis for determination of average size, Specific surface area, Particle population for the given sample.
6. Determination of effectiveness of screening in separating the given material by use of vibrating screens.
7. Perform froth flotation experiment to separate a mixture of coal into two fractions.
8. Verification of Stroke's law by settling a particle in a liquid column
9. Perform batch Sedimentation experiment to calculate the thickener area required using Kynch formula.
10. Determination of the resistance offered by filter cake & filter medium under constant pressure & constant rate of filtration in filtration operation by plate & frame type of filter press.

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-410	Heat transfer lab	3	45	40	60

Course Objectives	(i) To familiarize with the knowledge different materials tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant experiments/exercises	
Course Outcomes	CH-410.1	Demonstrate the skill of planning and organizing experimental set up for a desired purpose
	CH-410.2	Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems
	CH-403.3	Observe various parameters, their variations and graphically represent the same
	CH-410.4	Analyse the experimental results to draw inferences to make recommendations
	CH-410.5	Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

List of Experiments:

1. Verification of fourier's law of heat conduction through composite walls.
2. Verification of fourier's law of heat conduction and determination of thermal conductivity of a metal bar.
3. Determination of overall heat transfer co-efficient in a double pipe heat exchanger for counter flow.
4. Determination of overall heat transfer co-efficient in a double pipe heat exchanger for parallel flow.
5. Determination of overall heat transfer co-efficient in a shell and tube heat exchanger for counter flow.
6. Determination of overall heat transfer co-efficient in a shell and tube heat exchanger for parallel flow.
7. Determination of heat transfer co-efficient for forced convection of air.
8. Determination of heat transfer co-efficient for natural convection of air.
9. Determination of Stefan boltzman constant.
10. Determination of emmisivity of a test plate.

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-411	Mass transfer lab	3	45	40	60

Course Objectives	(i) To familiarize with the knowledge different materials tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant experiments/exercises	
Course Outcomes	CH-411.1	Demonstrate the skill of planning and organizing experimental set up for a desired purpose
	CH-411.2	Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems
	CH-411.3	Observe various parameters, their variations and graphically represent the same
	CH-411.4	Analyse the experimental results to draw inferences to make recommendations
	CH-411.5	Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

LIST OF EXPERMENTS:

1. To draw a graph of specific gravity Vs mole fraction of a given binary system.
2. To draw a graph of refractive index Vs mole fraction of a given binary system
3. Verification of Rayleigh's equation by conducting a simple distillation experiment.
4. Verification of Steam distillation law by conducting steam distillation experiment.
5. Estimation of vapour liquid equilibrium data of a given binary system.
6. To determine the no. of trays required using Mc.Cabe Thiele method
7. Calculation of time of drying of a given material and to draw the rate of drying curve.
8. To draw the Binodal curve for the given ternary liquid system.
9. To estimate the diffusivity for a given system.
10. Determination of amount of sodium carbonate/ sodium chloride in a mixture with sand using water by leaching process.
11. To determine the surface area of adsorption of a given sample by using Adsorption experiment.

V & VI Semesters
(Industrial Training)

V & VI Semesters (Industrial Training)
DIPLOMA IN CHEMICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS

INDUSTRIAL TRAINING

Subject Title : **Industrial Training**
Subject Code : **CH-501**
Duration : **6 months**

Time schedule

S.NO	Code	TOPICS	Duration
1	CH-501	• Practical training in Industry • Training Report Preparation Report Preparation: Title Page, Certificate, Acknowledgements, Abstract, Contents(introduction of Industry, Plant Layout, Organization Chart, List of Major Equipments, List of Processes: Skills Acquired; Conclusions; References	Six Months

Course Objectives and Course Outcomes

Upon completion of the course the student shall be able to		
Course Objectives		1.Expose to real time working environment 2. Enhance knowledge and skill already learnt in the institution. 3. Acquire the required skills of manufacturing processes, assembling, servicing, supervising in the engineering fields. 4. Install the good qualities of integrity, responsibility and self confidence.
COURSE OUT COMES	CO1	Apply theory to practical work situations
	CO2	Cultivate sense of responsibility and good work habits
	CO3	Exhibit the strength, teamwork spirit and self-confidence
	CO4	Write report in technical projects

PO-CO Mapping

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

3: High, 2: Moderate,1: Low

Learning Outcomes

The student shall be able to display the following skill sets

1)   Technical Skills *(*Manufacturing/Service/Drafting/Maintenance etc)

2)   Reading drawings and analysing Specifications

3)   Recognize and Practice safety Measures

4)   Handling Tools/Instruments/Materials/Machines

5)   Assess and Control of quality parameters

6)   Planning, Organizing and recording Skills

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

Weightage of marks for Assessment of Skill sets during first and second assessment.

Skill Set SI.No	SKILL SET	Max Marks Allotted For each parameter
1	Handling of various Equipments/Instruments	*15*
2	Supervising the Process of various manufacturing units in Chemical Engineering	*20*
3	Working with equipments, Instruments	*25*
4	Troubleshooting Skills	*25*
5	Safety aspects and crisis management	*15*
6	Soft skills and Reporting skills	*20*
	Total	*120*

During assessment the performance of the students shall be assessed in those skills in which the student has been trained and be awarded the marks as per the weightage assigned as above. In case the student has undergone training in a few skill sets then the total marks obtained shall be raised to 120 marks for the given assessment i.e. either assessment 1 or 2. However the performance of the student shall be assessed at the most skill sets listed above but not less than three skill sets.

Illustration

If the student has undergone training in only 4 skill sets (namely serial number 1, 3, 4, 5 of above skill sets) and marks awarded during assessment is 50 out of 80 marks, then the marks of 50 shall be enhanced to 120 proportionately as (50/80)*120=75.

GUIDELINES FOR INDUSTRIAL TRAINING

1. Duration of the training: 6 months.
2. Eligibility: The As per SBTET norms
3. Training Area: Students may be trained in the fields Fabrication/Foundry/Manufacturing/Service/Drafting/Maintenance etc.
4. The candidate shall put a minimum of 90% attendance during Industrial Training.
5. If the student fails to secure 90% attendance during industrial training, the student shall reappear for 6 months industrial training.
6. Formative assessment at industry level shall be carried out by the Mentor from of the industry, where the student is undergoing training and the faculty in charge (Guide) from the concerned section in the institution.
7. The Industrial training shall carry 300 marks and pass marks is 50% in assessments at industry (first and second assessment) and final summative assessment at institution level put together i.e. 150 marks out of 300 marks.
8. If the student fails to secure 50% marks in final summative assessment at institution level, the student should reappear for final summative assessment in the subsequent board examination.
9. Final Summative assessment at institution level is done by a committee including1. Head of the section(Concerned discipline ONLY),2. External examiner and3. Faculty members who assessed the students during Industrial Training as members.

No gap/holidays between one spell to another

Guidelines and responsibilities of the faculty members who are assessing the students' performance during Industrial Training:

1. **Every Teacher (Including HoD, if not holding any FAC) shall be assigned a batch of students of 10 to 15 for Industrial Training irrespective of students' placements for training**
2. Shall guide the students in all aspects regarding training.
3. Shall create awareness regarding safety measures to be followed in the industry during the training period, and shall check it scrupulously.
4. Shall check the logbook of the students during the time of their visit for the assessment.
5. Shall monitor progress at regular intervals and make appropriate suggestions for improvement.
6. Shall visit the industry and make first and second assessments as per stipulated schedules.
7. Shall assess the skill sets acquired by the students during their assessment.
8. Shall award the marks for each skill set as per the marks allotted for that skill set during 1st and 2nd assessments
9. Shall voluntarily supplement students learning through appropriate materials like photographs, articles, videos etc.
10. Shall act as co-examiner along with other examiners in the final assessment at institution.
11. Shall act as liaison between the student and mentor.
12. Shall maintain a diary indicating his observation with respect to the progress of students learning in all three domains (Cognitive, Psychomotor and Affective).

Guidelines to the Training Mentor in the Industry:

1. Shall train the students in all the skill sets as far as possible.
2. Shall assess and award the marks in both the assessments along with the faculty member .
3. Shall check and approve the log books of the students.
4. Shall approve the attendance of each student at the end of the training period.
5. Shall report to the guide about student's progress, personality development or any misbehavior as the case may be.

<div align="center">Department of Technical Education</div>

Name of the institution:	Visit (I /II)
PIN:	Date of visit
Name of the student:	Period of training
Semester:	
Name of the Industry	Maximum marks (120)

Skill Set Sl.No	SKILL SET	Max Marks Allotted For each parameter	Precisely completes the task	Completes the task, mistakes are absent, but not Precise	Completes the task, Mistakes are a few	Makes attempt, Mistakes are many
1	**Handling of various Equipments/Instruments(15)**					
	(i)Specifications of equipment and instruments	10	10	8	6	2
	(ii) Measuring the process parameters	5	5	4	3	1
2	**Supervising the Process of various manufacturing units in Chemical Engineering (20)**					
	(i) Raw materials and Product, byproducts	4	4	3	2	1
	(ii) Process Flow diagram, Line diagrams	3	3	2	1	1
	(iii) Process monitoring	5	5	4	3	1
	(iv) Design aspects	4	4	3	2	1
	(v) Quality control and Quality assurance	4	4	3	2	1
3	**Working with equipments, Instruments (25)**					
	(i) Working condition parameters	8	8	6	5	2
	(ii) Startup-Shutdown	5	5	4	3	1
	(iii) Maintenance	12	12	10	7	3
4	**Troubleshooting Skills (25)**					
	(i) Fault-Finding	15	15	12	9	3
	(ii) Rectification	10	10	8	6	2
5	**Safety aspects and crisis management (15)**					
	(i) Safety procedures	4	4	3	2	1
	(ii) Use of Personnel Protection Equipment	5	5	4	3	1
	(iii) Crisis management during hazards, accidents	3	3	3	2	1
	(iv) Pollution control techniques	3	3	3	2	1
6	**Soft skills and Reporting skills(20)**					
	(i)Communication Skills (oral/writing skills)	4	4	3	2	1
	(ii) Human relations.	4	4	3	2	1
	(iii) Supervisory abilities.	4	4	3	2	1
	(iv) Reporting technical issues	4	4	3	2	1
	(v)Maintenance of records in the industry.	4	4	3	2	1

(Marks in words:)

Signature of the Training In-charge (Mentor)   Signature of the visiting staff Name(Guide)

Name   Name:

Designation: Designation:

INDUSTRIAL TRAINING

Subject Title	:	Industrial Training
Subject Code	:	CH-601
Duration	:	6 months

Time schedule

S.NO	Code	TOPICS	Duration
1	CH-601	• Practical training in Industry • Training Report Preparation Report Preparation: Title Page, Certificate, Acknowledgements, Abstract, Contents(introduction of Industry, Plant Layout, Organization Chart, List of Major Equipments, List of Processes: Skills Acquired; Conclusions; References	Six Months

Course Objectives and Course Outcomes

Upon completion of the course the student shall be able to		
Course Objectives		1.Expose to real time working environment 2. Enhance knowledge and skill already learnt in the institution. 3. Acquire the required skills of manufacturing processes, assembling, servicing, supervising in the engineering fields. 4. Install the good qualities of integrity, responsibility and self confidence.
COURSE OUT COMES	CO1	Apply theory to practical work situations
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Learning Outcomes

The student shall be able to display the following skill sets

7)   Technical Skills *(Manufacturing/Service/Drafting/Maintenance etc)*
8)   Reading drawings and analysing Specifications
9)   Recognize and Practice safety Measures
10)   Handling Tools/Instruments/Materials/Machines
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	Total	120

During assessment the performance of the students shall be assessed in those skills in which the student has been trained and be awarded the marks as per the weightage assigned as above. In case the student has undergone training in a few skill sets then the total marks obtained shall be raised to 120 marks for the given assessment i.e. either assessment 1 or 2. However the performance of the student shall be assessed at the most skill sets listed above but not less than three skill sets.

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Department of Technical Education

Name of the institution: Visit (I /II)
PIN: Date of visit
Name of the student: Period of training
Semester:
Name of the Industry   Maximum marks (120)

Skill Set Sl.No	SKILL SET	Max Marks Allotted For each parameter	Precisely completes the task	Completes the task, mistakes are absent, but not Precise	Completes the task, Mistakes are a few	Makes attempt, Mistakes are many
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	(i) Working condition parameters	8	8	6	5	2
	(ii) Startup-Shutdown	5	5	4	3	1
	(iii) Maintenance	12	12	10	7	3
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	(i) Fault-Finding	15	15	12	9	3
	(ii) Rectification	10	10	8	6	2
5	**Safety aspects and crisis management (15)**					
	(i) Safety procedures	4	4	3	2	1
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	(v)Maintenance of records in the industry.	4	4	3	2	1

(Marks in words:)

Signature of the Training In-charge (Mentor)   Signature of the visiting staff Name(Guide)

Name   Name:

Designation: Designation:

VII Semester

INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Course code	Course title	No.Of Periods / week	Total number of periods	Marks for FA	Marks for SA
CH-701	Industrial Management and Entrepreneurship	5	75	20	80

S.No.	Chapter/unit title	No of Periods	CO's mapped
1.	Principles and functions of Management	5	CO1
2.	Organisation structure & organisational behaviour	14	CO1
3	Production Management	10	CO2
4.	Materials Management	10	CO2
5.	Marketing ,Sales & Feasibility study	10	CO1
6.	Industrial legislation & safety	8	CO4, CO1
7.	Introduction to ISO 9000 & T.Q.M.	8	CO4
8	Role of Enterprenuer and Enterprenuerial Development	10	CO3
	Total	**75**	

Course objectives:

1. To familiarize with different management, production and material principles and different structures of organization.
2. To know the role and expectations of entrepreneur.
3. To understand and reinforce the subject to establish a small scale industry

Learning out comes:

CO NO		Course outcomes
CO1	**CH-701.1**	To familiarize with the basics, principles and functions of management, ownership and marketing
CO2	**CH-701.2**	To familiarize with materials and production management
CO3	**CH-701.3**	To know the role of entreprenuer and feasibility report
CO4	**CH-701.4**	To understand safety , quality ans iso standards to in the industry

CO-PO/PSO Matrix:

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CH-701.1	3		2				3		2
CH-701.2	3						3		
CH-701.3	3	1						1	
CH-701.4	3	1						1	
AVERAGE	3	1	2				3	1	2

3=STRONGLY MAPPED
2=MODERATELY MAPPED
1=SLIGHTLY MAPPED

Note:
PO5: Appropriate quiz program may be conducted at intervals as decided by concerned teacher.
PO6: Seminars on applications of Industrial Managementand Entrepreneurship in chemical engineering are to be planned   and conducted.
PO7: Standard books must be referred in library. Latest updates in reputed national and international journals.

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   Explain the principles of scientific management.
1.5   Understand functions of Management.
1.6   Differentiate between management and administration.

2.0   Know the organisation structure of an industry and the behaviour of an individual in an organisation.
2.1   Understand types of ownerships
2.2   Differentiate types of ownerships.
2.3   Understand salient features of joint stock companies.
2.4   Understand the philosophy and need of organisation structure of an industry.
2.5   Understand the line and staff organisations.
2.6   List the advantages and limitations of line and staff organisations.
2.7   List different departments in a large scale industry.
2.8   Explain the factors of effective organisation.
2.9   Understand organisational behaviour.
2.10   Conduct for analysis.
2.11   Assess the incurring applicants.
2.12   Outline the selection process.
2.13   Understand the sources of manpower.
2.14   State motivation theories.
2.15   State Maslow's Hierarchy of needs.
2.16   Explain the phenomena of satisfaction.
2.17   Explain the performance levels.

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2.18   Design reward system

2.19   Explain quality of work life.

2.20   Explain socio-technical and socio-psychological approach.

2.21   List out different leadership models.

2.22   Explain the trait theory of leadership.

2.23   Explain behavioural theory of Leadership.

2.24   Explain the process of decision Making.

2.25   Outline the communication process.

2.26   Analyse the behaviour of groups in an organisation.

2.27   Explain group dynamics.

2.28   Detail the process of managing conflict.

2.29   Explain conflict resolution strategies.

3.0   Understand the different aspects of production management.

3.1   Differentiate and integrate production, planning and control.

3.2   Relate the production department with other departments.

3.3   State the need for planning and it's advantages.

3.4   Explain the stages of Production, planning and control.

3.5   Explain routing methods.

3.6   Explain scheduling methods.

3.7   Explain dispatching.

3.8   Draw PERT/CPM networks.

3.9   Identify the critical path.

4.0   Understand the role of materials management industries.

4.1   Explain the role of the materials in Industry.

4.2   Derive expression for inventory control.

4.3   Explain ABC analysis.

4.4   Define safety stock.

4.5   Define reorder level.

4.6   Derive an expression for economic ordering quantity.

4.7   Explain stock layout.

4.8   List out stores records.

4.9   Explain the Bin card.

4.10   Describe Cardex method.

4.11   Explain purchasing procedures.

4.12   List out purchase records.

4.13   Describe the stores equipment

4.14   Describe material handling methods and need.

4.15   Describe material lifting methods. List out hoists, cranes, conveyers, trucks, and forklift trucks.

4.16   Explain the concept of cost.

4.17   List out the elements of cost.

4.18   Explain the concept of contribution.

4.19   Explain break-even analysis.

5.0   Understand marketing, sales and feasibility study.

5.1   Explain marketing functions.

5.2   Explain Sales function.

5.3   List out market conditions.

5.4   Differentiate Sellers and Buyers' market.

5.5   Differentiate monopoly, oligarchy, and perfect competition.

5.6   Conduct market and demand surveys.
5.7   Differentiate product and production analysis.
5.8   Identify the input materials, i.e. Bill of materials
5.9   Define the main policy requirements.
5.10   Decide the location.
5.11   Evaluate Economic and Technical factors.
5.12   Preparation of feasibility study.
5.13   List out different products currently in demand with market or industry.
5.14   Role of advertising, media of advertising and selection of media

6.0   Comprehend the provisions of industrial legislation in India. & Safety procedures
6.1   Describe employer and employee relations.
6.2   Describe the mechanics of Trade Unions.
6.3   Describe mechanics of settlement of in outs.
6.4   Explain the significance of collective bargain.
6.5   List out Welfare activities.
6.6   List out subsidy schemes.
6.7   Explain the total welfare concept.
6.8   List out the rights and responsibilities of employees and employers.
6.9   List out the salient features of Indian Factories Act.
6.10   List out the salient features of Minimum Wages Act.
6.11   List out the salient features of Industrial Disputes Act.
6.12   List out the salient features of Workmen's Compensation Act
6.13   List out the salient features of E. S .I. Act.
6.14   List out the salient features of consumer protection rights Act
6.15   Explain the importance of safety at Work place.
6.16   List out the important provisions related to safety.
6.17   Explain the significance and mechanics of safety education.
6.18   Explain hazard and accident.
6.19   List out different hazards in the Industry.
6.20   Explain the causes of accidents.
6.21   Explain the direct and indirect cost of accidents.
6.22   List out Electrical Hazards.
6.23   List out types of fire extinguishers.
6.24   Describe the method of artificial Respiration.
6.25   Describe the method of CPR.
6.26   Describe the mechanics of safety Drills.
6.27   List out provisions of Indian Electricity Rules laid in the electricity act1923.

7.0   Understand ISO 9000 & TQM.
7.1   Understand the concept of quality.
7.2   Know the quality systems and elements of quality systems.
7.3   Know the principles of quality Assurance.
7.4   Know the Indian Standards on quality systems.
7.5   Know the evolution of ISO standards.
7.6   Discuss ISO standards and ISO 9000 series of quality systems.
7.7   State the constituents of ISO 9000 series of standards for quality systems.
7.8   State the outstanding features and drawbacks of ISO 9000 series of standards.
7.9   List the beneficiaries of ISO 9000.
7.10   Understand 5-Sprinciples and ZERO DEFECT.

8.0   Understand the role of entrepreneur in economic development and in improving the quality of life.

8.1   Outline the concepts of Entrepreneurship.
8.2   Define the word entrepreneur.
8.3   Determine the role of Entrepreneurship.
8.4   Describe the profile of an entrepreneur.
8.5   Explain the requirements of an entrepreneur.
8.6   Outline the expectations of Entrepreneurship.
8.7   Determine the role of entrepreneurs in promoting Small Scale Industries.
8.8   Describe the details of self-employment schemes.
8.9   Explain the method of product selection.
8.10   Explain the method of site selection.
8.11   Outline the method of plant layout.
8.12   State the needs for a planned and co-ordinated effect.
8.13   State the importance of follow up.
8.14   Describe the small business scheme.
8.15   List the financial assistance programmes.
8.16   List out the organisations that help an entrepreneur.
8.17   Conduct a demand survey.
8.18   Conduct a market survey.

Hyponated course outcomes

1.   **Principles and functions of management :**
Definitions of Industry, Commerce and Business. Evolution of management theories. Principles of Scientific Management, functions of management. Difference of administration and management.

2.   **Organisation Structure & organisational behaviour :**
Role of industry, Types of ownership – Sole proprietorship, Partnership, Private limited, Public limited company, Industrial Cooperatives, Philosophy, types of Organisations, Line and Staff and functional organisations. Advantages and limitations, departments in a large scale industry. Effective organisation. Job analysis, Assessing applicants, selection, motivation, different theories, satisfaction, performance reward systems quality of work life, socio-technical and socio-psychological approaches, Leadership in organisation, decision making, communication, group dynamics, Managing conflict.

3.   **Production Management :**
Production, planning and control, relation with other departments, need for planning and advantages Routing, scheduling, despatching, PERT and CPM, simple problems.

4.   **Materials Management :**
Materials in industry, inventory control model, ABC Analysis, Safety stock, re-order, level, Economic ordering quantity, Cost Elements of Cost, Contribution, Break even analysis, Stores layout, stores equipment, Stores records, purchasing procedures, purchase records, Bin card, Cardex, Material handling, Manual lifting, Hoist, Cranes, conveyors, trucks, fork trucks.

5. **Marketing, Sales & Feasibility Study :**

Sellers and Buyers markets, Marketing, Sales, Market conditions, monopoly, oligarchy, perfect competition, Budgets, Pricing Policies. Market Survey, Product and production Analysis, Materials input, Manpower, Location, Economic and Technical Evaluation, preparation of Feasibility study reports, - different products – Mechanical, Electrical, Electronics, consumer items, Consumer desires etc.

6. **Industrial Legislation & safety :**

Employer – Employee relations, Trade, Union Settlement of disputes, collective bargaining, Welfare activities, subsidies, Total Welfare concept, rights and responsibilities and Employers and employees. Salient features of (i) Indian Factories Act, (ii) Minimum Wages Act, (iii) Industrial Disputes Act, (iv) Workmen's compensation Act, (v) E.S.I Act. (Vi) Consumer protection act Important of Safety at work places, factories Act- Provisions, Safety Education, Hazards, causes of accidents, Cost of accidents, Electrical Hazards, Fire Extinguishers Artificial respiration, safety drills, Indian Electricity rules.

7. **Introduction to ISO 9000 and TQM :**

Concept of quality discussed by B. Crosby W. Edward, Deming, Joseph M. Jura Kooru Ishikawa, Genichi Taguchi, Shigco Shingo.

Quality systems – Definitions of the terms used in quality systems like, quality policy, quality management, quality systems, quality control and quality assurance.

Elements quality systems : Management responsibility, Quality system, contract review, design control, document control, purchasing, purchaser – supplied product, product identification and traceability, process control, Inspection and testing.

Principles of quality assurance – Definition of quality assurance.

Indian standards on quality systems – Main features of IS 13999 : 1990, IS 14000 : 1990, IS 14004 : 1990, IS 14001: 1990, IS 14002 : 1990, IS 14003: 1990.

Know the necessity of International standards – Evolution of ISO. **5-S** principles – importance – meaning – approach – benefits.

Various standards under ISO – Outstanding features of ISO 9000 series of standards – ISO 9000 Phenomenon ISO 9000 series of quality systems – Constituents of ISO 9000 series of standards for quality systems. Drawbacks of ISO 9000 series of standards, list the beneficiaries of ISO 9000 (Whom does ISO 9000 help).

8. **Role of Entrepreneur & Entrepreneurial Development :**

Concept, definition, role, expectation, entrepreneurship Vs Management, promotion of S.S.I. Self – employment schemes. Product selection, site selection, plant layout, profile and requirement, need for a planned and co-coordinated effort, following, Institutional support needed, Financial assistance programmes, Demand survey, Market survey.

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. S.S.I Hand Book by S.B.P. Publishers.
5. Personnel Management by Flippo.
6. Industrial Management and Entrepreneurship by Zakria Baig.
7. Entrepreneurship – by NITTT&R, Chennai.

S.No.	Major Topics	No of Periods	Weightage allocated	Marks wise distribution of weightage				Question wise distribution of weightage				Cos mapped
				R	U	Ap	An	R	U	Ap	An	
1.	Principles and functions of Management	5	3	3		-	-	1				CO1
2.	Organisation structure & organisational behaviour	14	14	6	8			2	1			CO1
3.	Production Management	10	13	3		10	-	1		1		CO2
4.	Materials Management	10	14	6	8			2	1			CO2
5.	Marketing ,Sales & Feasibility study	10	11	3	8			1	1			CO1
6.	Industrial legislation & safety	8	6	6				2				CO4, CO1
7	Introduction to ISO 9000 & T.Q.M.	8	8		8				1			CO4
8	Role of Enterprenuer and Enterprenuerial Development	10	11	3	8			1	1			CO3
	Total	75	80	30	40	10		10	5	1		

C-20, CH-701
Subject Name: Industrial Management and Entrepreneurship
Syllabus split up for Unit Test

Unit test NO	Learning out comes to be covered
Unit test-I	Objective from 1.1 to 4.19
Unit test-II	Objective from 5.1 to 8.18

Model paper 1
State Board of Technical Education and Training, A.P
Diploma in Chemical Engineering
Subject Name: Industrial Management and Entrepreneurship
SUBJECT CODE: CH-701
Unit Test-1

Time : 90minutes   **Max Marks: 40**

                                                  PART-A   **16Marks**

Instructions: (1) Answer all questions
        (2) First question carries 4marks and rest of the questions carries 3marks

1.   CO1
    a) Card attached tomthe bin is called_____
    b) Example for joint srock company_____
    c) Top level people have _____skills.
    d) Rate of production of goods is known as_____
2.   Define the terms Business and Commerce   CO1
3.   Distinguish between sole proprietorship and partnership   CO2
4.   Write short notes on dispatching.   CO2
5.   Explain about Bin cards.   CO1

                                                  PART-B   **8X3=24 Marks**

Instructions: (1) Answer all questions
                    (2) each question carries eight marks
                    (3) Answer should be comprehensive and the criterion for valuation is the
                          content but not the length of the answer

6.   Explain ABC analysis in inventory control with a graph.   CO2
                                                      (or)
7.   Explain about Cardex method.   CO2

8.   A Project has 7 activities, the expected time in weeks for each activity is as follows. Show that earliest and latest expected time on the network diagram. Find the critical path and duration of the project.   CO3

S.No.	1	2	3	4	5	6	7
Activity	1-2	1-3	1-4	2-5	3-5	5-6	4-6
Duration inWeeks(to)	2	4	3	6	9	2	4

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End Exam Model question paper

Q.No	Question	Blooms category	Marks allocated	CO adressed
Part-A(30 marks)				
1.	List out Scientific Management principles	remembering	3	CO1
2.	What is a joint stock company	Remembering	3	CO1
3.	What is the importance of motivation	understanding	3	CO2
4.	Write about scheduling	Remembering	3	CO2
5.	Explain about Re-orderlevel	understanding	3	CO2
6.	Explain about Bincard	Remembering	3	CO3
7.	List out the components of cost	understanding	3	CO3
8.	Define Trade Union. What are its objectives	remembering	3	CO1
9.	List out Major Trade Unions in India	remembering	3	CO4
10.	Mention the qualities of a good entrepreneur	remembering	3	CO4
Part-B(40 marks)				
11	Differentiate job description and job specification? (Or) Explain about selection procedure	understanding	8	CO1
12	Derive an expression for EOQ (Or) Explain about Cardex method	understanding	8	CO2
13	Explain and compare marketing conditions (Or) Explain the steps in preparing Feasibility report	understanding	8	CO2
14	State the benefits of ISO 9000 and explain whom does it help? (Or) Explain the elements of quality systems?	understanding	8	CO3
15	What factors must be considered in selection of a product? (Or) What is the need for market survey? How is it conducted.	understanding	8	CO4
Part-C(10 marks)				
16	Explain various terms used in network diagrams	analyzing	10	CO3

Course code	Course title	No.Of Periods / week	Total number of periods	Marks for FA	Marks for SA
CH-702	Thermodynamics and reaction engineering	5	75	20	80

S.No.	Chapter/unit title	No. of periods	Cos mapped
1.	Introduction, First law of thermodynamics and Volumetric properties of pure fluids	18	CO1, CO2, CO3, CO4, CO5
2.	The second law of thermodynamics	12	CO2, CO3, CO4, CO5
3	Refrigeration and Liquefaction	10	CO2, CO4, CO5
4.	Chemical reaction equilibria	10	CO1, CO2, CO3, CO5
5	Chemical kinetics and ideal reactors	18	CO2, CO3, CO5
6	Catalysis and Industrial reactors	07	CO1, CO2, CO4
	Total	75	

Course objectives:

1. To familiarize with the terms used in thermodynamics, thermodynamic processes, properties of fluids, second law of thermodynamics, refrigeration and liquefaction, lechatliers' principle, rate of reaction, factors affecting rate of reaction, methods to analyse rate data, industrial reactors and catalysis

2. To apply thermodynamic laws for steady state flow process and feasibility of a chemical process, lechatlier's principle to habers and contact process

3. To understand and reinforce the thermodynamic concepts in various chemical processes for better production results.

Course outcomes

CO1	CH-7O2.1	Interpret the basic concepts and definitions of thermodynamics, reaction engineering and catalysis
CO2	CH-7O2.2	Analyse various thermodynamic properties and their evaluation, applications of thermodynamics, reactors and catalysts
CO3	CH-7O2.3	Deduce the derivations of thermodynamics and reaction engineering
CO4	CH-7O2.4	Illustrate with the help of neat diagrams the construction and working of heat engines, heat pumps and various reactors
CO5	CH-7O2.5	Solve the problems on first and second law of thermodynamics and reaction engineering

CO-PO/PSO MATRIX:

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CH-702.1	3							2		
CH-702.2		2						1		
CH-702.3	2	2							2	
CH-702.4			2						2	
CH-702.5	2	2							2	
AVERAGE	**2**	**2**	**2**					**2**	**2**	

   3=STRONGLY MAPPED
   2=MODERATELY MAPPED
   1=SLIGHTLY MAPPED

Course code CH-702	Course Title: thermodynamics and reaction engineering No of Course outcomes 07				No of periods: 75
POs	**Mapped with CO No**	**CO periods addressing PO in Column 1**		**Level (1, 2, 3)**	**Remarks**
		NO	**%**		
PO1	CO1, CO3, CO5	43	44	3	>40%- level 3
PO2	CO2, CO3, CO5	25	33	2	
PO3	CO4	17	23	1	25%-40% level 2
PO4					
PO5					5-25% : level 1
PO6					
PO7					<5%: not addressed

Learning outcome
After completion of the course, the student will be able to

1.0 Introduction, First law of thermodynamics and volumetric properties of pure fluids
1.1 Describe importance of thermodynamics.
1.2 Define internal energy, enthalpy and their units in SI system.
1.3 Define the statement for 1st law of thermodynamics.
1.4 Derive an expression of first law of thermodynamics for the following processes:
    a) Closed process
    b) Steady state flow process.
1.5 Differentiate between state and path functions.
1.6 Distinguish extensive and intensive properties.
1.7 Derive the relation of constant volume and constant pressure processes
1.8 Define heat capacity and specific heat
1.9 Explain (a) Equilibrium (b) Reversible process.
1.10 Describe the PVT behaviour of pure substances.
1.11 Define ideal gas and the characteristics of ideal gas.
1.12 Define compressibility factor and know about compressibility Charts.
1.13 Derive $C_p – C_v = R$ for a mole of an ideal gas.
1.14 Explain about the following processes.
    A) Isobaric b) Isochoric c) Isothermal and d) Adiabatic.

1.15   Derive expression for ΔU, ΔH, Q and W in the above processes connecting PVT properties.

1.16   Solve problems on calculation of ΔU, ΔH, Q and W in the above processes   connecting PVT Properties.

2.0   The second law of thermodynamics.

2.1   Explain second law of thermodynamics.

2.2   Distinguish between heat engine and heat pump.

2.3   Give the schematic representation of heat engine and heat pump.

2.4   Define cop in heat engine and heat pump.

2.5   Define and explain Carnot cycle for an ideal gas.

2.6   Explain Carnot cycle principle.

2.7   Define entropy and its SI units.

2.8   Explain the entropy characteristics.

2.9   Describe the entropy changes of an ideal gas.

2.10   Derive the mathematical statement of 2nd law of thermodynamics.

2.11   Define third law of thermodynamics.

3.0 Refrigeration and Liquefaction.

3.1   Define refrigeration.

3.2   Explain the cycle of refrigeration.

3.3   List the methods of refrigeration.

3.4   List the applications of refrigeration.

3.5   Define refrigerant.

3.6   Describe classification of refrigerants (primary and secondary).

3.7   Explain the principle of Carnot cycle refrigerator.

3.8   Explain about choice of refrigerant.

3.9   Explain the method of obtaining vapour compression refrigeration.

3.10   Explain the method of obtaining vapour absorption refrigeration.

3.11   Solve simple problems on ton of refrigeration, COP on refrigeration

3.12   Explain a bout liquefaction

3.13   Explain Linde and Claude liquefaction processes

4.0   Chemical reaction equilibria.

4.1   Define equilibrium.

4.2   Explain about the standard Gibbs free energy change and the equilibrium constant.

4.3   Explain the effect of temperature on the equilibrium constants.

4.4   Evaluation of equilibrium constants.

4.5   Explain the relation between equilibrium constants and composition.

4.6 Simple problem equilibrium constant calculations

5.0 Chemical kinetics and ideal reactors.

5.1   Introduction to chemical kinetics

5.2   Explain the importance of reaction kinetics in chemical industries.

5.3   Explain the classification of reactions.

5.4   Define reaction rate and know its units.

5.5   Explainthe variables affecting the rate of reaction.

5.6   Define single, multiple, elementary and non-elementary reactions.

5.7   Explain about molecularity and order of reaction.

5.8   Explain about rate constant k, representation of a rate equation.

5.9   Explain about temperature – dependent term of a rate equation.

5.10   Explain temperature dependency from Arrchenius law.

5.11   Explain about constant – volume batch reactor.
5.12   Describe about
         a) Integral method of analysis of data.
         b)Differential method of analysis of data.
5.13   Define the following with examples.
         a) Zero order
         b) First order
         c) Second order .
5.14   Explain broad classification of reactor types.
5.15   Explain ideal batch reactor with diagram and design equation.
5.16   Define space time and space velocity.
5.17   Explain the steady state mixed flow reactor with diagram and design equation.
5.18   Explain steady state plug flow reactor with diagram and design equation.

 6.0   **Catalysis and Industrial reactors.**
6.1   Eefine catalysis.
6.2   Eescribe about the types of catalysis.
6.3   Scribe the characteristics of a catalytic reactions.
6.4   Define auto catalysis.
6.5   Explain the function of promoters, accelerators, carriers, inhibitors in catalytic reaction with examples.
6.6   Explain catalyst poisoning.
6.7   List out some important commercially available catalysts.
6.8   List six industrial catalytic processes.
6.9   Explain the working principle of the following with the help of neat sketches.
       a) Fixed bed reactors
       b) Moving bed reactors
       c) Fluidized bed reactors

HYPONATED COURSE

1.   **Introduction and First law of thermodynamics.**
      The importance of thermodynamics- Internal energy – Formulation of first law –closed   process - State functions and path functions – Enthalpy – Steady state flow process –Constant volume and constant pressure processes - heat capacity and specific heat- Equilibrium – Reversible process.

      Volumetric properties of pure fluids.
      PVT   behavior of pure substances – Ideal gas ––Definition of compressibility factor-
      Derivation of $C_p – C_v = R$ for a mole of an ideal gas-State and explain about the following processes : A) Isobaric b) Isochoric c) Isothermal and d) Adiabatic.
      The different expressions for ΔU, ΔH, Q and W in the above processes connecting PVT properties- Problems on calculation of ΔU, ΔH, Q and W in the above processes

2.   **The second law of thermodynamics:**
      Statement – The heat engine and heat pump- Carnot cycle for an ideal gas – Entropy –
      Entropy changes of an ideal gas – Mathematical statement of the second law – The third law of thermodynamics – Statement – Problems.

3. **Refrigeration and Liquefaction:** The Carnot refrigerator – Vapor – Compressioncycle – Comparison of refrigeration cycles – Refrigerant – Choice of refrigerant –Absorption refrigeration – Heat pump-Liquefaction- Linde and Claude liquefaction processes

4. **Chemical reaction equilibria :**
Application of equilibrium criteria to chemical reactions – The standard Gibbs energy change and the equilibrium constant – Effect of temperature on the equilibrium constant – Evaluation of equilibrium constants – Relation between equilibrium constants and composition

5. **Chemical kinetics and ideal reactors.**
Chemical kinetics – Classification of reactions – Variables affecting the rate of reaction – Reaction rate- Concentration – Dependent term of a rate equation – Single and multiple reactors, elementary and non-elementary reactions – Molecularity and order of a reaction – Rate constant K – Representation of a rate equation –
Constant volume batch reactor – Integral method of analysis of data and differential method of analysis of data. – Broad classification of reactor types – Ideal batch reactor – Space time and space velocity – Steady state mixed flow reactor – Steady stated plug flow reactor – Holding time and space time for flow systems – Problems.

6. **Catalysis and Industrial Reactors :**
Types of catalysis – Characteristics of catalytic reactions – Auto catalysis – Accelerators, Promoters, inhibitors, poisons- some important catalysts- industrial catalytic processes-Important industrial reactors

REFERENCE BOOKS :

1. Introduction to Chemical Reaction Engineering – by K.A. Gavane, Nirali Publications.
2. Chemical Kinetics – by J.M. Smith.
3 Introduction to Chemical Engineering Thermodynamics – by Smith and Vannes, 4th Edition.
4. Chemical reaction Engineering – by Octave Levenspiel, 2nd edition.

MODEL BLUE PRINT WITH WEIGHTAGES FOR BLOOMS CATEGORY AND QUESTIONS FOR EACH CHAPTER AND Cos MAPPED

S.No.	Major Topics	No of Periods	Weightage allocated	Marks wise distribution of weightage				Question wise distribution of weightage				COS mapped
				R	U	Ap	An	R	U	Ap	An	
1.	Introduction and First law of thermodynamics Volumetric properties of pure fluids	18	17	6	3	8		2	1	1		CO1, CO2, CO3, CO4, CO5
2.	The second law of thermodynamics	12	11		3	8			1	1		CO2, CO3, CO4, CO5
3.	Refrigeration and Liquefaction	10	11	3	8			1	1			CO2, CO4, CO5
4.	Chemical reaction equilibria	10	11		8	3			1	1		CO1, CO2, CO3, CO5
5.	Chemical kinetics and ideal reactors	18	19	6	3		10	2	1		1	CO2, CO3, CO5
6.	Catalysis and Industrial reactors	07	11	3	8			1	1			CO1, CO2, CO4
Total		**75**	**80**	**18**	**33**	**19**	**10**	**6**	**6**	**3**	**1**	

C-20-CH-702
Subject Name: THERMODYNAMICS AND REACTION ENGINEERING
VII SEMESTER
Syllabus split up for Unit Test

Unit test No.	Learning out comes to be covered
Unit test-I	Objective from 1.1 to 3.13
Unit test-II	Objective from 4.1 to 6.9

State Board of Technical Education and Training , A.P
Diploma in Chemical Engineering
VII SEMESTER
Subject Name: Thermodynamics and Reaction Engineering
Subject Code: CH-702

Time: 90 minutes	Unit Test I	Max .Marks:40

Part-A   **16Marks**

Instructions: (1) Answer **all** questions.

(2) First question carries **four** marks, each question of remaining carries **three** marks

1. Define the following
   (a) Extensive properties with example   **(CO1)**
   (b) Compressibility factor   **(CO1)**
   (c) Carnot's theorem   **(CO1)**
   (d) Refrigeration capacity   **(CO1)**
2. Differentiate between state and path functions with examples   **(CO1)**
3. Derive $Q = W = nRT\ln(V_2/V_1)$ for an ideal gas at constant temperature   **(CO3)**
4. A Carnot's engine receives 150KJ/S of heat from a heat source reservoir at 425°C and rejects heat to a sink reservoir at 30°C.What are the power produced and heat rejected?   **(CO5)**
5. Define refrigerant and list the few common refrigerants   **(CO2)**

Part-B   **3X8=24Marks**

Instructions: (1) Answer **all** questions
(2) Each question carries **eight** marks
(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer .

6. (a) Derive an expression of first law of thermodynamics for a steady state flow process   **(CO3)**

   or

   (b) An ideal gas undergoes the following reversible processes   **(CO5)**

   (i)   From an initial state of 343K and 1bar it is compressed adiabatically to 423K

   (ii) It is then cooled to 343K at constant pressure (c) Finally it is expanded to its original state isothermally. Calculate ΔU, ΔH, Q and W for each process and for the entire cycle with Cp = (5/2)R

7. (a)   Derive Carnot's equations for an ideal gas using Carnot's cycle   **(CO3)**

   or

   (b) A steel casting with Cp = 0.5KJ/KgK weighing 40Kg at a temperature of 450°C is quenched in 150Kg of oil at 25°C with Cp of oil = 2.5KJ/KgK. If there are no heat losses, What is the change in entropy of steel casting, change in entropy of oil and total entropy change?   **(CO5)**

8. (a) Explain the method of obtaining vapor compression refrigeration   **(CO4)**

   or

   (b) Define liquefaction   and explain Linde - Claude liquefaction process   **(CO4)**

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Model question paper

Q.No	Question	Blooms category	Marks allocated	CO addressed
Part-A(30 marks)				
1.	Define heat capacity and how it is classified.	remembering	3	CO1
2.	Define and explain phase rule	Remembering	3	CO1
3.	Describe a few equation of state of a real fluid	understanding	3	CO3
4.	Distinguish between heat engine and heat pump	understanding	3	CO1
5.	List six refrigerents	Remembering	3	CO1
6.	factors favours the forward reaction in the following reaction at 300K, $N_2+3H_2 \rightarrow 2NH_3$ $\Delta H=-22Kcal$	application	3	CO2
7.	Define molecularity and order of reaction	remembering	3	CO1
8.	Define space time and space velocity		3	CO1
9.	The half life of a first order reaction is 10min. what percent of reactant remains after 15 min	application	3	CO5
10.	Explain the classification of catalysis		3	CO2
Part-B(40 marks)				
11	Explain first law of thermodynamics for steady state flow process (or) derive PV^γ= constant for an adiabatic process	understanding	8	CO1 CO3
12	Explain the principle of increase of entropy (or) Explain that carnot engine has maximum efficiency than any other engine which is operating between the same temperature reservoirs	understanding	8	CO1 CO3
13	Explain vapor compression refrigeration with a sketch (or) explain the process of liquefaction of air by linde process	understanding	8	CO4 CO4
14	Apply lechatlier's principle for habers process (or) Describe the relation between standard Gibbs energy and equilibrium constant	application	8	CO2 CO3
15	Explain the role of promoters, accelerators in catalysis (Or) Explain the construction and working of fluidized bed reactor		8	CO2 CO4
Part-C(10 marks)				
16	Explain briefly how first and second order kinetics can be analysed using integral method of analysis	analysing	10	CO2

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-703	Instrumentation & Process Control	05	75	20	80

S.No.	Chapter/unit title	No. of periods	CO's Mapped
1.	Introduction and Qualities of measurement.	8	CO1, CO2
2.	Measurement of Temperature.	12	CO3, CO5
3.	Measurement of pressure and Vacuum:	10	CO1, CO3
4.	Measurement of Liquid level, Density and Viscosity.	10	CO1, CO3
5.	Measurement of composition.	10	CO3, CO4
6.	Process Instrumentation & Instrumentation diagrams for Chemical Engineering processes and operations:	10	CO3, CO5
7.	Principles of automatic process control and modes available for process control.	15	CO5
	Total periods	**75**	

Course objectives

Course objectives	(i)	To familiarize with the measurement, control of process and process instrumentation.
	(ii)	To use various instruments to measure the temperature, pressure, vacuum, level, density, viscosity and composition.
	(iii)	To know the principle, construction and working of different instruments.

Course Outcomes

CO1	**CH** -703.1	Illustrate with example the Definitions and concepts of First and Second order systems with various inputs and responses.
CO2	**CH** -703.2	Derive the response equations for various inputs related to First and Second order systems.
CO3	**CH** -703.3	Illustrate the Principle, Construction and working of various instruments to measure temperature, pressure, vacuum, level, density, viscosity and composition with diagram.
CO4	**CH** -703.4	Compare the applications of the temperature, pressure, vacuum, level, density, viscosity and composition measuring instruments
CO5	**CH** -703.5	Describe the Instrumentation diagrams and working of automatic process control systems both pneumatic and hydraulic operated.

CO-PO/PSO Matrix:

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CH-703.1	3	2						2		
CH-703.2	2	2						2		
CH-703.3			2						2	
CH-703.4	2							2		2
CH-703.5			2						2	
AVERAGE	2	2	2					2	2	2

3=STRONGLY MAPPED
2=MODERATELY MAPPED
1=SLIGHTLY MAPPED

Learning Outcome

Unit-1: Introduction and Qualities of measurement

 Know the importance of Instrumentation and process control in Chemical Industries.

1.1   Know the meaning of measurement.
1.2   Know the differences between direct and in-direct measurement.
1.3   Know about different elements of an instrument.
1.4   Know about the Static characteristics of an instrument.
1.5   Know about the Dynamic characteristics of an instrument.
1.6   Know about a First order system and physical examples of first order system.
1.7   Know about a Second order system and physical examples of second order system.
1.8   Know about various input functions like Step input, Impulse input, Sinusoidal input and Linear input.
1.10   Know about the response of a first order system for a given input functions with   derivations.
1.11   Know about the parameters that characterize a first order system and a second order system.

Unit-2 Measurement of Temperature.

2.2   Know about different temperature scales in different units.
2.3   Know about Principle, construction and working of expansion thermometers.
2.4   Know about Vapour actuated thermometer.
2.5   Know about the sources of static error in industrial pressure spring thermometers.
2.6   Know about thermo-electricity and thermo-electric circuit or Thermocouple.
2.7   Know about Seebeck effect, Pelteir effect and Thomson effect.
2.8   Know the types of industrial thermocouples.
2.9   Know about the accessories of an industrial thermocouple.
2.10   Know the mechanical properties of thermal well materials.
2.11   Know the effect of location of reference junction and lead wires for a Thermo couple.
2.12   Know about the principle, construction, working of Milli-voltmeter and its application.
2.13   Know about the principle, construction, working of Null Potentiometer circuit andits and its application.
2.14   Know about temperature coefficient of resistance.
2.15   Know about industrial resistance thermometer bulbs.
2.16   Know about resistance thermometer elements.
2.17   Know about thermal wells and lead wires for resistance thermometers.

2.18 Know the indicating elements of industrial resistance thermometers like Wheat stone bridge circuit and Modified wheat stone bridge circuit also known as "Callender Griffith circuit".

2.19 Know about radiation temperature measurement.

2.20 Know about radiation receiving elements.

2.21 Know the types of radiation pyrometers.

2.22 Know about Optical pyrometer and its principle, construction and working.

Unit-3: Measurement of pressure and Vacuum:

3.1 Know the basic concepts of pressure measurement.

3.2 Know different types of pressures.

3.3 Know about different types of liquid column manometers, their principle construction and working.

3.4 Know different types of pressure measuring elements.

3.5 Know the mechanical indicating elements.

3.6 Know about inductance coil method of an indicating element.

3.7 Know about resistance rod indicating element.

3.8 Know about electric pressure gauge of indicating element.

3.9 Know about different types of vacuum gauges.

Unit-4: Measurement of Liquid level, Density and Viscosity.

4.1 Know the principle construction and working of liquid level method of measuring density.

4.2 Know the direct methods of liquid level measurement.

4.3 Know the principle construction and working of bubbler system for measurement of liquid level.

4.4 Know the level measurement in pressure vessels.

4.5 Know about principle construction and working of displacement float liquid level system.

4.6 Know about principle construction and working of pneumatic balance displacement float liquid level system.

4.7 Know the basic concepts for measuring density.

4.8 Know the principle construction and working of displacement-meter for measuring density by republic flow-meter Company.

4.9 Know the principle construction and working of hydrometer for density measurement.

4.10 Know the basic concept of viscosity measurement.

4.11 Know the principle construction and working of viscosity measurement by Viscosity meter-Brabender Corporation.

4.12 Know the principle construction and working of viscosity measurement by Continuous Viscosity meter.

Unit-5: Measurement of composition.

5.1 Know the determination of gas analysis by thermal conductivity method.

5.2 Know the determination of moisture content in gases by Psychrometer.

5.3 Know the determination of moisture in Paper and Lumber.

5.4 Know the determination of PH of a solution by PH cell (Measuring cell & Calomel cell) method.

5.5 Know about Spectroscopic methods of analysis

5.6 Know about Working Principle of Spectro-Photometer.

5.7 Know about Working Principle of Gas-Liquid Chromotography.

Unit-6: Process Instrumentation & Instrumentation diagrams for Chemical Engineering processes and operations:

6.1 Know about recording instruments used for process instrumentation.
6.2 Know about indicating and signaling instruments.
6.3 Know about control center.
6.4 Know about signal conversion devices.
6.5 Know about the instrumentation diagrams.
6.6 Know about the instrumentation diagram for a distillation column.
6.7 Know about the instrumentation diagram for an evaporator.
6.8 Know about the instrumentation diagram for a reactor.
6.9 Know about the instrumentation diagram for extractor

Unit-7: Principles of automatic process control and modes available for process control.

7.1 Know about a simple automatic process control.
7.2 Know about components of a control system.
7.3 Know about types of control systems.
7.4 Know the basic nomenclature associated with a control system.
7.5 Know about control actions.
7.6 Know the expressions for the transfer function for the proportional control, Proportional-Derivative, Proportional-Integral, Proportional-Integral-Derivative control actions.
7.7 Know about the components of a hydraulic system.
7.8 Know about the construction, working of a hydraulic system incorporated with Proportional, Proportional-Integral, Proportional-Derivative and Proportional-Integral-Derivative control action.
7.9 Know about the components of a pneumatic system.
7.10 Know about the construction, working of a Pneumatic system incorporated with Proportional, Proportional-Integral, Proportional-Derivative and Proportional-Integral-Derivative control action.
7.11 Know about Control valve, its components, working and characteristics.
7.12 Know about the Elaborate Explanation of programmable logic control and Distributive control system.

Course code CH-703	Course title : Instrumentation & Process Control Number of course outcomes:07				No. of periods:75
POs	**Mapped with CO No.**	**CO Periods addressing PO in Column 1**		**Level (1,2,3)**	**Remarks**
		No	**%**		>40%- level 3
PO1	CO1, CO2, CO4	30	40	2	
PO2	CO1, CO2	13	17	1	25%-40% level 2
PO3	CO3, CO5	32	43	3	
PO4					5-25% : level 1
PO5					
PO6					<5%: not addressed
PO7					

Hyponated course contents with Reference books

Unit-1: Introduction and Qualities of measurement

Importance of instrumentation --Meaning of measurement - Different elements of an instrument - Static characteristics of an instrument - Dynamic characteristics of an instrument - First order system and physical examples - Second order system and physical examples of second order system -Various input functions like Step input, Impulse input, Sinusoidal input and Linear input

Unit-2: Measurement of Temperature.

Different temperature scales in different units—Principle, working and working of expansion thermometers like Mercury in glass thermometer, Bi-metallic thermometer and Pressure spring thermometer - Vapor actuated thermometer--Sources of static error in industrial pressure spring thermometers - Thermo-electricity and thermo-electric circuit or Thermocouple - Accessories of an industrial thermocouple - Milli-voltmeter and its application - Null Potentiometer circuit and its and its application - Resistance thermometer elements - Wheat stone bridge circuit and Modified wheat stone bridge circuit -Radiation temperature measurement - Radiation receiving elements - construction and working - Optical pyrometer and Radiation pyrometer.

Unit-3: Measurement of pressure and Vacuum:

Basic concepts of pressure measurement - liquid column manometers - pressure spring gauge, Bellow pressure element, Diaphragm element, Differential pressure indicating manometer, Bell differential pressure gauge--Mechanical indicating elements, Principle, working and construction of Pressure tight shaft and torque tube shaft--Principle, construction and working of inductance coil method of an indicating element--Principle, construction and working of resistance rod indicating element--Principle construction and working of electric pressure gauge of indicating element--Principle construction and working of different types of vacuum gauges like Mc-leod vacuum gauge, Pirani vacuum gauge, Thermocouple vacuum gauge, Thermionic type ionization vacuum gauge.

Unit-4: Measurement of Liquid level, Density and Viscosity:

Basic concepts for measuring density--Principle construction and working of displacement-meter for measuring density by republic flow-meter Company--Principle construction and working of hydrometer for density measurement--Principle construction and working of liquid level method of measuring density--Direct methods of liquid level measurement, Float and tape liquid level system, Hydraulic remote transmission of liquid level system--Principle construction and working of bubbler system for measurement of liquid level--Level measurement in pressure vessels, Principle construction and working of differential pressure manometer for measuring liquid level in pressure vessels-- Principle construction and working of displacement float liquid level system--Principle construction and working of pneumatic balance displacement float liquid level system--Basic concepts of viscosity measurement--Principle construction and working of viscosity measurement by Viscosity meter-Brabender Corporation--Principle construction and working of viscosity measurement by Continuous Viscosity meter.

Unit-5: Measurement of composition:

Gas analysis by thermal conductivity method--Determination of moisture content in gases by Psychrometer--Determination of moisture in Paper and Lumber--Determination of P^H of a solution by P^H cell (Measuring cell & Calomel cell) method--Spectroscopic analysis methods, Absorption spectroscopy, Emission spectroscopy, Mass spectroscopy,Working Principle of Spectro -Photometer,Gas -Liquid Chromotography.

Unit-6: Process Instrumentation & Instrumentation diagrams for Chemical Engineering processes and operations:

Recording instruments used for process instrumentation, Circular recording chart and concentric indicating scale, Strip recording chart and linear indicating scale, Multi-record recorder-- Indicating and signaling instruments, Eccentric scale indicator, Concentric indicating scale-- Control center--Signal conversion devices, Transducer, Amplifier--Instrumentation diagrams-- Instrumentation diagram of Control schemes for heat exchangers-- Instrumentation diagram for a distillation column--Instrumentation diagram for an evaporator--Instrumentation diagram for a reactor, Instrumentation diagram for extractor.

Unit-7: Principles of automatic process control and modes available for process control.

Simple automatic process control system--Components of a control system, Process, measuring element, Controller, Comparator, Final control element, Types of control systems, Feedback control system or closed loop control system - Feed forward control system (Open loop control system)--Basic nomenclature associated with a control system, Load, Controlled variable, set point, error, measured variable, manipulated variable, Proportional gain, Proportional band, Offset--Control actions, Proportional control action, Integral control action, Derivative control action, Proportional-Integral control action, Proportional-Derivative control action, ON-OFF Control action, Proportional-Integral-Derivative control action--Expressions for the transfer function for the proportional control, Proportional-Derivative, Proportional-Integral, Proportional-Integral-Derivative control actions-- Know about the components of a hydraulic system--Construction, working of a hydraulic system incorporated with Proportional, Proportional-Integral, Proportional-Derivative and Proportional-Integral-Derivative control action--Components of a pneumatic system, Construction, working of a Pneumatic system incorporated with Proportional, Proportional-Integral, Proportional-Derivative and Proportional-Integral-Derivative control action--Control valve, its components, working and characteristics— Elaborate Explanation of programmable logic control and Distributive control system.

REFERENCE BOOKS:

1. Industrial Instrumentation by Donald P. Eckmann
2. Industrial Instrumentation & Control by S K Singh.
3. Process systems analysis & Control by Donald R. Coughanowr.
4. Chemical Process Control by George Stephanopoulos.
5. Process Control by Peter Harriot.
6. Instrumentation & Process Measurements by W Bolton.

MODEL BLUE PRINT WITH WEIGHTAGES FOR BLOOMS CATEGORY AND QUESTIONS FRO EACH CHAPTER AND COs MAPPED

S.No.	Major Topics	No of Periods	Weightage allocated	Marks wise distribution of weightage				Question wise distribution of weightage				Cos mapped
				R	U	Ap	An	R	U	Ap	An	
1.	Introduction and Qualities of measurement	8	6	6		-	-	1	1			CO1, CO2
2.	Measurement of Temperature.	12	13	3	10			1	1			CO3, CO5
3.	Measurement of pressure and Vacuum:	10	11	3	8		-	1	1			CO1, CO3
4.	Measurement of Liquid level, Density and Viscosity.	10	11	3	8			1	1			CO1, CO3
5.	Measurement of composition.	10	11	3	8			1	1			CO3, CO4
6.	Process Instrumentation & Instrumentation diagrams for Chemical Engineering processes and operations:	10	14	3	11			1	2			CO3, CO5
7	Principles of automatic process control and modes available for process control.	15	14	6		8		2		1		CO5
	Total	**75**	**80**	**27**	**45**	**8**		**8**	**7**	**1**		

C-20-CH-703
CH-703, Instrumentation & Process Control VII SEMESTER
Syllabus split up for Unit Test

Unit test NO	Learning out comes to be covered
Unit test-I	Objective from 1.1 to 4.12
Unit test-II	Objective from 5.1 to 7.12

State Board of Technical Education and Training , A.P
Diploma in Chemical Engineering
VII SEMESTER
Subject Name Instrumentation & Process Control
Subject Code: CH-703

Time: 90 minutes   **Unit Test I**   **Max .Marks:40**

Part-A   16Marks

Instructions: (1) Answer **all** questions.
         (2) First question carries **fou**r marks, each question of remaining carries **three** marks

1.   Write the following

      (a) time constant is the product of resistance and capacitance (true / false)   (CO1)

      (b) first order instrument will have ------ no.resistances and ------no of capacitances in series (CO1)

      (c) what is the positive wire in the iron-constantan thermocouple   (CO1)

      (d) The Ph of a basic solution ranges from ------------- to ------------------   (CO1)

2.   Differentiate between Ist. Order instrument and 2nd order instrument.   (CO1)

3.   Write about the elements of a instrument.   (CO1)

4.   State the accuracy of an instrument   (CO1)

5.   Write a short notes on psychrometer.   (CO1)

Part-B   **3X8=24Marks**

Instructions: (1) Answer **all** questions
(2) Each question carries **eight** marks
(3) Answer should be comprehensive and the criterion for valuation is the content but
         not the length of the answer .

 6. (a)   Derive the first order response equation for a first order instrument for a step change
      of A units.   (CO2)
                              or
      (b) Describe the static and dynamic characteristics of instruments.   (CO5)
7.   (a) Describe the working principles of thermocouples with figures   (CO3)
                              or
      (b) Explain the working principles of radiation pyrometers with neat sketches   (CO3)
8.   (a) Describe the mass spectroscopy with a neat diagram   (CO3)

                              or
      (b) Explain the working principles of a pH meter with neat diagrams   (CO3)

***

Q.No	Question	Blooms category	Marks allocated	CO adressed
	Part-A(30 marks)			
1.	Write the response equation for First Order Instrument for sinusoidal Input	remembering	3	CO2
2.	Explain about thermal walls.	Remembering	3	CO3
3.	List the various indicating elements for pressure gages.	understanding	3	CO1
4.	Explain the principle of Pirani gage.	Remembering	3	CO3
5.	Write the principle of a hydrometer-specific gravity meter.	understanding	3	CO3
6.	Explain about Fluorescence Spectroscopy.	Remembering	3	CO4
7.	Write short notes on Central layout.	understanding	3	CO1
8.	Write short notes on Indicating instruments.	remembering	3	CO1
9.	List the different types of control actions.	remembering	3	CO1
10.	Define Capacitance Self-regulation.	remembering	3	CO1
	Part-B(40 marks)			
11	Explain about Dynamic characteristics of an Instrument. (or) Find the response of first order system for a step input.	understanding	8	CO1 CO2
12	Explain the principle, construction and working of a bimetallic thermometer. (or) Write the mechanical properties of thermal well materials.	understanding	8	CO3 CO4
13	Describe the principle construction and working of resistance thermometer. (or) Explain the principle and working of optical pyrometer	understanding	8	CO3 CO3
14	Explain the construction and working of Mcleod gage.(or) Explain the working of Pirani gauge with a sketch.	understanding	8	CO3 CO3
15	Describe the principle construction and working of Bubbler system for liquid level measurement. (or) Explain the principle construction and working of continuous viscometer.	understanding	8	CO3 CO3
	Part-C(10 marks)			
16	Suggest different working fluids for pressure spring thermometer for different temperature ranges and explain its working process.	analyzing	10	CO5

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-704	Environmental studies and pollution control engineering	4	60	20	80

S.No.	Chapter/unit title	No. of periods	CO's Mapped
01.	Introduction to Environmental Studies & pollution	14	**CO1,CO2,CO5**
02.	Water pollution	10	**CO1,CO2, CO3,CO4**
03.	Air pollution	10	**CO1,CO2, CO3,CO5**
04.	Solid waste management	8	**CO1,CO3,CO4**
05.	Pollution control and safety in process industries	12	**CO1,CO3,CO5**
06.	Legal aspects of pollution	6	**CO4,CO5**
Total periods		**60**	

Course objectives

Course objectives	(i) To know environment, environment segments, pollution, forest and land resources, ecosystem, biodiversity, water conservation, natural disasters
	(ii) To water and air pollution, various pollutants in industrial wastes, air emissions, COD/BOD, treatment methods- air emission control methods
	(iii) To know solid wastes, methods of collection of solid wastes, disposal of solid wastes, pollution control in process industries and legal aspects of pollution

Course Outcomes

CO1	CH-7O4.1	Appraise the definitions, concepts ,safety in environment and chemical industries
CO2	CH-7O4.2	Classify environment and pollution
CO3	CH-7O4.3	Describe the controlling methods of pollution and solid waste management
CO4	CH-7O4.4	Explain sources, effects and aspects of air and water pollution
CO5	CH-7O4.5	Identify the features, characteristics, functions of various pollution control boards

CO-PO/PSO MATRIX

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CH-704.1	3							3		1
CH-704.2	3							3	1	
CH-704.3			2	1				3	1	1
CH-704.4	3							3		
CH-704.5		1						3		
Average	3	1	2	1				3	1	1

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

Note:

PO5:   Appropriate quiz program may be conducted at intervals as decided by concerned teacher.
PO6:   Seminars on applications of Environmental studies and Pollution control engineering in chemical engineering are to be planned   and conducted.
PO7:   Standard books must be referred in library; Latest updates in reputed national and international journals.

LEARNING OUTCOMES

1.0   Introduction to Environmental Studies & pollution
1.1   Define terms environment and environmental studies.
1.2   Explain the scope and importance of environmental studies.
1.3   Know the segments of environment– lithosphere, hydrosphere, atmosphere, biosphere, biotic component and energy component,
1.4   Understand the terms- pollutant, pollution, contaminant, receptor, sink, particulates, dissolved oxygen, Threshold limit value.
1.5   Know the impact of human being on environment.
1.6   Know the effect of environment on human being.
1.7   Classify the different types of pollution.
1.8   Understand the types of pollutants and their effects
1.9   Explain the use and over exploitation of forest resources and deforestation.
1.10   Explain the green house effect- ozone layer depletion and acid rain
1.11   Know the importance of land resources, land degradation, soil erosion and desertification.
1.12   Define an ecosystem and Biodiversity.
1.13   Explain water conservation, rain water harvesting and watershed management.
1.14   Explain the pollution case studies and natural disasters.
2.0   Water pollution
2.1   Define water pollution and origin of waste water.
2.2   List and classify various pollutants in industrial waste waters.
2.3   Know the characteristics of waste water like oxygen demanding wastes, disease causing agents , synthetic organic compounds.
2.4   Define BOD and COD and understand in detail their significance.
2.5   Describe the methods of treatment of waste water
2.6   Describe the methods of primary treatment of waste water

2.7   Describe secondary treatment methods
       (a). Activated Sludge process   (b). Trickling Filter   (c).   Lagoons
2.8   Describe Tertiary treatment/ Advanced treatment methods.
2.9   Describe the methods of disposal of sludge

3.0   Air pollution
3.1   Define and understand air pollution.
3.2   Know the classification of air pollutants and properties of air pollutants.
3.3   Know the sources of air pollutants and their effects.
3.4   Understand the air pollution control methods.
3.5   Describe particulate emission control – Gravity settling chamber, cyclone separator, fabric filter, electrostatic precipitator & wet scrubber
3.6   Describe the gaseous emission control-Absorption by liquids, absorption by solids, cleaning of gaseous effluents.

4.0   Solid waste management
4.1   Define solid waste and know the classification.
4.2   Know the sources of solid wastes and the characteristics of solid wastes.
4.3   Know the effect of solid waste on public health.
4.4   Explain the methods of collection of solid waste
4.5   Know about Transfer station
4.6   Know the potential methods of disposal of solid waste-a) Open dumping b)Sanitary Land filling c) Land composting d) Incineration e) pyrolysis)
4.7   Know about Hazardous Waste management
4.8   Know about recycling and reuse.

5.0   Pollution control and safety in process industries
5.1   Know the characteristics and treatment methods of wastes from pulp and paper industries.
5.2   Know the characteristics and treatment methods of wastes from fertilizer industries.
5.3   Know the characteristics and treatment methods of wastes from petroleum refinery industries.
5.4   Know the characteristics and treatment methods of wastes from sugar industries
5.5   Know about risks associated with industrial activity.
5.6   Know about hazards in chemical processes such as nitration and halogenation.
5.7   Know about material safety data sheet (MSDS)
5.8   Know about selection of protective equipment for the handling of different chemical substances.

6.0   Legal aspects of pollution
6.1   Know the various legal aspects involved in pollution control.
6.2   Know the salient features of air act and water act.
6.4   Know the salient features of environmental protection act.
6.5   Understand the functions of State pollution control board and Central pollution control board.

COURSE CONTENTS:

1.0   Environmental studies
       Environment and environmental studies - scope and importance of environmental studies - segments of environment– energy component - pollutant, pollution, contaminant, receptor, sink, particulates, dissolved oxygen, Threshold limit value –Environmental pollution - types of pollution - types of pollutants and their effect - deforestation - green house effect- ozone layer depletion - acid rain - land resources, land degradation, soil erosion – desertification – ecosystem - producers, consumers, decomposers – biodiversity - water conservation, rain water harvesting and watershed management - pollution case studies and natural disasters .

2.0   Introduction to pollution and Water pollution

water pollution - origin of waste water - industrial waste waters - characteristics of waste water - BOD and COD - primary treatment, secondary treatment- Activated sludge process,Trickling filter,Lagoons and tertiary treatment - - disposal of sludge.

3.0   Air pollution

Air pollution -   classification – properties - sources of air pollutants and their effects - air pollution control methods - particulate emission control –Gravity settling chamber, cyclone separator, and fabric filter electrostatic precipitator wet scrubber - gaseous emission control- Absorption by liquids, absorption by solids, cleaning of gaseous effluents.

4.0   Solid waste management

Solid waste - classification – sources - characteristics - effect on public health - collection of solid waste, Transfer station, Disposal methods – Open dumping, Land composting, sanitary land filling , incineration and pyrolysis – Hazardous waste management- recycling and reuse.

5.0   Pollution control and safety in process industries

Characteristics of wastes from pulp and paper, fertilizer, petroleum refinery, sugar industries - treatment methods of wastes from pulp and paper , fertilizer, petroleum refinery, sugar industries- risks associated with industrial activity-hazards in chemical processes such as nitration and halogenation- material safety data sheet (MSDS)-selection of protective equipment for the handling of different chemical substances.

.6.0   Legal aspects of   pollution

Legal aspects- air act. - water act - environmental protection act - functions of state pollution control board, central pollution control board.

REFERENCE BOOKS:

1. Environmental pollution control engineering by C.S.Rao, Wiley eastern Ltd., New age international Ltd.
2. Pollution control in process industries by S P Mahajan, T.M.H Publications.
3. Environmental chemistry & pollution control by S.S.Dhara, S.Chand. Company Ltd.
4. Environmental Engineering by G.N.Pandey, G.C.Carney: T.M.H Publishers.
5. Industrial hygiene & Chemical safety by M.H.Fulekar ,I.K.International
6. Industrial health and safety management by A.M .Sarma , Himalaya publishing house
7. Renewable energy sources and emerging technologies, 2nd edition, Prentice Hall Publishers
8. Advances in waste to energy technologies 2020 edition, CRC press.

C-20
ENVIRONMENTAL STUDIES AND POLLUTION CONTROL ENGINEERING
PO- CO – Mapping strength

PO no	Mapped with CO no	CO periods addressing PO in column I		Level (1,2 or 3)	Remarks
		No	%		
1	CO1, CO2, CO4	21	35%	2	
2	CO4	10	16%	1	>40% Level 3 Highly addressed
3	CO3	21	35%	2	
4	CO3	21	35%	2	
					25% to 40% Level 2 Moderately addressed
					5% to 25% Level 1 Low addressed
					<5% Not addressed

Model Blue print with weightages for Blooms category and questions for each chapter and COs mapped

S.No	Chapter/unit title	No. of periods	Weightage allocated	Marks wise Distribution of weightage				Question wise Distribution of weightage				CO'sMapped
				R	U	Ap	An	R	U	Ap	An	
1	Introduction to Environmental Studies & pollution	16	17	3	6	8		1	2	1		CO1,CO2,CO5
2	Water pollution	10	14	3	3	8		1	1	1		CO1, CO2, CO3,CO4
3	Air pollution	10	14	3	3	8		1	1	1		CO1,CO2, CO3,CO5
4	Solid waste management	8	11	3	-	8		1	-	1		CO1,CO3,CO4
5	Pollution control in process industries	10	18	-	-	8	10	-	-	1	1	CO3,CO5
6	Legal aspects of pollution	6	6	3	3	-	-	1	1	-	-	CO4,CO5
	Total	**60**	**80**	**15**	**15**	**40**	**10**	**5**	**5**	**5**	**1**	

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

Unit Test	Learning outcomes to be covered
Unit Test-I	From1.1 to 3.3
Unit Test-II	From3.4 to 6.5

State Board of Technical Education and Training, A.P
Diploma in Chemical Engineering
VII Semester
Subject Name**: Environmental Studies and Pollution Control Engineering**
Subject Code**: CH-704**
Unit Test-1

Time **:** 90minutes   Max Marks: 40

PART-A   **16marks**

Instructions: (1) Answer **all** questions.
(2) First question carries **four** marks and rest of the questions carries **three** marks

1. (a) Define Environment.
    (b) Define ecosystem.
    (c)Write various pollutants in industrial waste water?   CO1
    (d)what is air pollution
2. Explain green house effect?   CO4
3. Define BOD and COD and write their system.   CO1
4. Write about Tertiary treatment method.   CO3
5. Write about gravity settling chamber.   CO3

PART-B   **3x8=24Marks**

Instructions:1) Answer **all** questions.
2) Each question carries **eight** marks.
3) Answer should be comprehensive and the criterion for valuation is   the
content but not the length of the answer.

6. Explain the segments of environment and the effects of environment on human being.
                                            Or
    Explain rain water harvesting and acid rain.   CO1

7. Explain primary and secondary treatment methods of waste water.   CO3
                                            Or
    Explain various methods of disposal of sludge

8.   Explain the method of particulate emission control by cyclone separator and electrostatic
     precipitator.   CO3
                                            Or
    Explain the gaseous emission control method by absorption by liquids

*****

TIME :3 HOURS   **MAX.MARKS:80**

<div align="center">

Part –A   **10x3=30**

</div>

Instructions:1) Answer **all** questions.
              2) Each question carries **three** marks.
              3) Answer should be brief and straight to the point and shall not exceed five simple
                 sentences.

1. Write the importance of Environmental Studies   (CO1)
2. Define Ecosystem and Biodiversity   (CO1)
3. Write about water conservation   (CO1)
4. Define BOD and COD   (CO2)
5. Write about primary treatment of waste water.   (CO3)
6. Write the sources of air pollutants.   (CO4)
7. Write briefly about Gravity settling chamber.   (CO3)
8. What are the sources of solid waste?   (CO4)
9. Write three salient features of Water act.   (CO5)
10. Write the functions of state pollution control board.   (CO5)

<div align="center">

Part-B

</div>

Instructions: 1) Answer **all** questions.   2) Each question carries **eight** marks.
        3) Answer should be comprehensive and the criterion for valuation is the
           content but not the length of the answer.

11. Write the segments of environment and write about ozone layer depletion.   (CO1)
<div align="center">or</div>
    Explain water conservation , water harvesting and water shed management   (CO1)
12. Write various pollutants in industrial waste waters and origin of waste water.   (CO2)
<div align="center">Or</div>
    Describe the following secondary treatment of waste water.
a)   Activated sludge process   b) Trickling filter   c) Lagoons   (CO3)

13. Write about classification of air pollutants and sources of air pollutants   (CO2)
<div align="center">Or</div>
    Describe the gaseous emission control-Absorption by liquids and absorption by   solids.   (CO3)
14. Explain various methods of collection of solid waste   (CO2)
<div align="center">Or</div>
    Write about Hazardous waste management, recycling and reuse.   (CO3)
15. Write the characteristics and treatment methods of wastes from pulp and paper industries.
                                                                                          (CO3)
<div align="center">Or</div>
    Write various Hazards taking place in chemical processes.   (CO2)

<div align="center">

Part –C

</div>

Instructions: 1) Answer the question below.It carries 10 marks
              2) Answer should be comprehensive and the criterion for valuation is the content but
                 not the length of the answer.
16. Why the treatment methods are necessary for the wastes from fertiliser industry.   (CO3)
<div align="center">***</div>

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-705	Energy Technology	5	75	20	80

S.No.	Chapter/unit title	No. of periods	CO's Mapped
01.	Introduction to energy Sources and Solid fuels	14	CO1,CO2
02.	Liquid & Gaseous fuels	18	CO1,CO2,CO3
03.	Combustion Principles, furnaces & Refractories	19	CO1 to CO5
04.	Non Conventional energy sources	16	CO1,CO2,CO3
05.	Energy conservation	08	CO1,CO2
	Total periods	**75**	

Course objectives

Course objectives	ii. To know energy resources, solid, liquid and gaseous fuels
	iii. To know about principles of combustion, furnaces and refractories
	iv. To know about non-conventional energy sources and energy conservation

Course Outcomes

CO1	CH-7O5.1	**Classify energy sources and appraise definitions**
CO2	CH-7O5.2	**Analyse the fuels**
CO3	CH-7O5.3	**Find the concepts in fuels and related processes**
CO4	CH-7O5.4	**Describe various apparatus for testing of fuels**
CO5	CH-7O5.5	**Illustrate the principles and applications of furnaces and refractories with diagrams**

CO-PO/PSO MATRIX

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CH-705.1	3							3		
CH-705.2		1						3	1	1
CH-705.3	3							3	1	
CH-705.4				1				3		
CH-705.5			1					3		1
Average	3	1	1	1				3	1	1

3= strongly mapped

2= moderately mapped

1= slightly mapped

Note:

PO5: Appropriate quiz program may be conducted at intervals as decided by concerned teacher.

PO6: Seminars on applications of energy technology in chemical engineering are to be planned and conducted.

PO7: Standard books must be referred in library. Latest updates in reputed national and international journals.

LEARNING OUTCOMES

1.0   Introduction to energy Sources and Solid fuels
1.1   Classification of energy sources with examples
1.2   Conventional energy sources viz solid, liquid & gaseous fuels
1.3   Information of coal and constituents of coal
1.4   Manufacture of coke by High Temperature carbonization of coal includes by-products recovery.
1.5   Know the selection of coal for different applications
1.6   Know the Classification of chemical Energy systems
1.7   Understand Rank of coal and Classification of coal by rank.
1.8   Understand proximate and Ultimate analysis of coal

2.0   Liquid & Gaseous fuels
2.1   Know about Occurrence of crude petroleum and exploration of crude petroleum.
2.2   Understand Crude petroleum refinery operations-CDU.
2.3   Know Conversion process like cracking, reforming.
2.4   Know about Fluid Catalytic Cracking
2.5.   Understand Catalytic reforming
2.6   Explain Analysis of liquid fuels to determine Flash point, fire point by Abel's apparatus, Pensky-Martin apparatus
2.7   Know about Octane number, Diesel index, Cetane number and Knocking Tendency.
2.8   Know the procedure of determination of the viscosity of an oil using Redwood viscometer.
2.9   Classification of gaseous fuels-
        (a). Natural Gas (b). Coke Oven Gas (c) BF Gas (d).Water Gas (e). Producer Gas   (f). LPG

3.0   Combustion Principles, furnaces & Refractories
3.1   Combustion Principles of solid fuels.
3.2   Determination of calorific value of solid fuel (coal) by Bomb calorimeter.
3.3   Function of stoker and comparison between hand firing & mechanical firing devices.
3.4   Know the firing of liquid and gaseous fuels.
3.5   Know the classification of furnaces on various factors
3.6   Know the general features of the furnace.
3.7   Know the furnace used in cement manufacture
3.8   Know the factors for fuel economy of a furnace
3.9   Know the classification and properties of Refractories
3.10   Know the Causes for failure of refractories and applications of refractories.
3.11   Explain Manufacture of fire clay and silica refractories.

4.0   Non Conventional energy sources
4.1   Know the nuclear energy
4.2   Understand the nuclear raw materials
4.3   Differentiate the fission – fusion reactions.
4.4   Classification of nuclear reactors.
4.5   Explain the manufacture of heavy water (D_2O)
4.6   Understand solar energy and wind energy with applications.
4.7   Know the Bio energy and applications
4.8   Understand the geothermal energy .
4.9   Know the Hydal – Tidal – ocean wave energy
4.10   Know about storage of energy –batteries and fuel cells

5.0   Energy conservation
5.1   Know the importance of energy conservation
5.2   Know the factors affecting fuel economy in furnace
5.3   Know the energy conservation with reference to thermal insulation
5.4   Know the energy conservation in iron and steel plants

COURSE CONTENT:

1.0   Introduction to Energy sources and solid fuels: Classification of energy sources conventional energy – Non conventional energy. Coal – origin – constituents of coal- Low and high temperature carbonization (LTC and HTC)- manufacture of coke & Byproducts recovery – Coal classification by Rank – Ultimate and proximate analysis- Applications of coal for different uses.

2.0   Liquid and Gaseous Fuels: Crude Petroleum - Refining operations – CDU, FCC, Catalytic Reforming – Abel's apparatus, Octane number, Diesel index, Cetane number, Knocking tendency- Viscosity using red wood viscometer-Classification of gaseous fuels.

3.0   Combustion Principles, Furnaces and Refractories:
Combustion Principles of Fuels: Solid fuels calorific value by bomb calorimeter, solid fuel firing by stokers. Liquid and gaseous fuel firing by burners.

Furnaces: Classification on various factors – General Features of a furnace – Furnaces used in in cement Industry – Fuel economy of furnace.

Refractories: Classification of refractories – properties of refractory – manufacture of refractory – Fire clay/silica - causes for failure of refractory – applications of refractories.

4.0   Non conventional energy sources: Nuclear energy – nuclear fuels – fission fusion – Classification of Nuclear Reactors - Heavy water (D_2O).
Solar Energy - Wind energy - Bio Energy –Geothermal -Hydal, Tidal, ocean- wave energy Applications –energy storage –Batteries and fuel cells.
Energy Conservation: Importance - Factors effecting fuel Economy in furnace,
Energy conservation with reference to thermal insulation - Energy conservation in
selected Industries like iron and steel industries.

REFERENCE BOOKS:

1.   Elements of fuels furnaces & Refractories – O.P.Gupta, Khanna Publishers, New Delhi.
2.   Fuel Combustion and Energy Technology, S.N.Saha, Dhanpatrai Publishing Co., New Delhi.
3.   Dryden's Outlines of Chemical Technology, 3rd edition, M.Gopal Rao, Marshall Sittig,   East West Press Pvt. Ltd., New Delhi

C-20
ENERGY TECHNOLOGY
PO- CO – Mapping strength

PO no	Mapped with CO no	CO periods addressing PO in column I		Level (1,2 or 3)	Remarks
		No	%		
1	CO1,CO3	41	55%	3	>40% Level 3 Highly addressed
2	CO2	18	24%	1	
3	CO5	14	19%	1	
4	CO4	2	3%	Not addressed	
					25% to 40% Level 2 Moderately addressed
					5% to 25% Level 1 Low addressed
					<5% Not addressed

Model Blue print with weightages for Blooms category and questions for each chapter and COs mapped

S.No	Chapter/unit title	No. of periods	Weightage allocated	Marks wise Distribution of weightage				Question wise Distribution of weightage				CO'sMapped
				R	U	Ap	An	R	U	Ap	An	
1	Introduction to energy Sources and Solid fuels	14	**14**	3	3	8	--	1	1	1	--	CO1,CO2
2	Liquid & Gaseous fuels	18	**24**	3	3	8	10	1	1	1	1	CO1,CO2,CO3
3	Combustion Principles, furnaces &Refractories	19	**20**	3	9	8	--	1	3	1	--	CO1 to CO5
4	Non Conventional energy sources	16	**14**	3	3	8	--	1	1	1	--	CO1,CO2,CO3
5	Energy conservation	08	**8**	-	-	8	--	--	--	1	--	CO1,CO2
	Total	**75**	**80**	**12**	**18**	**40**	**10**	**4**	**6**	**5**	**1**	

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

Unit Test	Learning outcomes to be covered
Unit Test-I	From 1.1 to 2.9
Unit Test-II	From 3.1 to 5.4

Model paper 1
C-20,CH-705
State Board of Technical Education and Training, A.P
Diploma in Chemical Engineering(DCHE)
VII SEMESTER

Subject Name: Energy Technology   **Subject code: CH-705**

Unit Test-1

Time : 90minutes   **Max Marks: 40**

PART-A   **16Marks**

Instructions:1)Answer **all** questions.
        2) First question carries **four** marks and rest of the questions carries **three** marks.

1.   a) What are the different types of calorific values?   (CO1)

     b) What is nuclear energy?   (CO1)

     c) What is Bio-energy?   (CO1)

     d) What is energy conservation?   (CO1)

2.   Write the causes for failure of refractories.   (CO1)

3.   Differentiate between hand firing & mechanical firing devices.   (CO2)

4.   Write about the advantages of Solar energy.   (CO1)

5.   What are factors affecting fuel economy in furnace?   (CO3)

PART-B   **3X8=24 Marks**

Instructions: 1) Answer **all** questions.
        2) Each question carries **eight** marks.
        3) Answer should be comprehensive and the criterion for valuation is the content but
           not the length of the answer.

6.   a)Explain about the classification of Refractories.   (CO1)
                    or
    b)Explain the classification of furnaces on various factors.   (CO2)

7.   a) Describe how the wind energy is obtained and write its applications.   (CO4)
                    or
b) Write about manufacture of heavy water (D20) with a neat sketch.   (CO3)

8.   a) What is the importance of energy conservation and how energy conserved with
     reference to thermal insulation?   (CO1)
                    or
    b) Write in detail about the energy conservation in iron and steel plants.   (CO4)

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BOARD DIPLOMA EXAMINATION
D.CH.E-VII SEMESTER
ENERGY TECHNOLOGY

<u>**Time: 3 hours**</u> **Max. Marks: 80**

PART – A **3X10=30**

Instructions: 1. Answer **all** questions.
2. Each question carries **Three** marks.
3. Answers should be brief and straight to the point and should not exceed five simple sentences.

1. What are the different conventional energy sources?

2. What do you understand by convectional energy sources?

3. What is the composition of crude petroleum?

4. What are advantages and disadvantages of liquid fuels?

5. Define calorific value of a fuel and mention its units?

6. What are the characteristics required for a good mechanical stoker.

7. What are the advantages of mechanical stoker over hand firing?

8. Name the various types of liquid fuels.

9. What is meant by nuclear fusion?

10. What are nuclear raw materials?

PART – B **5x8=40**

Instructions: 1. Answer any **Five** questions.
2. Each question carries **EIGHT** marks.
3. Answer should be comprehensive and the criteria for valuation is the content but not the length of the answer.

11) (a) Explain about the classification of chemical energy systems.

OR

(b) Explain the process of Ultimate analysis to determine various elements present in coal.

12) (a) Explain about atmospheric distillation with the product ranges with a neat flow sheet.

OR

(b) Explain the catalytic cracking process with a neat flow sheet.

13) (a) Explain how you determine the C.V. of solid fuel (coal) by Bomb calorimeter.

OR

(b) Write down the construction and working of pot furnace.

14) (a) Explain the manufacturing of solar energy and its merit & demerits.

OR

(b) Explain about the manufacturing and applications of wind energy.

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15) (a)Write in detail about the factors to be considered for fuel economy in a furnace.

OR

(b)Explain in detail about the energy conservation in iron and steel plants.

PART – C   **1x10=10**

Instructions: 1. Answer the following compulsory question.
2. This question carries Ten marks.
3. Answer should be comprehensive and the criteria for valuation is the content but not the length of the answer.

16)   What are the advantages and disadvantages of Pensky martin apparatus over Abel's apparatus in determining the flash and fire points?

***

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-706	Chemical plant equipment drawing	6	90	40	60

S.No.	Chapter/unit title	No. of periods	CO's Mapped
01.	Drawing of heat transfer equipment	25	CO1
02.	Drawing of mass transfer and mechanical unit operations	25	CO1
03.	Process flow diagrams using process description (flow sheeting)	20	CO2
04.	Process instrumentation diagrams, process equipment layouts and plant layouts	20	CO3,CO4,CO5
	Total periods	**90**	

Course objectives

Course objectives	1) To draw various heat transfer, mass transfer and mechanical unit operations equipment 2) To draw process block diagram/flow diagram using process description 3) To draw process instrumentation diagrams, process layouts and plant layouts

Course Outcomes

Course Outcomes	CH-706.1	Demonstrate the skill of drawing and labelling heat transfer, mass transfer and mechanical unit operations equipments
	CH-706.2	Practice the flow sheeting of process flow diagrams using process description for the production of various chemical compounds
	CH-706.3	Sketch the instrumentation diagrams of the equipments for unit operations
	CH-706.4	Follow the principles of process equipment layout in chemical process industries
	CH-706.5	List the factors in identification of plant location for the proposed chemical process plant layout

Learning Outcome
Chapter-1
1.1   Draw a neat sketch of Shell & tube heat exchanger (1-1)
1.2   Draw a neat sketch of 2-4 Shell & tube heat exchanger
1.3   Draw a neat sketch of Short tube vertical evaporator
1.4   Draw a neat sketch of Long tube forced circulation evaporator

Chapter-2
2.1   Draw a neat sketch of Rotary drum vacuum filter
2.2   Draw a neat sketch of Bubble cap plate
2.3   Draw the neat sketch of Jaw crusher
2.4   Draw a neat sketch of Plate & Frame filter press
2.5   Draw a neat sketch of Basket centrifuge
2.6   Draw a neat sketch of Rotary drum driers
2.7   Draw a neat sketch of Crystallizer

Chapter-3

3.1   Draw the sketch for the production of glacial acetic acid using acetaldehyde
3.2   Draw the sketch for the production of para-nitroaniline from Para –nitrochlrobenzene
3.3   Draw the sketch for the production of acetone from Iso-propanol
3.4   Draw the sketch for the production of Diethyl oxalate from oxalic acid and ethanol
3.5   Draw the sketch for the conversion of ethanol to alcohol by azeotropic distillation
3.6   Draw the sketch for the manufacture of any fertilizer /any petrochemical product.

Chapter-4
Part-A
4.1   Draw the Instrumentation diagram for Reactor temperature control
4.2   Draw the Instrumentation diagram for Hot fluid temperature control in heat exchanger
4.3   Draw the Instrumentation diagram for Spray drier temperature control
4.4   Draw the Instrumentation diagram for Control of mechanically agitated vessel   used for gas absorption
4.5   Draw the Instrumentation diagram for Distillation column tower pressure control
Part-B
4.6   Understand the important Equipment layout in Ammonia plant
4.7   Understand the important Equipment layout in water treatment plant
4.8   Understand the important Equipment layout in sugar manufacturing unit
4.9   Understand the important Equipment layout in paper industry
4.10   Understand the important Equipment layout in cement plant

Part-C
4.11   Know the diagram of project layout for phosphoric acid, urea plant, ammonia plant and utilities of DAP plant in fertilizer Industry
4.12   Know the diagram of a project layout consisting various units of pulp and paper Industry
4.13   Know the diagram of project layout of CDU, FCCU, utilities etc in petroleum refinery
4.14   Understand the diagrams of a project layout of Glycerin, vanaspathi, soap of vegetable oil industry.

COURSE CONTENTS:

Unit-1: Drawings of Chemical Engineering equipment
        Draw the neat sketches of Shell & tube heat exchanger (1-1)- 2-4 Shell & tube heat exchanger - Short tube vertical evaporator - Long tube forced circulation evaporator .
Unit-2: Draw the neat sketches of Rotary drum vacuum filter - Bubble cap plate - Jaw crusher- Plate & Frame filter press- Basket centrifuge- Rotary drum driers- Crystallizer.
Unit-3   Process flow diagrams using process description (Flow sheeting)
        Production of glacial acetic acid using acetaldehyde solution- Para-nitro aniline from Para-nitrochlrobenzene.- acetylene from Isopropanol- Diethyl oxalate from oxalic acid and ethanol - Conversion of ethanol to alcohol by Azeotropic distillation – fertilizer / a petrochemical product.
Unit-4: Process instrumentation diagrams of equipments
        Reactor temperature control-   Hot fluid temperature control in heat exchanger - Spray drier temperature control--Control of mechanically agitated vessel used for gas absorption-Distillation column tower pressure control.
        Process equipment layout
        Equipment layout in Ammonia plant - water treatment plant - sugar manufacturing unit- paper industry - cement plant

Plant layouts and location identification

Plant layout for phosphoric acid - urea plant in fertilizer industry - D.A.P plant- pulp and paper industry - petroleum refinery - Vegetable oil industry for vanaspathi.

REFERENCE BOOKS:

1. Chemical Engineering drawing by KA Ghavane, Nirali publications
2. Chemical Engineering drawing by R.S.Hiremath. Nirali Publications.
3. Introduction to Chemical Engineering by Badger & Benchero, Mc Graw Hill Publications
4. Unit operation of Chemical Engineering by Mc Cabe and smith –Mc Graw Hill publications
5. Plant design drawing by vibrant & Dryden, Mc Graw Hill publications

Model Blue print with weightages for Blooms category and questions for each chapter and COs mapped

S.No	Chapter/unit title	No. of periods	Weightage allocated	Marks wise Distribution of weightage				Question wise Distribution of weightage				CO's Mapped
				R	U	Ap	An	R	U	Ap	An	
1	Drawing of heat transfer equipment	25	**15**			**15**				**1**		CO1
2	Drawing of mass transfer and mechanical unit operations	25	**15**			**15**				**1**		CO1
3	Process flow diagrams using process description (flow sheeting)	20	**15**			**15**				**1**		CO2
4	Process instrumentation diagrams, process equipment layouts and plant layouts	20	**15**			**15**				**1**		CO3,CO4,CO5
	Total	**90**	**60**			**60**				**4**		

Note: The question from chapter-4 consisting of 3 sub questions from each part with 5 marks

(Chapter-4: PartA-5 Mark, PartB-5 Marks, PartC-5 Marks)

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-707	Instrumentation and Process Control& Reaction Engineering Lab	3	45	40	60

Course Objectives	(i) To familiarize with the knowledge different materials tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant experiments/exercises	
Course Outcomes	CH-707.1	Demonstrate the skill of planning and organizing experimental set up for a desired purpose
	CH-707.2	Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems
	CH-707.3	Observe various parameters, their variations and graphically represent the same
	CH-707.4	Analyse the experimental results to draw inferences to make recommendations
	CH-707.5	Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

Learning outcome
INSTRUMENTATION PROCESS CONTROL LAB

1. Perform the experiment to calibrate the following thermocouples.
   (a). Iron- constantan (b). Copper- constanton (c). Chromel- Alumel
2. Measure the temperature using resistance thermometer.
3. Calibrate an unknown pressure gauge using dead weight piston gauge.
4. Determine the time constant and response in two tank interacting system by conducting experiment.
5. Determine time constant and response in two tank non-interacting system by performing experiment.
6. Determine the time constant and response in single tank system by conducting experiment.
7. Perform an experiment to study the Control valve characteristics.
8. Perform an experiment to study the response. of "on-off " control system.

REACTION ENGINEERING LAB

1. Perform an experiment to calculate the volume required for constant volume batch reactor.
2. Perform an experiment to calculate the volume required for constant volume steady state mixed flow reactor.
3. Perform an experiment to calculate the volume required for constant volume steady state plug flow reactor.

Life Skills

Course Code	Course Title	No. of Periods/Week	Total No. of Periods	Marks for FA	Marks for SA
CH-708	Life Skills	3	45	40	60

S. No.	Unit Title	No of Periods	COs Mapped
1	Attitude	4	CO1
2	Adaptability	4	CO1, CO2
3	Goal Setting	4	CO1, CO2, CO3
4	Motivation	4	CO1, CO2, CO3
5	Time Management	4	CO2
6	Critical thinking	4	CO3
7	Creativity	4	CO3
8	Problem Solving	5	CO3
9	Team Work	4	CO4
10	Leadership	4	CO4
11	Stress Management	4	CO4
Total Periods		**45**	

Course Objectives	To understand the importance of Life skills for acceptable, sustainable and ethical behaviour in academic, professional and social settings
	To exhibit language competence appropriate to acceptable social and professional behaviour.
	To demonstrate time management, stress management, team skills, problem solving ability to manage oneself in academic, professional and social settings.

CO-PO Matrix

CO No.	Course Outcomes
CO1	Demonstrates positive attitude and be able to adapt to people and events
CO2	Fixes personal and professional goals and manages time to meet targets
CO3	Exhibits critical and lateral thinking skills for problem solving.
CO4	Shows aptitude for working in teams in a stress free manner and sometimes/ very often/ mostly display leadership traits.

Course Code CH-708		Course Title: English Number of Course Outcomes: 4			No. of Periods: 45
POs	Mapped with CO No.	CO Periods Addressing PO in Column 1		Level of Mapping (1,2,3)	Remarks
		Number	Percentage %		
PO1		Not directly applicable for Life Skills Course. However activities that use content and situations from academic, professional and social settings relevant to the Programme shall be exploited for triggering thought and interaction in the Course.			
PO2					
PO3					
PO4					
PO5	CO1, CO2, CO3, CO 4	11	25%		>60%: Level 3
PO6	CO1, CO2, CO3, CO4	27	45%		16 -59%: Level 2
PO7	CO1, CO2, CO3, CO4	7	30%		Up to 15%: Level 1

Level 3 – Strongly Mapped
Level 2- Moderately Mapped
Level 1- Slightly Mapped
Mapping Course Outcomes with Program Outcomes:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1					✓	✓	✓
CO 2					✓	✓	✓
CO3					✓	✓	✓
CO4					✓	✓	✓

Blue Print for evaluation based on Course Outcomes for SA:
Note: Every Activity based Question that focuses on COs and responses as exhibited through communication has to be given marks for the following parameters:

- Clarity of Thinking as Exhibited through Content
- Features of Etiquette

*Rubric Descriptors 'Outstanding/ Very Good/ Good/ Satisfactory/ Poor' levels of Competence

Level of Competence	Parameters of Assessment	
	Clarity of thinking as exhibited through content	**Features of etiquette**
Outstanding 10	**Thinking** is **extremely logical** and suggested course of action is **feasibile** Shows **creativity and uniqueness** Exhibits **expert use of expression** (organizational devices and discourse markers) that denote clarity in thought.	Exhibits **courtesy to all most appropriately** with **confidence**
Very Good 8/9	**Thinking** is **clear and logical** Suggested **course of action is feasible** Shows **traces of creativity** Exhibits **good expression** (organizational devices and discourse markers) that denote clarity in thought.	Exhibits **courtesy to all to a considerable level.**
Good 6/7	**Thinking is clear and logical most of the time**. Lacks creativity or out of the box thinking as expressed through content.	Exhibits **courtesy / politeness to an acceptable level.**
Satisfactory 4/5	**Thinking is logical**; However **expressing content is disjointed and disorganized.**	Has courtesy but often fumbles with language.
Poor 3 or less than 3	**Thoughts** as expressed through content are **incoherent. Language skills are very limited.**	Fails to show courtesy to others.

Blue Print for evaluation based on Course Outcomes for SA of each student:

Note: Marks are awarded for each student as per the Rubric descriptors.

S No.	Questions based on Course Outcomes	Periods Allocated for practical work	Max Marks	Poor >3	Satisfactory 4 /5	Good 6/7	Very Good 8/9	Outstanding 10
1	Short presentation on GOALS with Timeline and Action Plan	12	10					
2	State what you will do in the given situation (Assesses adaptability and critical thinking skills, leadership, team skills)	12	10					
3	In how many different and creative way can you use _____ (Object) other than its primary use	8	10					
4	What solutions can you think of for _____ problem.	13	10					
	Total	**45**	**60**					

Note: The marks that are awarded for the student for 40 to be increased proportionally for 60.

Learning Outcomes

1.   Attitude Matters :

1.1   Understand the importance of positive attitude and the consequences of negative attitude.

1.2   Demonstrate positive attitude in dealing with work-related issues and in personal life.

2.   Adaptability….makes life easy :

2.1   Understand the significance of adaptability.

2.2   Show adaptability whenever needed, both at place of work and on personal front.

3.   Goal Setting … life without a Goal is a rudderless boat!

3.1   Understand the SMART features of goal-setting.

3.2   State one's short-term and long-term goals and spell out plans to achieve them.

4.   Motivation … triggers success!

4.1   Comprehend the need for motivation in order to achieve success in life.

4.2   State how one is motivated in life.

4.3   Show the impact of motivation on one's life

5.   Time Management… the need of the Hour!

5.1   Understand the value of time management and prioritizing in life

5.2   Demonstrate the effect of time management on one's professional work.

6.   Critical Thinking … logic is the key!

6.1 Distinguish between facts and assumptions

6.2 Use logical thinking in dealing with professional matters

7. Creativity … the essential you!

7.1 Understand the importance of thinking out of the box in dealing with critical issues

7.2 Solve problems using creativity / imagination

8. Problem Solving … there is always a way out!

8.1 Understand the need for and importance of problem solving.

8.2 Use logic or creativity to solve a problem at workplace or home.

9. Team Work… together we are better!

9.1 Understand the need for team skills / team building

9.2 Demonstrate one's skills as a team player

10. Leadership… the meaning of a leading!

10.1 Understand the need for team skills / team building

10.2 Demonstrate one's skills as a team player

11. Stress Management… live life to the full!

11.1 Understand what causes stress and how to cope with stress at workplace.

11.2 Demonstrate how stress can be overcome in a healthy way.

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-709	Energy TechnologyLab	3	45	40	60

Course Objectives	(i) To familiarize with the knowledge different materials tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant experiments/exercises	
Course Outcomes	CH-709.1	Demonstrate the skill of planning and organizing experimental set up for a desired purpose
	CH-709.2	Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems
	CH-709.2	Observe various parameters, their variations and graphically represent the same
	CH-709.3	Analyse the experimental results to draw inferences to make recommendations
	CH-709.4	Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

Learning outcome

1. Determine the moisture content, Volatile matter in a given a sample of Coal.
2. Determine the fixed carbon and ash content given sample of coal.
3. Determine the carbon and Hydrogen in coal by ultimate analysis.
4. Determine the Calorific value of solid fuel by using Bomb calorimeter.
5. Determine the flash and fire point of a given sample of oil using Abel's closed cup apparatus.
6. Determine the flash and fire point of a given sample of oil using Pensky marten's apparatus.
7. Determine the viscosity of a lubricating oil by Red wood viscometer-I.
8. Determine the viscosity of lubricating oil by Red wood viscometer-II.
9. Determine the CO, CO_2 andO_2 content present in the flue gas using Orsat apparatus.
10. Determine the smoke point of Kerosene.

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CH-710	Project work	3	45	40	60

Course Objectives	(i) To familiarize with the knowledge different materials tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant experiments/exercises	
Course Outcomes	CH-710.1	Demonstrate the skill of planning and organizing experimental set up for a desired purpose
	CH-710.2	Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems
	CH-710.3	Observe various parameters, their variations and graphically represent the same
	CH-710.4	Analyse the experimental results to draw inferences to make recommendations
	CH-710.5	Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

Learning outcome

A list of topics suggested for project work

1. Basic design and cost estimating of the following equipment based on the problems suggested by teachers on topics;
   a) Heat exchangers and condensers
   b) Distillation units
   c) Pumping installation
   d) Absorption system
   e) Extraction system
   f) Water purification system
   g) Crystallizer unit
   h) Evaporator system
   i) Dryers
2. Prepare a process report on industrially important chemicals.
3. Design and fabricate small prototype chemical engineering equipments useful for doing experiments in the laboratory.
4. To conduct a survey of a chemical industry and produce a report on
   a) Various safety methods being followed
   b) Various pollution control methods being carried out.
   c) Production, planning and control systems
   d) Process instrumentation of the plant
   e) Maintenance schedule of chemical engineering equipment
   f) Material transportation and storage of chemicals

5. To understand safety procedures in chemical Industries
6. To know the softwares connected with Chemical Engineering and prepare a project by using MATLAB, ASPEN PLUS, HYSIS, COMSOL etc

Note :-The project as suggested by industry or any allied institution

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