GOVERNMENT OF ANDHRA PRADESH

STATE BOARD OF TECHNICAL EDUCATION AND TRAINING

Andhra Pradesh :: Amaravathi

Globally Competetive

CURRICULUM (C-16)

For Polytechnic Diploma Courses
In Andhra Pradesh

DIPLOMA IN CERAMIC TECHNOLOGY

Front Cover Page

Objective of the New Curriculum (C-16)

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

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

Highlights of the Curriculum (C-16)

- 6 months /1 year industrial training in all the Diploma Courses.
- 1 year industrial training in collaboration with BOAT (Board of Apprenticeship & Training (SR), Chennai).
- Virtual labs for ECE & Computer Branches & Strengthening of Skill Development Centers to provide industrial training to students.

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

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

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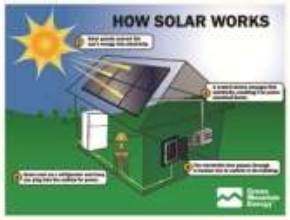
"Computer Fundamentals Laboratory" is introduced for all the Branches in First year. AutoCAD specific to the Branch has been given emphasis in the Curriculum.

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



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

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

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

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

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Journal (JPAP)

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

Back Cover Page

CURRICULUM – 2016
(C-16)

DIPLOMA IN
CERAMIC TECHNOLOGY
(3 ½ YEARS SANDWICH COURSE)

UNDER
MULTI POINT ENTRY CREDIT (MPEC) SYSTEM

STATE BOARD OF TECHNICAL EDUCATION & TRAINING,
ANDHRA PRADESH

DIPLOMA IN

CERAMIC TECHNOLOGY

3 ½ YEAR SANDWICH

UNDER MPEC

FIRST SEMESTER

CURRICULUM – 2016

(C-16)

STATE BOARD OF
TECHNICAL EDUCATION & TRAINING
ANDHRA PRADESH

CURRICULUM-2016
(C-16)
FOR DIPLOMA COURSES IN ANDHRA PRADESH

PREAMBLE

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

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

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

Salient Features:

1. Duration of course is either 3 years / 3½ years duration of Regular Academic Instruction.
2. The Curriculum is prepared in Semester Pattern. However, First Year is maintained as Year-wise pattern.
3. 6 Months/ 1 year Industrial Training is introduced for all the Diploma courses.
4. Fundamentals of Internet of Things (IOT) is introduced for all the Diploma courses in the subject.
5. Modern subjects relevant to the industry are introduced in all the Diploma courses.
6. CISCO course content has been incorporated into the ECE and CME courses to get certification from CISCO along with Diploma.
7. The policy decisions taken at the State and Central level with regard to environmental science are implemented by including relevant topics in Chemistry. This is also in accordance with the Supreme Court guidelines issued in Sri Mehta's case.

8. Keeping in view the increased need of communication skills which is playing a major role in the success of Diploma Level students in the Industries, emphasis is given for learning and acquiring listening, speaking, reading and writing skills in English. Further as emphasized in the meetings, Communication Skills lab and Life Skills lab are introduced for all the branches.
9. Modern topics relevant to the needs of the industry and global scenario suitable to be taught at Diploma level are also incorporated in the curriculum.
10. AutoCAD specific to the branch has been given more emphasis in the curriculum. Preparing drawings using CAD software has been given more importance.
11. Every student is exposed to the computer lab at the 1st year itself in order to familiarize himself with skills required for keyboard/mouse operation, internet usage and e-mailing.
12. Upon reviewing the existing C-14 curriculum, it is found that the theory content is found to have more weightage than the Practical content. In the revised C-16 curriculum, more emphasis is given to the practical content of Laboratories and Workshops, thus strengthening the practical skills.
13. With increased emphasis for the student to acquire Practical skills, the course content in all the subjects is thoroughly reviewed and structured as outcome based than the conventional procedure based.
14. Curricula of Laboratory and Workshops have been thoroughly revised based on the suggestions received from the industry and faculty, for better utilization of the equipment available at the Polytechnics. The experiments /exercises that are chosen for the practical sessions are identified to conform to the field requirements of industry.
15. The Members of the working group are grateful to Sri G.S. Panda Das, I.A.S., Special Commissioner of Technical Education & Chairman of SBTET, AP. and Sri. Adityanath Das, I.A.S., Principal Secretary of Higher Education for their guidance and valuable inputs in revising, modifying and updating the curriculum.
16. The Members acknowledge with thanks the cooperation and guidance provided by Sri. A.Nirmal Kumar Priya, Secretary, SBTET, Andhra Pradesh and other officials of Directorate of Technical Education and the State Board of Technical Education, Andhra Pradesh, experts from industry, academia from the universities and higher learning institutions and all teaching fraternity from the Polytechnics who are directly or indirectly involved in preparation of the curricula.

RULES AND REGULATIONS

1 DURATION AND PATTERN OF THE COURSES

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

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

semester. Run-through system is adopted for all the Diploma Courses, subject to eligibility conditions.

2 PROCEDURE FOR ADMISSION INTO THE DIPLOMA COURSES:

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

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

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

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

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

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

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

3 MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

4 PERMANENT IDENTIFICATION NUMBER (PIN)

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

5 NUMBER OF WORKING DAYS PER SEMESTER / YEAR:

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

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

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

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

6 ELIGIBILITY OF ATTENDANCE TO APPEAR FOR THE END EXAMINATION

a). A candidate shall be permitted to appear for the end examination in all

subjects, if he or she has attended a minimum of 75% of working days during the year/Semester.

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

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

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

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

7 READMISSION

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

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

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

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

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

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

8 SCHEME OF EXAMINATION

a) First Year

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

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

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

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

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

9 INTERNAL ASSESSMENT SCHEME

a) Theory Subjects: Theory Subjects carry 20% sessional marks, Internal

examinations will be conducted for awarding sessional marks on the dates specified. **Three unit tests will be conducted for I year students and two Unit Tests for semesters.** Average of marks obtained in all the prescribed tests will be considered for awarding the sessional marks.

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

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

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

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

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

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

Industrial assessment	:	200 marks (in two spells of 100 marks each)
Maintenance of log book	:	30 marks
Record Work	:	30 marks
Seminar / viva-voce	:	40 marks
TOTAL	:	300 marks

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

10 MINIMUM PASS MARKS

THEORY EXAMINATION:

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

examination marks put together.

PRACTICAL EXAMINATION:

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

11. PROVISION FOR IMPROVEMENT

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

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

a) For Diploma Courses of 3 Years duration

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

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

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

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

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

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

For IVC & ITI Lateral Entry Students:

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

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

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

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

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

For IVC& ITI Lateral Entry students:

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

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

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

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

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

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

For IVC & ITI Lateral Entry students:

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

ii) should get eligibility to appear for 5th Semester Examination.

Important Note:

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

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

1. A candidate shall be permitted to appear for 1st year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds upto 10%)

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

2. A candidate shall be promoted to 3rd semester if he/she puts the required percentage of attendance in the 1st year and pays the examination fee. A candidate who could not pay the 1st year examination fee has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 3rd semester.
3. A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and pay the examination fee. A candidate, who could not pay the 3rd semester exam fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 4th semester.

   A candidate is eligible to appear for the 4th semester exam if he/she
   i) Puts the required percentage of attendance in the 4th semester
   ii) Should not have failed in more than Four backlog subjects of 1st year.

For IVC & ITI Lateral Entry students:

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

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

   A candidate is eligible to appear for 7th semester examination if he/she
   i) Puts the required percentage of attendance in the 7th semester
   ii) Should get eligibility to appear for 4th semester Examination.

For IVC & ITI Lateral Entry students:

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

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

OTHER DETAILS

a) In case a candidate does not successfully complete the Industrial training,

he / she will have to repeat the training at his / her own cost.

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

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

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

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

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

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

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

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

For IVC & ITI Lateral Entry Students:

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

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

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

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

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

For IVC & ITI Lateral Entry students:

iii) Puts the required percentage of attendance in the5th semester

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

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

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

A candidate is eligible to appear for 6th semester examination

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

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

For IVC & ITI Lateral Entry students:

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

ii) should get eligibility to appear for 5th Semester Examination.

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

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

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

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

For IVC & ITI Lateral Entry students:

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

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

Important Note:

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

OTHER DETAILS

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

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

13. STUDENTS PERFORMANCE EVALUATION

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

1. First Class with Distinction shall be awarded to the candidates who secure an overall aggregate of 75% marks and above.
2. First Class shall be awarded to candidates who secure overall aggregate of 60% marks and above and below 75% marks.
3. Second Class shall be awarded to candidates who secure a pass with an overall aggregate of below 60%.

The Weightage of marks for various year/Semesters which are taken for

computing overall aggregate shall be 25% of I year marks + 100% of 3rd and subsequent Semesters.

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

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

14. EXAMINATION FEE SCHEDULE:

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

15. STRUCTURE OF END EXAMINATION QUESTION PAPER:

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

a) Each theory paper consists of Section 'A' and Section 'B'. Section 'A' contains 10 short answer questions. All questions are to be answered and each carries 3 marks Max. Marks: 10 x 3 = 30.
   Section B contains 8 essay type questions including Numerical questions, out of which 5 questions each carrying 10 marks are to be answered.
   Max.Marks: 5 x 10 = 50.
   Total Maximum Marks: 80.

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

c) Practical Examinations

   For Workshop practice and Laboratory Examinations, Each student has to pick up a question paper distributed by Lottery System.
   Max. Marks for an experiment / exercise : 50%
   Max. Marks for VIVA-VOCE : 10%
   Total : 60% (of total marks for the subject)
   In case of practical examinations with 50 marks, the marks will be worked out basing on the above ratio.
   In case of any change in the pattern of question paper, the same shall be informed sufficiently in advance to the candidates.

16. ISSUE OF MEMORONDUM OF MARKS

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

17. MAXIMUM PERIOD FOR COMPLETION OF DIPLOMA COURSES:

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

18. ELIGIBILITY FOR AWARD OF DIPLOMA

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

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

ii. He / she has completed all the subjects.

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

For IVC & ITI Lateral Entry students:

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

ii. He / she has completed all the subjects.

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

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

A) FOR ISSUE OF PHOTO COPIES OF VALUED ANSWER SCRIPTS

1. A candidate desirous of applying for Photo copy of valued answer script/ scripts should apply within prescribed date from the date of the declaration of the result.
2. Photo copies of valued answer scripts will be issued to all theory subjects and Drawing subject(s).
3. The Photo copy of valued answer script will be dispatched to the concerned candidate's address as mentioned in the application form by post.
4. No application can be entertained from third parties.

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

1. A candidate desirous of applying for Re-verification of valued answer script should apply within prescribed date from the date of the declaration of the result.
2. Re-verification of valued answer script shall be done for all theory subjects and Drawing subject(s).
3. The Re-verification committee constituted by the Secretary, SBTETAP with subject experts shall re-verify the answer scripts.

I) RE-COUNTING

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

2) RE-VERIFICATION

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

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

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

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

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

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

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

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

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

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

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

20. MAL PRACTICE CASES:

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

21. DISCREPANCIES/ PLEAS:

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

22. ISSUE OF DUPLICATE DIPLOMA

If a candidate loses his/her original Diploma Certificate and desires a duplicate to be issued he/she should produce written evidence to this effect. He /

she may obtain a duplicate from the Secretary, State Board of Technical Education and Training, A.P., on payment of prescribed fee and on production of an affidavit signed before a First Class Magistrate (Judicial) and *non-traceable certificate* from the Department of Police. In case of damage of original Diploma Certificate, he / she may obtain a duplicate certificate by surrendering the original damaged certificate on payment of prescribed fee to the State Board of Technical Education and Training, A.P.

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

23. ISSUE OF MIGRATION CERTIFICATE AND TRANSCRIPTS:

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

24. GENERAL

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

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

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

STATE BOARD OF TECHNICAL EDUCATION & TRAINING
ANDHRA PRADESH
DIPLOMA IN CERAMIC TECHNOLAGY
3 ½ YEAR SANDWICH COURSE (UNDER MPEC SYSTEM)

FIRST SEMESTER

Subject	Name of the Subject	Instruction Periods/Week		Total Periods / Semester	Duration (hrs)	Scheme of Examinations			
		Theory	Practicals			Sessional Marks	End Exam Marks	Total Marks	Credits
	THEORY SUBJECTS								
CER-1101	English -I	3	-	45	3	20	80	100	3
CER-1102	Engineering Mathematics – I	5	-	75	3	20	80	100	5
CER-1103	Engineering Physics-I	4	-	60	3	20	80	100	4
CER-1104	Engineering Chemistry & Environmental Studies -I	4	-	60	3	20	80	100	4
CER-1201	Elements of Ceramic Technology -I	4	-	60	3	20	80	100	4
CER-1202	Ceramic Raw Materials	5		75	3	20	80	100	5
	PRACTICAL SUBJECTS								
CER-1105	Physics Laboratory-I	-	1 ½	22 ½	3	20	30	50	0.75
CER-1106	Chemistry Laboratory-I	-	1 ½	22 ½	3	20	30	50	0.75
CER-1107	Engineering Drawing-I	-	06	90	3	40	60	100	4
CER-1203	Computer Fundamentals Laboratory- I	-	04	60	3	40	60	100	2
CER-1301	Fundamental Properties of Ceramics Laboratory	-	04	60	3	40	60	100	2
	Total	**25**	**17**	**630**	**-**	**280**	**720**	**1000**	**34.5**

DIPLOMA IN CERAMIC TECHNOLAGY
3 ½ YEAR SANDWICH COURSE (UNDER MPEC SYSTEM)

SECOND SEMESTER

Subject	Name of the Subject	Instruction Periods/Week		Total Periods/ Semester	Scheme Of Examinations				
		Theory	Practical		Duration (hrs)	Sessional Marks	End Exam Marks	Total Marks	Credits
	THEORY SUBJECTS								
CER-2108	English -II	03	-	45	3	20	80	100	3
CER-2109	Engineering Mathematics – II	05	-	75	3	20	80	100	5
CER-2110	Engineering Physics -II	04	-	60	3	20	80	100	4
CER-2111	Engineering Chemistry & Environmental Studies -II	04	-	60	3	20	80	100	4
CER-2204	Elements of Ceramic Technology -II	05	-	75	3	20	80	100	5
CER-2205	General Engineering	06	-	90	3	20	80	100	6
	PRACTICAL SUBJECTS								
CER-2112	Physics Laboratory-II	-	1 ½	22 ½	1 ½	20	30	50	0.75
CER-2113	Chemistry Laboratory-II	-	1 ½	22 ½	1 ½	20	30	50	0.75
CER-2114	Engineering Drawing-II	-	07	105	3	40	60	100	4.5
CER-2206	Computer Fundamentals Practice- II	-	05	75	3	40	60	100	2.5
	Total	**27**	**15**	**630**	**-**	**240**	**660**	**900**	**35.5**

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THIRD SEMESTER

Subject Code	Name of the Subject	Instruction Periods/Week		Total Periods/	Scheme of Examination				
		Theory	Practical	Semester	Duration **(Hrs)**	Sessional Marks	End Exam Marks	Total Marks	Credits
	THEORY SUBJECTS								
CER-3115	Engineering Mathematics – III	5	--	75	3	20	80	100	5
CER-3207	Fuels and Furnace Technology	4	--	60	3	20	80	100	4
CER-3208	Ceramic Tests & Quality Control	5	--	75	3	20	80	100	5
CER-3302	Glass Engineering - I	4	--	60	3	20	80	100	4
CER-3303	White ware & Heavy Clay Ware-I	5	--	75	3	20	80	100	5
CER-3304	Refractories-I	4	--	60	3	20	80	100	4
	PRACTICAL SUBJECTS								
CER-3209	Communication Skills	--	3	45	3	40	60	100	1.5
CER-3305	Glass Engineering-I Lab	--	4	60	3	40	60	100	2
CER-3306	White ware & Heavy Clay Ware-I Lab	--	4	60	3	40	60	100	2
CER-3307	Refractories Lab	--	4	60	3	40	60	100	2
	TOTAL	**27**	**15**	**630**	**-**	**280**	**720**	**1000**	**34.5**

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(MPEC SYSTEM)

FOURTH SEMESTER

Subject Code	Name of the Subject	Instruction Periods/Week		Total Periods/ Semester	Scheme of Examination				
		Theory	Practical		Duration (Hrs)	Sessional Marks	End Exam Marks	Total Marks	Credits
	THEORY SUBJECTS								
CER-4210	Ceramic Calculations	5	--	75	3	20	80	100	5
CER-4308	Glass Engineering - II	5	--	75	3	20	80	100	5
CER-4309	White Ware & Heavy Ware-II	5	--	75	3	20	80	100	5
CER-4310	Refractories-II	5	--	75	3	20	80	100	5
CER-4311	Cement Technology	5	--	75	3	20	80	100	5
	PRACTICAL SUBJECTS								
CER-4211	Life Skills	--	3	45	3	40	60	100	1.5
CER-4312	Cement Technology Lab	--	4	60	3	40	60	100	2
CER-4313	Glass Engineering – II Lab	--	5	75	3	40	60	100	2.5
CER-4314	White Ware & Heavy Clay Ware-II Lab	--	5	75	3	40	60	100	2.5
	TOTAL	**25**	**17**	**630**	**-**	**260**	**640**	**900**	**33.5**

STATE BOARD OF TECHNICAL EDUCATION & TRAINING
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FIFTH SEMESTER

SUBJECT CODE: 5315
SUBJECT NAME: INDUSTRIAL TRAINING

Marks Awarded by the Industry	Seminar Marks	Log Book/ Dairy Marks	Project Record Marks	Total Marks	No. of Credits
200	**40**	**20**	**40**	**300**	**25**

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SIXTH SEMESTER

SUBJECT CODE: 6316
SUBJECT NAME: INDUSTRIAL TRAINING

Marks Awarded by the Industry	Seminar Marks	Log Book/ Dairy Marks	Project Record Marks	Total Marks	No. of Credits
200	**40**	**20**	**40**	**300**	**25**

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SEVENTH SEMESTER

Subject Code	Name of the Subject	Instruction Periods/Week		Total Periods/ Semester	Scheme of Examination				
		Theory	Practicals		Duration (Hrs)	Sessional Marks	End Exam Marks	Total Marks	Credits
	THEORY SUBJECTS								
CER-7212	Industrial Management &Smart Technologies	5	--	75	3	20	80	100	5
CER-7213	C Language	5	--	75	3	20	80	100	5
CER-7214	Ceramic Science	5	--	75	3	20	80	100	5
CER-7401	Advanced Ceramics	5	--	75	3	20	80	100	5
CER-7402	Special Glasses & Enamels	5	--	75	3	20	80	100	5
	PRACTICAL SUBJECTS								
CER-7215	C Language Lab	--	6	90	3	40	60	100	3
CER-7216	Computer Applications practice in Ceramic Industry	--	6	90	3	40	60	100	3
CER-7403	Ceramic Coatings Lab	--	5	75	3	40	60	100	2.5
	TOTAL	**25**	**17**	**630**	**-**	**220**	**580**	**800**	**33.5**

Note:1. Subject CER-7212 is same as M-501 of Diploma in Mechanical Engineering.

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FIRST YEAR

STATE BOARD OF TECHNICAL EDUCATION & TRAINING
ANDHRA PRADESH
DIPLOMA IN CERAMIC TECHNOLAGY
3 ½ YEAR SANDWICH COURSE (UNDER MPEC SYSTEM)

FIRST SEMESTER

Subject	Name of the Subject	Instruction Periods/Week		Total Periods / Semester	Duration (hrs)	Scheme of Examinations			
		Theory	Practicals			Sessional Marks	End Exam Marks	Total Marks	Credits
	THEORY SUBJECTS								
CER-1101	English -I	3	-	45	3	20	80	100	3
CER-1102	Engineering Mathematics – I	5	-	75	3	20	80	100	5
CER-1103	Engineering Physics-I	4	-	60	3	20	80	100	4
CER-1104	Engineering Chemistry & Environmental Studies -I	4	-	60	3	20	80	100	4
CER-1201	Elements of Ceramic Technology -I	4	-	60	3	20	80	100	4
CER-1202	Ceramic Raw Materials	5		75	3	20	80	100	5
	PRACTICAL SUBJECTS								
CER-1105	Physics Laboratory-I	-	1 ½	22 ½	3	20	30	50	0.75
CER-1106	Chemistry Laboratory-I	-	1 ½	22 ½	3	20	30	50	0.75
CER-1107	Engineering Drawing-I	-	06	90	3	40	60	100	4
CER-1203	Computer Fundamentals Laboratory- I	-	04	60	3	40	60	100	2
CER-1301	Fundamental Properties of Ceramics Lab	-	04	60	3	40	60	100	2
	Total	**25**	**17**	**630**	**-**	**280**	**720**	**1000**	**34.5**

ENGLISH – I

SUBJECT TITLE : ENGLISH –I
SUBJECT CODE : CER-1101
PERIODS PER WEEK : 3
PERIODS PER SEMESTER : 45

TIME SCHEDULE

S.No of Lessons	TOPIC/LESSON	Number of Hours	No . of short Questions	No. of Essay Questions	Total marks Weightage
1	Need for English	02		1	10
2	Classroom English	02	1		3
3	Expressing feelings	02	1		
4	Expressing likes/dislikes	02	1		
5	Making requests	02	1		3
6	Expressing obligations	02	1		3
7	Appointments(fix, reschedule, cancel)	02	1		3
8	Invitations(extend, accept, reject politely)	02	1		3
9	Giving Instructions	02		1	10
10	Asking and giving Directions	02		1	10
11	Describing words(adjectives)	02	1		3
12	The Here and Now (prepositions)	03			
13 to 18	Lessons 13 to 18 (Reading comprehension, vocabulary , writing a paragraph)	08		1+1+1	30
19	Tenses. Lessons 19.1 to 19.5	05	1	1	13
20	Voice. Lessons 21.1 to 21.2	02			
21	Basic sentence structure. Lessons 20.1 to 20.2	02	1		3
22	Questioning. Lessons 22.1 to 22.2	03		1	10
	TOTAL	45	10	08	110

End Exam pattern : Total marks : 80
Part A ; 10 Short questions , each one carries 3 marks, all compulsory, 3x10 = 30 Marks
Part B ; 5 Essay questions +3 choice *Q.No.18 is compulsory, each one carries10 marks- 10X5=50Marks

Preface: The First Year Engineering Diploma of **C-16-ENGLISH-101** has 40 Lessons . These lessons were existing in the previous Curriculum i.e.C-14 and the same lessons are going to be used in C-16 curriculum without any change. The 40 lessons are divided into 5 major topics i.e. 'Vocabulary& Need for English,(Lessons 1&2 and vocabulary from other lessons) English in Action, (3 to 10) Grammar(11,12,&19 to26), Reading (13 to 18) and Writing'(27 to 40) for other Engineering branches (Year wise scheme) . However the same syllabus has been bifurcated into two semesters for Diploma in Textile Technology (DTT) as from **1 to 22 Lessons for First Semester** and Lessons from **23 to 40 for Second Semester.** The first Semester syllabus focuses on the need for learning English, vocabulary, sentence patterns, framing questions, situational conversations i.e. English in Action and basic grammatical topics like Tenses and Voice. The Second Semester focuses mostly on writing skills with various exercises like paragraph writing, data interpretation, report writing, note making, summarizing, Letter writing. It also gives scope to learn employability skills like making resume, cover letter. To check the accuracy of English speaking and writing skills of the students, three lessons are designed to find the errors, analyse and correct them. These Lessons of 'Error Analyses' provide reinforcement of the previously learned topics and help students hone their language skills. On the whole, the syllabus was framed to make students get exposure to all the four Language skills through varied and interesting activities. It helps them inculcate English communication skills and make them employable.

Rationale and Scope

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

Upon completion of this course the student shall be able to

1.0 Build their vocabulary in the direction of their future needs, improve English skills

2.0 Learn various conversational patterns suited to the situations

3.0 Read and comprehend English and understand the details and draw inferences

4.0 Learn to use correct Tenses, Voice, verb patterns

5.0 Practice various types of questions in conversation and sentence structures

1.0 Build vocabulary in the direction of their future needs

Learn and use the words related to class room, higher education and various professions, find solutions, strategies to improve English.

1.1 Pronounce words intelligibly, learn spellings, understand meanings

1.1 Find synonyms and antonyms, Use affixation

1.2 Learn and use different kinds of words, Nouns, pronouns, describing words, prepositions, adverbs, linkers..etc.

1.3 Comprehend meanings of words by understanding meanings of roots.

2.0 Learn various conversational patterns suited to the situations

2.1 Expressing personal feelings and of others, expressing likes and dislikes of self and others.

2.2 Ability to use different ways of making requests , offering help and use words of obligation, order, strong suggestions

2.3 Make appointments, fixing, rescheduling and cancelling of appointments

2.4 Extending invitations and accepting & rejecting politely

2.5 Ability to give instructions& asking for and giving directions

3.0 Read and comprehend English passages for a purpose.

3.1 Read and comprehend, identify the main ideas, catch the central idea, giving a title.

3.2 Identify the specific details, scrutinizing for minute details

3.3 Draw inferences, able to express inferences, opinions based on the available facts

3.4 Give contextual meanings of the words, guess synonyms and antonyms, enrich vocabulary.

3.5 Perceive tone in a text and able to answer the factual, inferential questions.

4.0 Learn to use correct Tense, Voice and verb patterns

4.1 Learn and use four aspects of Present Tense, understand the use of Present tense for daily routines, importance of Simple Present Tense in conversation as substitute for other aspects.

4.2 Learn and use four aspects of Past Tense, describing past events, incidents, experiences

4.3 Learn and use four aspects of Future Tense, able to talk about future plans, aims, future life.

4.4 Passive Voice, its purpose, transitive, intransitive verbs, transformation from Active to Passive voice

4.5 To fill in the blanks with the correct verb form in the context with the help of given base form.

5.0 Practice various types of questions & sentence structures

5.1 Learn and use various 'Wh; questions, asking for Information , its word order, 'Wh' words as linkers

5.2 Learn and use 'Yes or No' questions, its purpose, word order, Various auxiliaries to frame questions,

5.3 Learn the use of 'do' forms in framing questions, understand the difference between an affirmative sentence and interrogative, inversion of word order.

5.4 Basic Sentence structures, practice, understanding ' Subject, object, complement, Direct and Indirect objects'.

5.5 Find and correct the errors in framing questions and Sentence patterns.

Course Material

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

Reference Books

1. Essential English Grammar (Intermediate Level) Raymond Murphy
2. Learn English (A Fun Book of Functional Language, Grammar and Vocabulary) Santanu Sinha Chaudhuri
3. Grammar Builder (Entire Series) Oxford University Press
4. High School English Grammar (Revised Edition) Wren and Martin
5. Sentence skills with Readings (fourth Edition, Tata McGraw Hill) John Langan, Paul Langan
6. Word Power Made Easy Norman Lewis
7. Spoken English Shashi Kumar and Dhamija

ENGINEERING MATHEMATICS-I

SUBJECT TITLE : ENGINEERING MATHEMATICS - I
SUBJECT CODE : CER-1102
PERIODS PER WEEK : 5
PERIODS PER SEMESTER : 75

Time Schedule

S. No	Major Topic	No of Periods		Weightage of Marks	Short Type			Essay Type		
	Unit - I : Algebra	**Theory**	**Practice**		**R**	**U**	**App**	**R**	**U**	**App**
1	Logarithms	3	0	0	0	0	0	0	0	0
2	Partial Fractions	5	0	6	0	2	0	0	0	0
3	Matrices and Determinants	10	10	29	1	1	1	1/2	1/2	1
	Unit - II : Trigonometry									
4	Trigonometric Ratios	2	0	0	0	0	0	0	0	0
5	Compound Angles	3	2	8	1	0	0	0	0	1/2
6	Multiple and Submultiple angles	3	4	8	0	1	0	0	0	1/2
7	Transformations	3	4	13	1	0	0		1/2	1/2
8	Inverse Trigonometric Functions	3	2	10	0	0	0	1/2	1/2	0
9	Trigonometric Equations	3	2	13	1	0	0	1/2	0	1/2
10	Properties and solutions of triangles	4	4	15	0	0	0	1/2	0	1
11	Hyperbolic Functions	2	0	0	0	0	0	0	0	0
12	Complex Numbers	4	2	8	0	1	0	0	1/2	0
	Total no. Questions				4	5	1	2	2	4
	Marks	45	30	110	12	15	03	20	20	40

Marks allocation:

R: Remembering -32
U: Understanding -35
App: Application- 43

ENGINEERING MATHEMATICS – I

Objectives

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

UNIT – I

Algebra

1.0 Use Logarithms in engineering calculations

1.1 Define logarithm and list its properties.

1.2 Distinguish natural logarithms and common logarithms.

1.3 Explain the meaning of e and exponential function.

1.4 State logarithm as a function and its graphical representation.

1.5 Use the logarithms in engineering calculations.

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

2.1 Define the following fractions of polynomials:

1. Rational,
2. Proper and
3. Improper

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

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

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

3.0 Use Matrices for solving engineering problems

3.1 Define a matrix and order of a matrix.

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

3.3 Compute sum, scalar multiplication and product of matrices.

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

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

3.6 Define symmetric and skew-symmetric matrices.

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

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

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

3.10 Distinguish singular and non-singular matrices.

3.11 State properties of determinants with simple examples.

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

3.13 Compute adjoint and multiplicative inverse of a square matrix.

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

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

3.16 Solve system of linear equations by matrix inversion method

3.17 State elementary row operations.

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

UNIT – II

Trigonometry :

4.0 Understand Trigonometric Ratios

4.1 Define trigonometric ratios of any angle.

4.2 List the values of trigonometric ratios at specified values.

4.3 Draw graphs of trigonometric functions

4.4 Explain periodicity of trigonometric functions.

5.0 Solve simple problems on Compound Angles

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

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

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

5.4 Solve simple problems on compound angles.

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

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

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

6.3 Solve simple problems using the above formulae

7.0 Apply Transformations for solving the problems in Trigonometry

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

8.0 Use Inverse Trigonometric Functions for solving engineering problems

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

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

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

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

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

9.0 Solve Trigonometric Equations in engineering applications

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

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

10.0 Appreciate Properties of triangles and their solutions

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

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

10.3 List various formulae for the area of a triangle.

10.4 Solve problems using the above formulae.

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

11.0 Represent the Hyperbolic Functions in terms of logarithm functions

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

11.2 Represent inverse hyperbolic functions in terms of logarithms.

12.0 Represent Complex numbers in various forms

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

12.2 Define the operations on complex numbers with examples.

12.3 Define amplitude of a complex number

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

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

COURSE CONTENT

Unit-I

Algebra

1. Logarithms :

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

2. Partial Fractions :

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

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

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

Matrices:

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

Unit-II

Trigonometry :

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

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

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

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

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

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

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

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

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

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

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

Reference Books :

1. A text book of matrices by Shanti Narayan,
2. Plane Trigonometry, by S.L Loney

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ENGINEERING PHYSICS-I

SUBJECT TITLE : ENGINEERING PHYSICS - I

SUBJECT CODE : CER-1103

PERIODS PER WEEK : 4

PERIODS PER SEMESTER : 60

S.No	Major Topic	No.of periods	Weightage of marks	Short answer type	Essay answer type
1.	Units &Dimensions	08	16	02	01
2.	Elements of Vectors	12	26	02	02
3.	Kinematics	12	26	02	02
4.	Friction	08	13	01	01
5.	Work,Power & Energy	12	16	02	01
6.	Properties of Matter	08	13	01	01
	Total	60	110	10	08

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Understand the concept of Units and dimensions

1.1 Explain the concept of Units
1.2 Define the terms
a) Physical quantity, b) Fundamental physical quantities and
c) Derived physical quantities
1.3 Define unit
1.4 Define fundamental units and derived units
1.5 State SI units with symbols
1.6 State Multiples and submultiples in SI system
1.7 State Rules of writing S.I. units
1.8 State advantages of SI units
1.9 Define Dimensions
1.10 Write Dimensional formulae
1.11 Derive dimensional formulae of physical quantities
1.12 List dimensional constants and dimensionless quantities
1.13 State the principle of Homogeneity of Dimensions
1.14 State the applications of Dimensional analysis

1.15 State the limitations of dimensional analysis
1.16 Solve problems

2.0 Understand the concept of Elements of Vectors

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

3.0 Understand the concept of Kinematics

3.1 Write the equations of motion in a straight line
3.2 Explain the acceleration due to gravity
3.3 Derive expressions for vertical motion
a) Maximum Height, b) time of ascent, c) time of descent, and d) time of flight
3.4 Derive height of a tower when a body projected vertically upwards from the top of a tower.
3.5 Explain projectile motion with examples
3.6 Explain Horizontal projection
3.7 Derive an expression for the path of a projectile in horizontal projection
3.8 Explain oblique projection
3.9 Derive an expression for the path of projectile in oblique projection
3.10 Derive formulae for projectile in oblique projection
a) Maximum Height, b) time of ascent, c) time of descent, and d) time of flight e) Horizontal Range, f) Maximum range
3.11 Solve the related numerical problems

4.0 Understand the concept of Friction

4.1 Define friction
4.2 Classify the types of friction and define
4.3 Explain the concept of Normal reaction
4.4 State the laws of friction

4.5 Define coefficients of friction
4.6 Explain the Angle of friction
4.7 Derive an expression for acceleration of a body on a rough horizontal surface
4.8 Derive an expression for the displacement and time taken to come to rest over a rough horizontal surface
4.9 Define Angle of repose
4.10 Derive expressions for acceleration of a body on a smooth inclined plane (up and down)
4.11 Derive expressions for acceleration of a body on a rough inclined plane (up and down)
4.12 List the Advantages and Disadvantages of friction
4.13 Mention the methods of minimizing friction
4.14 Solve the related numerical problems

5.0 Understand the concepts of Work, Power, and Energy

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

6.0 Understand the properties of matter

6.1 Define the term Elasticity
6.2 Define the terms stress and strain and also define different types of stress and strain
6.3 State the units and dimensional formulae for stress and strain
6.4 State and explain Hooke's law
6.5 Define surface tension and state examples
6.6 Explain Surface tension with reference to molecular theory
6.7 Define angle of contact
6.8 Define capillarity
6.9 Write the formula for surface tension based on capillarity and name the parameters
6.10 Explain the concept of Viscosity
6.11 Mention examples of Viscosity
6.12 State Newton's formula for viscous force and explain
6.13 Define co-efficient of viscosity and write its units and dimensional formula
6.14 Explain the effect of temperature on viscosity of liquids and gases

6.15 State Poiseulle's equation for Co-efficient of viscosity and name the physical quantities involved
6.16 Solve the related numerical problems

COURSE CONTENT

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

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

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

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

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

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

REFERENCE BOOKS

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

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ENGINEERING CHEMISTRY & ENVIRONMENTAL STUDIES-I

SUBJECT TITLE : ENGINEERING CHEMISTRY & ENVIRONMENTAL STUDIES-I
SUBJECT CODE : CER - 1104
PERIODS/WEEK : 04
PERIODS / SEMESTER : 60

TIME SCHEDULE

Sl/NO	Major Topics	Number Of Periods	Weightage Of Marks	Number Of Essay Type Queos	Number Of Short Answer Questions	Remembering	Understanding	Applying/ Analyzing
1	Fundamentals of Chemistry	18	32	2	4	8	8	10
2	Solutions	10	16	1	2	3	10	13
3	Acids & Bases	10	16	1	2	5	11	10
4	Principles of Metallurgy	10	20	2	_	3	3	10
5	Electrochemisry	12	26	2	2	8	8	_
	Total	60	110	08	10	27	40	43

Objective

Upon completion of the course the student shall be able to

A. ENGINEERINGCHEMISTRY

1.0 Understand the concept of Atomic structur

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

1.2 Explain the concept of atomic number and mass number.

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

1.4 Explain the significance of four Quantum numbers.

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

1.6 Define Orbital in an atom.

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

1.8 Distinguish between Orbit and Orbital

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

1.10 Explain the significance of chemical bonding

1.11 Explain the Postulates of Electronic theory of valency

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

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

1.14 Explain bond formation in NaCl and MgO.

1.15 List Properties of Ionic compounds

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

1.17 List Properties of Covalent compounds

1.18 Distinguish between properties of ionic compounds and covalent compounds.

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

1.20 Structures of Unit cells of NaCl and CsCl.

1.21 Define the term. Oxidation number.

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

a)$K\underline{Mn}O_4$ b) $K_2\underline{Cr}_2O_7$ c) $H\underline{N}O_3$ d) $H_2\underline{S}O_4$ e) $\underline{Cl}O_4^-$ f) $\underline{N}H_4^+$

1.23 Differentiate between Oxidation Number and Valency

2.0 Calculate Molarity and Normality of given Solution

2.1 Define the terms 1.Solution, 2.Solute and 3.Solvent

2.2 Classify solutions based on physical state and solubility

2.3 Define mole

2.4 Problems on 'Mole concept'

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

2.6 Calculate Molecular weight and Equivalent weight of given Acids,(HCl,H_2SO_4 HNO_3) Bases (NaOH, KOH, $Ca(OH)_2$) and Salts (NaCl, Na_2CO_3, $CaCO_3$)

2.7 Define 1.Molarity, 2.Normality of solutions

2.8 Solve Numerical problems on Molarity and Normality

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

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

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

3.0 Understand the concepts of Acids and bases

3.1 Explain Arrhenius theory of Acids and Bases

3.2 State the limitations of Arrhenius theory of Acids and Bases

3.3 Explain Bronsted–Lowry theory of acids bases

3.4 State the limitations of Bronsted–Lowry theory of acids bases

3.5 Explain Lewis theory of acids and bases

3.6 State the limitations of Lewis theory of acids and bases

3.7 Explain the Ionic product of water

3.8 Define pH and explain Sorenson scale

3.9 Solve the Numerical problems on pH (Strong Acids and Bases)

3.10 Define Buffer solution

3.11 Give atleast three examples for Buffer solutions

3.12 State the applications of Buffer solution

4.0 Understand the Principles of Metallurgy

4.1 List at least eight Characteristics of Metals

4.2 Distinguish between Metals and Non Metals

4.3 Define the terms 1.Mineral, 2.Ore, 3. Gangue, 4.Flux and 5.Slag

4.4 Describe the methods of concentration of Ore; 1.Hand picking, 2.Levigation, and 3. Froth

Floatation

4.5 Describe the methods involved in extraction of crude metal- Roasting, Calcination and Smelting.

4.6 Explain the purification of Metals by Electrolytic Refining

4.7 Define an Alloy

4.8 Write the Composition of the following alloys:1.Brass, 2.Germansilver,

3 Nichrome

4.9 List the uses of the following Alloys: 1. Brass, 2. German silver, 3. Nichrome

5.0 Understand the concepts of Electrochemistry

5.1 Define the terms1. Conductor, 2. Insulator, 3.Electrolyte 4.Non–electrolyte

5.2 Distinguish between metallic conduction and Electrolytic conduction

5.3 Explain electrolysis by taking example fused NaCl

5.4 Explain Faraday's laws of electrolysis

5.5 Define 1.Chemical equivalent (E) 2.Electrochemical equivalent (e) and their relation.

5.6 Solve the Numerical problems based on Faraday's laws of electrolysis

5.7 Define Galvanic cell

5.8 Explain the construction and working of Galvanic cell

5.9 Distinguish between electrolytic cell and galvanic cell

5.10 Explain the electrode potentials and standard electrode potentials

5.11 Explain the electrochemical series and its significance

5.12 Explain the emf of a cell.

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

6.0 Understand the concept of Corrosion

6.1 Define the term corrosion

6.2 state the Factors influencing the rate of corrosion

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

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

6.5 Explain the methods of prevention of corrosion:

a)Protective coatings (anodic and cathodic coaitings)

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

7. 0 Understand the concept of Water Technology

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

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

7.3 Define the term hardness of water

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

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

7.6 State the disadvantages of using hard water in industries

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

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

7.9 Concept of Osmosis and Reverse Osmosis with examples .

7.10 State the applications of Reverse Osmosis.

7.11 State essential qualities of drinking water.

8.0 Understand the concepts of Polymers

8.1 Explain the concept of polymerisation

8.2 Describe the methods of polymerization a) addition polymerization of Ethylene b)condensation polymerization of phenol and formaldehyde (Only flow chart i.e. with out chemical equations)

8.3 Define the term plastic

8.4 Classify the plastics with examples

8.5 Distinguish between thermo and thermosetting plastics

8.6 List the Characteristics of plastics

8.7 State the advantages of plastics over traditional materials

8.8 State the disadvantages of using plastics.

8.9 Explain the methods of preparation of the following plastics:
1.Polythene, 2. PVC, 3.Teflon, 4. Polystyrene and 5. Urea formaldehyde

8.10 Explain the uses of the following plastics:
1.Polythene, 2. PVC, 3.Teflon, 4.Polystyrene and 5. Urea formaldehyde

8.11 Define the term natural rubber

8.12 write the structural formula of Natural rubber

8.13 Explain the processing of Natural rubber from latex

8.14 List the Characteristics of natural rubber

8.15 Explain the process of Vulcanization

8.16 List the Characteristics of Vulcanized rubber

8.17 Define the term Elastomer

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

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

9.0 Understand the concepts of Fuels

9.1 Define the term fuel

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

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

9.4 List the characteristics of good fuel

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

B. ENVIRONMENTAL STUDIES

1.1 Define the term environment

1.2 Explain the scope and importance of environmental studies

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

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

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

1.6 Define the terms:

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

1.7 Explain biodiversity and threats to biodiversity

1.8 Define air pollution

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

1.10 Explain the causes of Air pollution.

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

1.12 State the uses of forest resources.

1.13 State the deforestation and its causes and effects.

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

1.15 Explain the methods of control of Air pollution

1.16 Define Water pollution

1.17 Explain the causes of Water pollution

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

1.19 Explain the methods of control of Water pollution.

COURSE CONTENT

A. ENGINEERINGCHEMISTRY

1. Fundamentals of Chemistry

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

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

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

2. Solutions

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

3. Acids and Bases

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

4. Principles of Metallurgy

Characteristics of Metals and distinction between Metals and Non Metals, Metallurgy, ore, Gangue, Flux, Slag - Concentration of Ore –Hand picking, Levigation, Froth floatation – Methods of Extraction of crude Metal – Roasting, Calcination, Smelting – Alloys – Composition and uses of Brass, German silver and Nichrome

5. Electrochemistry

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

6. Water technology

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

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

8. Polymers

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

9. Fuels

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

B. ENVIRONMENTALSTUDIES

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

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

REFERENCEBOOKS

1.	Intermediate chemistry Vol 1&2	Telugu Academy
2.	Intermediate chemistry Vol 1&2	Vikram Publishers
3.	Intermediate chemistry Vol 1&2	Vignan Publishers &Deepthi Publishers
4.	Engineering Chemistry	Jain & Jain
5.	Engineering Chemistry	O.P. Agarwal, Hi-Tech.
6.	Engineering Chemistry	Sharma
7.	Engineering Chemistry	A.K. De

ELEMENTS OF CERAMIC TECHNOLOGY-I

SUBJECT NAME : ELEMENTS OF CERAMIC TECHNOLOGY-I

SUBJECT CODE : CER-1201

PERIODS/ WEEK : 04

PERIODS / SEMESTER : 60

TIME SCHEDULE

S.No	Major Topic	No. of Periods	Weightage of Marks	No. of Short Questions	No. of Essay Questions
1	Introduction	10	16	02	01
2	Types Of Clay Ware / Pottery Ware	12	16	02	01
3	Preparation Of Clay Bodies	12	26	02	02
4	Fabrication Methods In Clay Industry	12	23	01	02
5	Finishing And Drying Of Clay Ware	05	13	01	01
6	Glazing And Decoration	04	03	01	--
7	Firing Of Ceramic Ware	05	13	01	01
	Total	**60**	**110**	**10**	**08**

OBJECTIVES:

On completion of the course the student should be able to know the following:

1.0 INTRODUCTION

1.1 Know the Origin of Ceramics.
1.2 Definition of Ceramics.
1.3 Discuss the Stages in the Development of Ceramics.
1.4 Understand the applications of the Ceramics.
1.5 List the Sub-branches in Ceramics.
1.6 Define the term Refractories with examples.
1.7 Define Glass and mention examples.
1.8 List the Pottery Ware and mention examples.
1.9 Define the Enamel and mention examples.
1.10 Define the Cement and mention examples.
1.11 Know the importance of Silicate Technology in Ceramics.

2.0 TYPES OF CLAY / POTTERY WARE

2.1 Define the terms Clay and Pottery.
2.2 Know the Porous bodies.
2.3 List the types of porous bodies and its properties.
2.4 List the Heavy Clay Ware products.
2.5 Define Terracotta.
2.6 Define Majolica Ware.
2.7 Define Earthen Ware.
2.8 Definition of Non-porous/Dense bodies.
2.9 List the types of Non-porous/ Dense bodies.
2.10 Define Stoneware.
2.11 Define Porcelain.
2.12 Define Bone China.
2.13 Know the Properties of Non-porous/Dense bodies.
2.14 Define the term White Ware.
2.15 List the Types of product comes under White Ware.
2.16 List the Types of products comes under Vitreous and Semi Vitreous bodies

3.0 PREPARATION OF CLAY BODIES

3.1 Know the Benification process of Plastic Materials (Clays) and Non-plastic Materials.
3.2 Know the Calcination and the use of calcination.
3.3 Know the Stages in the body preparation.
3.4 Describe the crushing of Raw materials.
3.5 Describe the grinding of Raw materials.
3.6 Know the Necessity of weighing of the batch.
3.7 Know the Importance of mixing of Raw materials.
3.8 Know the Tempering of Raw materials.
3.9 Know Blunging.
3.10 Know Agitation and Agitator.
3.11 Know Screening (or) Lawn.
3.12 Know Magnetic Separation process
3.13 Know the Spray drying process.
3.14 Know Filter pressing process.
3.15 Understand the term Ageing and Souring.
3.16 Know Pugging and De-airing.

4.0 FORMING METHODS IN CLAY INDUSTRY

4.1 List the types of Fabrication methods.
4.2 Know briefly the Slip casting processes like Solid Casting, Hallow Casting, Pressure Casting, Battery Casting, etc.
4.3 Know the Plastic Forming.

4.4 Know the Soft mud processes like Hand moldings, Throwing, Jiggering and jollying, ram press, etc.
4.5 Know the stiff mud process like extrusion, wire cut process etc.
4.6 Know the Turning process.
4.7 Know the Dry Pressing.

5.0 FINISHING & DRYING OF CERAMIC WARE

5.1 Know the Necessity of Finishing.
5.2 Know the Trimming process.
5.3 Know the Sponging process
5.4 Know the Fettling process.
5.5 Know the Towing process.
5.6 Know the Necessity of drying.
5.7 Know the List of drying defects in Clay Ware.
5.8 List the Types of dryers used in Ceramic industry.

6.0 GLAZING AND DECORATION

6.1 Define the term Glaze.
6.2 Classify the glazes according to Composition and Temperature
6.3 List the Application methods of glaze.
6.4 Write the need of decoration of Ceramic Ware.
6.5 List the Ceramic coloring oxides.
6.6 Name the different Ceramic Stains.
6.7 Name the application methods of decoration.
6.8 Understand the under- glaze and on-glaze decoration process
6.9 List the defects in glazed ware.

7.0 FIRING OF CERAMIC WARE

7.1 Name the types of Kilns used for firing of ceramic ware
7.2 Know about Bisque Firing process.
7.3 Know about Glost Firing process.
7.4 Explain the action of Heat on clay bodies.
7.5 Understand the Physical & Chemical changes in the ceramic ware.

COURSE CONTENTS:

1. **INTRODUCTION**: Origin of Ceramics, Definition of Ceramics, Development of Ceramics, Importance of Ceramics, Sub-branches in Ceramics, Silicate Technology related to Ceramics.

2. **TYPES OF CLAY/POTTERY WARE:** Definition of Pottery, Types of Pottery, Porous and Non-porous Bodies, Vitreous and Semi-Vitreous bodies.

3. **PREPARATION OF CLAY BODIES:** Treatment of Plastic Materials. Treatment of Non-plastic materials. Body Preparation.

4. **FORMING METHODS IN CLAY INDUSTRY:** Types of Fabrication methods. Types of Slip Casting methods. Types of Plastic Forming methods. Turning Process. Dry Pressing Process.

5. **FINISHING AND DRYING OF CERAMIC WARE**: Types of Finishing methods. Need of Drying, Types of Dryers.

6. **GLAZING AND DECORATION**: Definition of glaze, Types of glazes. Preparation of glazes. Methods of application of glaze. Need of decoration. Application methods of decoration. Ceramic colors. Ceramic stains.

7. **FIRING OF CERAMIC WARE**: Types of Kilns, Bisque Firing. Glost Firing. Action of Heat on clay ware during firing.

***NOTE**: - The faculty, teaching the subject are requested to keep it in view that these topics are taught in detail as an individual papers in the future semesters, hence stress is to be given on the basis.*

REFERENCE BOOKS:

1. Sudhir Sen, Ceramic White Wares, Oxford & IBH publishing Ltd., New Delhi, 1992.

2. S.Kumar, Hand Book of Ceramics, Volume I and II. Kumar and Associates, Kolkata, 1994 and 1995

3. F.H.Norton, Elements of Ceramics, 2nd edition, Addison Wesley, London, 1994.

4. S.Kumar, Source of Ceramics, Dipankar Kumar, Kolkata, 2002

5. Saikat Maitra and Asis K Bandyopadhyay, Gate Way to Ceramics, SMD Udyog, 9/4A/1Q South Sinthee Road, Kolkata-5, 2003.

6. Felix Singer and Sonja S Singer Industrial Ceramics, Oxford & IBH Publishing Co., New Delhi, 1991.

7. Budnikov, P.P, The Technology of Ceramics and Refractories, Cambridge MIT, 1964.

8. R.CHARAN, Hand Book of Glass Technology,

9. FAY V. TOOLEY, Handbook of Glass Manufacture Volume I & II, Ogden Publishing Company, New York, 1960.

10. SAMUEL R SCHOLES, Modern Glass Practice, Industrial Publications, Inc., Chicago, 1952.

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CERAMIC RAW MATERIALS

NAMEOF THE SUBJECT : CERAMIC RAW MATERIALS

SUBJECT CODE : CER - 1202

PERIODS / WEEK : 05

PERIODS/ SEMESTER : 75

TIME SCHEDULE:

S.No	Major Topic	No. of Periods	Weightage of Marks	No. of Short Questions	No. of Essay Questions
1	Elementary Geology	15	29	03	02
2	Descriptive Mineralogy	15	19	03	01
3	Major Ceramic Raw Materials	40	59	03	05
4	Byproducts	05	03	01	--
	Total	**75**	**110**	**10**	**08**

OBJECTIVES: *On completion of the course, the student should be able to know the following:*

1.0 ELEMENTARY GEOLOGY:

1.1 Define the term Geology, Petrology.
1.2 Explain the formation of rocks.
1.3 Write the characteristics of rocks.
1.4 Classify the rocks.
1.5 Know the Sub classification of rocks.
1.6 Differentiate the Magma and Lava.
1.7 Explain the formation of intrusive rock and extrusive rocks.
1.8 Know the Sedimentary rock formation..
1.9 Know the Metamorphism

2.0 DESCRIPTIVE MINERALOGY:

2.1 Define the term Mineral.
2.2 Define the term Mineralogy.
2.3 List the types of Minerals used in Ceramic industry.
2.4 Define the term Ore.
2.5 List the types of Ores used in Ceramic industry.
2.6 Differentiate the Ore and a Mineral.
2.7 Know the chemical composition of Minerals.
2.8 Know the physical properties of minerals.
2.9 List the major rock forming minerals for ceramics.
2.10 Write the minerals used in ceramics with the help of physical properties.
2.11 Know Magnetism
2.12 Know Optical Mineralogy

3.0 MAJOR CERAMIC RAW MATERIALS:

CLAYS:

3.1 Know the types of Clay minerals as natural raw material like kaoline group, Montmorillonite group and Illite group.

3.2 Write the Origin of clays.

3.3 Understand the term kaolinization.

3.4 Classification of Clays.

3.5 Define the terms primary, secondary and fusible clays with examples.

3.6 Classify the Kaoline.

3.7 Know the Properties and uses of Kaoline.

3.8 Know the Properties and uses of Pyrophyllite.

3.9 Write the Impurities and its effects in clays.

3.10 List the Physical properties of clays.

3.11 ***Know the occurrence, physical, chemical properties and uses in ceramics of the following materials: -***

a. Fire clay.
b. Grog.
c. Flint fire clay.
d. Marls
e. Ball clay.
f. Bentonite
g. Shales, Loams. Loes etc.
h. Low Vitrified Clays.

3.12 SILICA MINERALS:

3.12.1 Classify the Silica minerals

3.12.2 ***Know the occurrence, physical, chemical properties and uses in ceramic of the following materials: -***

a. Quartz
b. Quartzite
c. Flint
d. Diatomite
e. Quartz sand.
f. Glass sand

3.12.3 Know the Polymorphic modifications of quartz.

3.13 ALUMINA MINERALS

3.13.1 Classify the Alumina minerals.

3.13.2 Know the ***the occurrence, physical, chemical properties and uses in ceramics of the following materials: -***

a. Alumina minerals-Corundum
b. Hydrated Alumina minerals.

(i). Bauxite, (ii). Gibbsite, (iii) Diaspore, (iv). Boehmite etc.

c. Alumino - Silicate minerals.

(i). Sillimanite, (ii) Kyanite, (iii) Andalusite etc.,

d. Hydrated Alumino Silicates.

e. Alkali Alumino silicates: (i). Feldspar, (ii). Talc, (iii). Beryl etc.

3.14 FELDSPAR GROUP MINERALS

3.14.1 Classify the Feldspar based on Mineralogical formula.

3.14.2 Classify the feldspar by chemical formula..

3.14.3 Know the Properties and uses of all varieties of Feldspars.

3.14.4 Know the Properties and uses of Nepheline syenite

3.14.5 Know the Occurrence, properties and uses of China stone/Cornish stone.

3.15 CARBONATE MINERALS:

3.15.1 List the carbonate minerals.

3.15.2 Know the Occurrence, properties and uses of Limestone, Dolomite, Magnesite, and Calcite.

3.15.3 Know the Properties and uses of Wollastonite.

3.16 MAGNESIUM SILICATE MINERALS:

3.16.1 List the Magnesium silicates.

3.16.2 Know the Occurrence, properties and uses of Steatite, Talc, Cordierite, and Forsterite

3.16.3 Know the Occurrence, properties and uses of Olivine, Fayalite,

3.17 FLUORINE MINERALS:

3.17.1 List the Fluorine minerals.

3.17.2 Know the Occurrence, properties and uses of Fluorspar and Cryolite

3.18 TITANIUM MINERALS:

3.18.1 List the Titanium Minerals.

3.18.2 Know the Occurrence, properties and uses of Rutile, Brookite. Anatase etc.,

3.19 Know the Occurrence, properties and uses of **BERYL.**

3.20 Know the Occurrence, properties and uses of **ZIRCON, ZIRCONIA AND BEACH SAND.**

3.21 List the **RARE EARTH MINERALS**.

3.22. GYPSUM:

3.22.1 List the types of Gypsum

3.22.2 Know the Occurrence, properties and uses of Gypsum.

3.22.3 Write the effect of Heat on gypsum.

3.22.4 Explain the Preparation of plaster of Paris.

3.22.5 List the Types of Plaster of Paris.

3.22.6 Know the Properties and uses of Plaster of Paris.

3.23.1 Properties and uses of Pyroxene,
3.23.2 Properties of Barites,
3.23.3 Properties and uses of Graphite.
3.23.4 Know the Properties and uses of Read lead.
3.23.5 Know the Properties and uses of white lead.
3.23.6 Know the Properties and uses of Chromite.

4.0 BYPRODUCTS

Identify the occurrence and use of the following:

4.1 Understand the term Man made materials or Byproducts.
4.1 Blast Furnace Slag.
4.2 Fly ash and Paddy Husk ash.
4.3 Bone ash.
4.4 Phospho – gypsum
4.5 Red mud

COURSE CONTENTS:

1. ELEMENTARY GEOLOGY: Formation, characteristics, classification, Sub-classification of Rocks. Formation of mineral deposits. Relation of mineral deposits to igneous activity. Magma, lava, crystallization, metamorphic process, sedimentary process of mineral formation.

2. DESCRIPTIVE MINERALOGY: Chemical composition, Physical properties like color, streak, luster, cleavage, hardness, Crystalline, form, specific gravity, etc and major rock forming minerals for ceramics., magnetism and Optical mineralogy

3. MAJOR CERAMIC RAW MATERIALS: Natural Raw Materials, Occurrence, availability, physical and chemical properties of natural minerals of clays, Synthetic materials etc.,

4. BYPRODUCTS: Blast furnace slag, Fly ash, Paddy husk ash, Bone ash, Phospho gypsum etc.,

BOOKS RECOMMENDED:

1. C D Gribble, Rutley's Elements of Mineralogy, 27th Edition, Satish Kumar Jain for CBS Publishers, New Delhi, 1991.

2. Krishnan M.S, Introduction to Geology of India, The Madras Law Journal, 1943.

3. Kumar.S. , Handbook of Ceramics. Volume I , Kumar and Associate, Kolkata, 1994,

4. Worral, W.E. Clays and Ceramic Raw Materials, Pergaman press, New York, 1992.

5. W.Ryan, Properties of Ceramic Raw Materials, Pergaman press, New York, 1978.

6. A.V. Milovsker and O V Kononov, Mineralogy, Mir Publishers, Mascow, 1985.

7. DANA, E.S. Text book of Mineralogy, 1946

8. Norton FH, Fine Ceramics, Mec Graw Hill, New York, 1992.

PHYSICS LABORATORY-I

SUBJECT TITLE : PHYSICS LABORATORY-I
SUBJECT CODE : 1105
PERIODS /WEEK : 03(PER 2 WEEKS)
PERIODS / SEMESTER : 22 ½

TIME SCHEDULE

S.No	Name of the Experiment	No. of Periods
1.	Hands on practice on Vernier Calipers	03
2.	Hands on practice on Screw gauge	03
3.	Verification of Parallelogram law of forces and Triangle law of f	03
4.	Simple pendulum	03
5.	Velocity of sound in air – (Resonance method)	03
6.	Focal length and Focal power of convex lens (Separate & Combination)	03
	Revision	03
	Test	1 ½
	Total:	**22 ½**

Objectives:

Upon completion of the course the student shall be able to

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

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

3.0 Verify the parallelogram law and Triangle law

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

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

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

Competencies and Key competencies to be achieved by the student

Name of the Experiment (No of Periods)	Competencies	Key competencies
1. Hands on practice on Vernier Calipers(03)	• Find the Least count • Fix the specimen in posit • Read the scales • Calculate the physical	• 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 $l\text{-}T^2$ graph	• Find the time for number of oscillations • Find the time period • Calculate the acceleration due to gravity • Draw l-T and $l\text{-}T^2$ 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

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CHEMISTRY LABORATORY-I

SUBJECT TITLE : CHEMISTRY LABORATORY-I
SUBJECT CODE : CER-1106
PERIODS PER WEEK : 03 (PER 2 WEEKS)
PERIODS PER SEMESTER : 22 ½

TIME SCHEDULE

S.N	Name of the Experiment	No. of Periods
1.	Familiarization of methods for Volumetric analysis	03 ½
2.	Preparation of Std Na_2CO_3 and making solutions of different	03
3.	Estimation of HCl solution using Std. Na_2CO_3 solution	03
4.	Estimation of NaOH using Std. HCl solution	03
5.	Estimation of H_2SO_4 using Std. NaOH solution	03
6.	Determination of pH using pH meter	03 ½
7.	Determination of conductivity of water and adjusting ionic	03 ½
	Total:	**22 ½**

Objectives:

Upon completion of the course the student shall be able to

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

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

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

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

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

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

7.0 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

Competencies and Key competencies to be achieved by the student

Name of the Experiment (No of Periods)	Competencies	Key competencies
Familiarization of methods for Volumetric analysis (03)	--	--
Preparation of Std Na_2CO_3 and making solutions of different dilution (03)	▪ Weighing the salt to the accuracy of .01 mg ▪ Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette ▪ Making appropriate 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
Estimation of HCl solution using Std. Na_2CO_3 solution (03)	▪ Cleaning the glassware and rinsing with appropriate solutions ▪ Making standard solutions ▪ Measuring accurately the standard solutions and titrants ▪ Filling the burette with titrant ▪ Fixing the burette to the stand ▪ Effectively Controlling the flow of the titrant ▪ Identifying the end point ▪ Making accurate observations ▪ Calculating the results	▪ Making standard solutions ▪ Measuring accurately the standard solutions and titrants ▪ Effectively Controlling the flow of the titrant ▪ Identifying the end point ▪ Making accurate observations
Estimation of NaOH using Std. HCl solution (03)		
Estimation of H_2SO_4 using Std. NaOH solution (03)		
Estimation of Mohr's Salt using Std. $KMnO_4$ (03)		
Determination of acidity of water sample (03)		
Determination of alkalinity of water sample (03)		
Determination of total hardness of water using Std. EDTA solution (03)		
Estimation of Chlorides present in water sample (03)		
Estimation of Dissolved Oxygen (D.O) in water sample (By titration method) (03)		
Estimation of Dissolved Oxygen (D.O) in water sample (By electrometric method) (03)	▪ Familiarize with instrument ▪ Choose appropriate 'Mode' / 'Unit'	▪ Prepare standard solutions / buffers, etc. ▪ Standardize the

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)	▪ Prepare standard solutions / buffers, etc. ▪ Standardize the instrument with appropriate standard solutions ▪ Plot the standard curve ▪ Make measurements accurately ▪ Follow Safety precautions	instrument with appropriate standard solutions ▪ Plot the standard curve ▪ Make measurements accurately

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ENGINEERING DRAWING-I

SUBJECT TITLE : ENGINEERING DRAWING-I
SUBJECT CODE : CER-1107
PERIODS/WEEK : 06
PERIODS PER SEMESTER : 90

TIME SCHEDULE

Sno	Major Topics	No. of Periods	Weightage of marks	Short Answer Questions	Essay type Questions
1	Importance of Engineering Drawing	03	-	-	-
2	Engineering Drawing Instruments	06	-	-	-
3	Free hand lettering & Numbering	09	5	1	-
4	Dimensioning Practice	12	15	1	1
5	Geometrical Constructions	27	25	1	2
6	Projection of points, Lines, Planes & Solids	21	25	1	2
7	Auxiliary views	12	10		1
	Total	**90**	**80**	**04**	**06**

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

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

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

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

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

4) Understand Dimensioning Practice

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

5) Apply Principles of Geometric Constructions

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

6) Apply Principles of Projection of points, lines, planes & solids

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

7) Understand the need of auxiliary views

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

COURSE CONTENT

NOTE

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

1) **The importance of Engineering Drawing**

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

2) Engineering drawing Instruments

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

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

3) **Free hand lettering & numbering**

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

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

4) **Dimensioning practice**

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

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

5) Geometric Constructions

Division of a line: to divide a straight line into given number of equal parts internally and it's examples in engineering applications. Construction of tangent lines: to draw tangent lines touching circles internally and externally. Construction of tangent arcs i) To draw tangent arc of given radius to touch two lines inclined at given angle (acute, right and obtuse angles) ii) Tangent arc of given radius touching a circle or an arc and a given line iii) Tangent arcs of

radius R, touching two given circles internally and externally Construction of polygon: Construction of any regular polygon of given side using general method. Conical Curves: Explanation of Ellipse, Parabola, Hyperbola, as sections of a double cone and loci of a moving point, Eccentricity of above curves – Their Engg. applications viz. Projectiles, reflectors, P-V Diagram of a Hyperbolic process - Construction of ellipse by concentric circles method - Construction of parabola by rectangle method - Construction of rectangular hyperbola - General Curves: Involute, Cycloid and Helix, explanations as locus of a moving point, their engineering applications, viz, Gear tooth profile, screw threads, springs etc. - their construction.

Drawing Plate 4: Consisting of eight exercises on construction of polygons
Drawing Plate 5: Consisting of eight exercises on construction of conics
Drawing Plate 6: Consisting of eight exercises on involute, cycloid and helix

6) **Projection of points, lines, planes & solids**

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

Drawing Plate 7: Consisting of eight exercises on projection of points and Lines
Drawing Plate 8: Consisting of eight exercises on projection of planes
Drawing Plate 9: Consisting of eight exercises on projection of solids

7) Auxiliary views

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

Drawing plate 10: Consisting of four exercises on auxiliary views

REFERENCE BOOKS

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

COMPUTER FUNDEMENTALS LABORATORY –I

SUBJECT TITLE : COMPUTER FUNDAMENTALS LABORATORY-I

SUBJECT CODE : CER-1203

PERIODS/WEEK : 04

PERIODS/YEAR : 60

TIME SCHEDULE

S. No.	Major Topics	No. of sessions each of 3 periods duration	No. of Periods
I.	Computer hardware Basics	04	16
II.	Windows Operating System	04	16
III.	MS Word	07	28
	Total	15	60

OBJECTIVES:

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

I. Computer Hardware Basics (Not for end examination)

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

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

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

III. Practice with MS-WORD

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

Competencies and Key Competencies to be achieved by the students

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

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

Exp No.	Name of the Experiment	Competencies	Key Competencies
9.	To insert a table of required number of rows and columns	a. Edit the table by adding the fields – Deleting rows and columns –inserting sub table – marking borders. Merging and splitting of cells in a Table b. Changing the background colour of the table c. Use table design tools d. Use auto fit – fixed row/ column height/length – Even distribution of rows / columns features e. Convert Text to table and Table to Text f. Use Sort feature of the Table to arrange data in ascending/descending order	a. Insert table in the word document and edit b. Use sort option for arranging data.
10.	To Insert objects, clipart and Hyperlinks	a. Create a 2-page document. &Insert hyperlinks and Bookmarks. b. Create an organization chart c. Practice examples like preparing an Examination schedule notice with a hyperlink to Exam schedule table.	a. Insert hyperlinks &Bookmarks b. Create organization charts/flow charts
11.	To Use Mail merge feature of MS Word	a. Use mail merge to prepare individually addressed letters b. Use mail merge to print envelopes.	Use Mail merge feature
12.	To use Equations and symbols features.	a. Explore various symbols available in MS Word b. Insert a symbol in the text c. Insert mathematical equations in the document	Enter Mathematical symbols and Equations in the word document

FUNDAMENTAL PROPERTIES OF CERAMICS LABORATORY

SUBJECT : FUNDAMENTAL PROPERTIES OF CERAMICS LABORATORY
SUBJECT CODE : Cer- 1301
PERIODS/ WEEK : 4
PERIODS / SEMESTER : 60

LIST OF EXPERIMENTS:

S.No	Name of the Experiment	No. of Periods
1	Identification of Ceramic Raw materials	02
2	Demonstration of Primary and secondary crushers for crushing of the material	04
3	Preparation of clay models and Geometrical shapes	04
4	Determination of the Particle size analysis by Ro-Tap sieve shaker (Ceramic powders and glass sand)	02
5	Determination of the moisture content of plastic and Non-plastic materials	04
6	Determination of Slaking of clays	04
7	Determination of Water of Plasticity of clays	06
8	Determination of the Linear shrinkage of specimen made of clays	06
9	Determination of the Volume shrinkage of clay specimen	06
10	Routine tests for ceramic products like white ware/heavy clay ware /refractory/Glass/Cement etc	06
11	Determination of Density and Specific gravity of Ceramic powders	06
12	Preparation of cement brick and find the properties	06
	Total	60

S.NO	OBJECTIVE	COMPETENCY	KEY COMPETENCY
1.	Identification of Raw materials.	-Identification of Raw materials used in Ceramic Industries based on Physical Properties.	-Know the Physical Properties like hardness, density, color, Streak, Luster, Fracture. -Based on Physical Properties Identify Raw materials.
2.	Determination of Crushers.	-Identification of different types of Primary & Secondary Crushers.	-Understanding the importance of Crushing. -Know the Working Principle of different types of Crushers. -Observe the Working of Crushers.
3.	Preparation of Clays &bodies.	-Making of different Geometrical Shapes & models using Clays &bodies.	-Measure the Volume of mold. -Weigh the Raw materials. -Mix with Water. -Pressing in mold.
4.	Determination of Particle Size	-Identify different Sieves used in determination of Particle Size.	-Know the Relationship between Sieve No &Particle Size. -Weighing of material. -Transfer to a set of Sieves. -Placed in Rotap Sieve Shaker for 5mm. -Weigh the retain Components.
5.	Moisture Content	-Identify the Instruments used in measuring Moisture Content.	-Know the important of measuring Moisture Content. -Understand the Working of Infrared Moisture balance.
6.	Determination of Slaking of Clays.	-To find the time of dissolving of Clays in water.	-The Students is able to Understand the relationship between Slaking &Plasticity.
7.	Determination of Water of Plasticity of Clay.	-To find amount of water required to make Plastic mass.	-The Student is able to Understand the importance of Plasticity.

8.	Determination of Linear Shrinkage of Specimen made of Clay.	-Select the Plastic or non Plastic Clay Which has to measure Linear Shrinkage. -Make it in to Specimen by using suitable mold. -then Dry and Fire at suitable temperature. -Find out the Dry and Firing Shrinkages.	-Identify the Plastic & non Plastic Clays. -Know the Drying &Firing. -Know the Drying &Firing Shrinkage of the different Clays.
9.	Determination of the Volume Shrinkage of Clay Specimen.	-The Specimen was Prepare by using different Clays. -Find out the Volume Drying Shrinkage &Volume Firing Shrinkage.	-Know the relationship between Liner Shrinkage to its Volume Shrinkage. -Know the Volume Shrinkage of different Clays Which was used in the Ceramic Industry.
10.	Routine test for Ceramic Products like White ware/Heavy Clay ware/Refractory/Glass/Cement etc.	-Take the Specimens of the different ceramic products.. -Find out the density , porosity, water, absorption, SPGR etc.,	-Know the preparation of test specimen -Know the different properties of the ceramic properties.
11.	Determination of density and SPGR of ceramic powders.	-To find out the density and SPGR of ceramic powders.	-Know the density and specific gravity of the different ceramic powders.
12.	Preparation of cement brick and find the properties.	-Prepare the standard brick by using OPC -Find out the properties of the Cement Brick.	-Know the properties of the cement brick i.e., compressive Strength, Tensile Strength, porosity, water absorption etc.,

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DIPLOMA IN

CERAMIC TECHNOLOGY

3 ½ YEAR SANDWICH

UNDER MPEC

SECOND SEMESTER

CURRICULUM – 2016

(C-16)

STATE BOARD OF
TECHNICAL EDUCATION & TRAINING
ANDHRA PRADESH

DIPLOMA IN CERAMIC TECHNOLAGY
3 ½ YEAR SANDWICH COURSE (UNDER MPEC SYSTEM)

SECOND SEMESTER

Subject	Name of the Subject	Instruction Periods/Week		Total Periods/ Semester	Scheme Of Examinations				
		Theory	Practical		Duration (hrs)	Sessional Marks	End Exam Marks	Total Marks	Credits
	THEORY SUBJECTS								
CER-2108	English -II	03	-	45	3	20	80	100	3
CER-2109	Engineering Mathematics – II	05	-	75	3	20	80	100	5
CER-2110	Engineering Physics -II	04	-	60	3	20	80	100	4
CER-2111	Engineering Chemistry & Environmental Studies -II	04	-	60	3	20	80	100	4
CER-2204	Elements of Ceramic Technology -II	05	-	75	3	20	80	100	5
CER-2205	General Engineering	06	-	90	3	20	80	100	6
	PRACTICAL SUBJECTS								
CER-2112	Physics Laboratory-II	-	1 ½	22 ½	1 ½	20	30	50	0.75
CER-2113	Chemistry Laboratory-II	-	1 ½	22 ½	1 ½	20	30	50	0.75
CER-2114	Engineering Drawing-II	-	07	105	3	40	60	100	4.5
CER-2206	Computer Fundamental Practice- II	-	05	75	3	40	60	100	2.5
	Total	**27**	**15**	**630**	**-**	**240**	**660**	**900**	**35.5**

ENGLISH-II

SUBJECT TITLE : ENGLISH -II
SUBJECT CODE : CER-2108
PERIODS/WEEK : 03
PERIODS / SEMESTER : 45

TIME SCHEDULE

S. No	TOPIC / LESSON	No. of Hours	Number of short Questions	Number of Essay Questions	Total marks Weightage
1	Reported Speech- (Lesson 23)	03	2	-	06
2	Error Analyses (Lessons 24,25,26)	08	2	1	16
3	Paragraph Writing (Lessons 27, 28)	04	-	1	10
4	Data Interpretation (Lessons 29,30,31)	06	-	1	10
5	Letter writing (Lessons 32, 33)	06	1	1	13
6	Resume (Lesson 34)	02	1	1	16
7	Cover Letter (Lesson 35)	02	1		
8	Note Taking &Note Making (Lessons 36.1 &36.2)	04	1	1	13
9	Summarizing (Lesson 37)	04	1	1	13
10	Report Writing (Lessons 38,39,40)	06	1	1	13
	TOTAL	45	10	08	110

End Exam pattern : Total marks : 80
Part A ; 10 short questions , each carries 3 marks, all compulsory- 3x10 = 30 Marks
Part B ; Any 5 essay questions out of 8, each carries 10 marks- 10X5 = 50 Marks

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

1.0 Learn and use Direct and Indirect speech & Error analyses
2.0 Write compositions, paragraph writing, data interpretation
3.0 Write Letters, Resumes, Cover Letter for employability
4.0 Take Notes , make notes , Summarizing the given text
5.0 Write Reports , various kinds of reports

1.0 Learn and use Direct and Indirect speech & Error analyses

1.1 Ability to present the exact words of a speaker, format, punctuation, arrangement of words in a Direct speech
1.2 Ability to convert a sentence of Direct speech into a Reported or Indirect speech, learn all the changes involved.
1,3 To locate the errors in a sentence or in a paragraph based on the previous knowledge in all topics.
1.4 To analyse the errors, able to explain the reason and make necessary correction
1.5 To be familiar with common errors that occur in grammar, vocabulary, punctuation usage and correct them.

2.0 Write compositions, paragraph writing, data interpretation

2.1 Learn to generate ideas , organize them and write a short paragraph
2.2 Identifying topic sentence, supporting details, write cohesive paragraph
2.3 Study and understand the information in the flow charts
2.4 Analyse, interpret the flow charts , tree diagram, tables,
2.5 Ability to write a paragraph with given hints/details, pictures, interpret any flow chart, expand an idea.

3.0 Write Letters, Resumes, Cover Letter for employability

3.1 Know the format of the Personal / informal Letter, able to write letters to friends and relations.
3.2 Know the format of an official / Formal Letter, able to write letters to officers with a purpose,
3.3 Learn the components like Salutation, opening& closing phrases, subject, reference, body, and subscription of an Official letters
3.4 Format and purpose of a Resume, its main components/details, preparing personal Resume, preparing other's Resume with the given details,
3.5 Purpose and format of a Cover Letter, Its parts, Difference between an official letter and cover letter

4.0 Take Notes , Make notes , Summarizing the given text

4.1 Importance of Note Taking while listening, using various abbreviations, understand its purpose, advantages of Note taking
4.2 Purpose and uses of Note Making while reading, identify important words, ideas
4.3 Learn to use Cue method, Mind mapping technique to make notes. Practice some exercises
4.4 Learn techniques of Summarizing a text, gathering hints, organizing the ideas, write a short paragraph with essential details, Correct the draft, recheck and finalise the summary

4.5 Understand the importance of Note Taking, Note Making, Summarizing a text. Learn and use different techniques in the class room, while studying the lessons and preparing for exams.

5.0 Write various kinds of Reports

5.1 Formal Reports on Lab experiments, Record the procedure and findings of an experiment.

5.2 Format of Report on Industrial visits, Write work done statements

5.3 Various details in a detailed Report on Industrial visit, or larger reports. Prepare a report on Industrial visit.

5.4 Write maintenance reports, Organise information to report an incident, prepare a report on an incident

5.5 Collect as much information as possible like images, charts, statistical data, background information, Prepare a format, template to make a draft, check revise and make a final report.

Course Material:

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

Reference Books

1. Essential English Grammar (Intermediate Level) Raymond Murphy
2. Learn English (A Fun Book of Functional Language, Grammar and Vocabulary) Santanu Sinha Chaudhuri
3. Grammar Builder (Entire Series) Oxford University Press
4. High School English Grammar (Revised Edition) Wren and Martin
5. Sentence skills with Readings (fourth Edition, Tata McGraw Hill) John Langan, Paul Langan
6. Word Power Made Easy Norman Lewis
7. Spoken English Shashi Kumar and Dhamija

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ENGINEERING MATHEMATICS-II

SUBJECT TITLE : ENGINEERING MATHEMATICS-II
SUBJECT CODE : CER-2109
PERIODS / WEEK : 05
PERIODS/ SEMESTER : 75

TIME SCHEDULE

S. No	Major Topic	No of Periods		Weightage of Marks	Short Type			Essay Type		
		Theory	Practice		R	U	App	R	U	App
	Unit I : Co-ordinate Geometry									
1	Straight Lines	5	3	11	1	1	0	0	0	1/2
2	Circle	4	2	8	1	0	0	0	1/2	0
3	Conic Sections	4	4	10	0	0	0	1/2	1/2	0
	Unit – II : Differential Calculus									
4	Limits and Continuity	4	2	8	0	1	0	1/2	0	0
5	Differentiation	18	10	39	1	1	1	1	1	1
	Unit - III : Applications of Differentiation									
6	Geometrical Applications	3	3	11	1	0	1	0	0	1/2
7	Physical Applications	2	3	8	0	1	0	0	0	1/2
8	Maxima and Minima	3	3	10	0	0	0	1/2	0	1/2
9	Errors and Approximations	2	0	5	0	0	0	0	0	1/2
	Total	45	30	110	4	4	2	$2\frac{1}{2}$	2	$3\frac{1}{2}$
				Marks	12	12	6	25	20	35

R: Remembering type 37 marks
U: Understanding type 32 marks
App: Application type 41 marks

ENGINEERING MATHEMATICS

Objectives

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

UNIT - I

Coordinate Geometry

1.0 Solve the problems on Straight lines

1.1 Write the different forms of a straight line – point slope form, two point form, intercept form,

Normal form and general form

1.2 Solve simple problems on the above forms

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

2.0 Solve the problems on Circles

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

2.2 Find the equation of a circle given

(i) Center and radius

(ii) Two ends of a diameter

(iii) Centre and a point on the circumference

(iv) Three non collinear points

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

3.0 Appreciate the properties of Conics in engineering applications

3.1 Define a conic section.

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

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

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

UNIT - II

Differential Calculus

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

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

4.2 Mention the Standard limits $\lim_{x \to a} \frac{x^n - a^n}{x - a}$, $\lim_{x \to 0} \frac{\sin x}{x}$, $\lim_{x \to 0} \frac{\tan x}{x}$, $\lim_{x \to 0} \frac{a^x - 1}{x}$, $\lim_{x \to 0} \frac{e^x - 1}{x}$, $\lim_{x \to 0} (1 + x)^{\frac{1}{x}}$, $\lim_{x \to \infty} \left(1 + \frac{1}{x}\right)^x$ (All without proof).

4.3 Solve the problems using the above standard limits

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

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

5.0 Appreciate Differentiation and its meaning in engineering situations

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

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

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

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

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

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

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

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

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

5.9 Find the derivatives of hyperbolic functions.

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

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

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

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

5.14 Explain the definition of Homogenous function of degree n

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

UNIT - III

Applications of the Differentiation

6.0 Understand the Geometrical Applications of Derivatives

6.1 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.

6.2 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.

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

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

7.0 Understand the Physical Applications of Derivatives

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

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

8.0 Use Derivatives to find extreme values of functions

8.1 Define the concept of increasing and decreasing functions.

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

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

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

9.0 Use Derivatives to find Errors and Approximations

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

COURSE CONTENT

UNIT-I

Coordinate geometry

1. **Straight lines:** various forms of straight lines, angle between lines, perpendicular distance from a point, distance between parallel lines-examples.
2. **Circle:** locus of a point, Circle definition-Circle equation given (i) center and radius, (ii) two ends of a diameter (iii) centre and a point on the circumference (iv) three non collinear points - general equation of a circle - finding center, radius.
3. Definition of a conic section, equation of a conic when focus directrix and eccentricity are given. Properties of parabola, ellipse and hyperbola, standard forms.

UNIT-II

Differential Calculus

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

Applications of Derivatives:

6. Geometrical meaning of the derivative, equations of Tangent and normal to a curve at any point. Lengths of tangent, normal, sub tangent and subnormal to the curve at any point. Angle between the curves - problems.
7. Physical applications of the derivative – velocity, acceleration, derivative as a rate Measure – Problems.
8. 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.
9. Applications of derivative in finding errors and approximations of functions and simple problems.

Reference Books :

1. Co-ordinate Geometry, by S.L Loney
2. Thomas Calculus, Pearson Addison-Wesley publishers
3. Calculus – I, by Shanti Narayan and Manicavachgam Pillai, S.V Publications

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ENGINEERING PHYSICS-II

SUBJECT TITLE : ENGINEERING PHYSICS-II
SUBJECT CODE : CER-2110
PERIODS / WEEK : 4
PERIODS /SEMESTER : 60

TIME SCHEDULE

S.No	Major topic	No.of Periods	Weightage of marks	Short answer type	Essay answer type
1.	Simple Harmonic Motion	12	26	02	02
2.	Heat &Thermodynamics	14	26	02	02
3.	Sound	12	26	02	02
4.	Electricity & Magnetism	14	26	02	02
5.	Modern Physics	08	06	02	Nil
	Total	60	110	10	08

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Understand the concept of Simple harmonic motion

1.1 Define Simple harmonic motion
1.2 Give examples for Simple harmonic motion
1.3 State the conditions of Simple harmonic motion
1.4 Explanation of SHM in terms of projection of circular motion on any one of the diameters of the circular path
1.5 Derive expression for displacement
1.6 Derive expression for velocity
1.7 Derive expression for acceleration
1.8 Derive expression for Time period and frequency of S H M
1.9 Define phase of S H M and explain from the expression of displacement
1.10 Define Ideal simple pendulum and derive expression for Time period of simple pendulum
1.11 State the laws of motion of simple pendulum and mention formulae
1.12 Solve the related numerical problems

2.0 Understand the concept of Heat and thermodynamics

2.1 Explain the concept of expansion of gases
2.2 State and explain Boyle's law and also express it in terms of density
2.3 Define absolute zero temperature
2.4 Explain absolute scale of temperature

2.5 State Charles laws in terms of absolute temperature and explain
2.6 Define ideal gas and distinguish from real gas
2.7 Derive Ideal gas equation
2.8 Define Specific gas constant and Universal gas constant
2.9 Explain why universal gas constant is same for all gases
2.10 State SI unit and dimensional formula of universal gas constant
2.11 Calculate the value of universal gas constant
2.12 State the gas equation in different forms (as a function of density and mass)
2.13 Distinguish between r and R
2.14 State and Explain Isothermal process
2.15 State and Explain adiabatic process
2.16 Distinguish between isothermal and adiabatic processes
2.17 State first and second laws of thermodynamics and state applications
2.18 Define specific heats & molar specific heats of a gas and differentiate them
2.19 Derive the relation $C_p - C_v = R$ (Mayer's Equation)
2.20 Solve the relavent numerical problems

3.0 Understand the concept of Sound

3.1 Define the term sound
3.2 Explain longitudinal and transverse wave motion and state differences
3.3 Distinguish between musical sound and noise
3.4 Explain noise pollution and state SI unit for intensity level of sound
3.5 Explain causes of noise pollution
3.6 Explain effects of noise pollution
3.7 Explain methods of minimizing noise pollution
3.8 Explain the phenomenon of beats
3.9 State the applications of beats
3.10 Define Doppler effect
3.11 List the Applications of Doppler effect
3.12 Define reverberation and reverberation time
3.13 Write Sabine's formula and name the parameters contained
3.14 Define and Explain echoes and also state its applications
3.15 State conditions of good auditorium
3.16 Solve the related numerical problems

4.0 Understand the concept of Electricity and Magnetism

4.1 Explain the concept of Electricity
4.2 State Ohm's law and write the formula
4.3 Explain Ohm's law
4.4 Define specific resistance, conductance and state their units
4.5 State Kichoff's laws
4.6 Explain Kichoff's laws
4.7 Describe Wheatstone's bridge with legible sketch
4.8 Derive an expression for balancing condition of Wheatstone's bridge
4.9 Describe Meter Bridge experiment for the determination of resistivity with a neat circuit diagram

4.10 Write the formula in Meter Bridge to determine specific resistance
4.11 Explain the concept of magnetism
4.12 State the Coulomb's inverse square law of magnetism
4.13 Define magnetic field and magnetic lines of force and write the properties of magnetic lines of force
4.14 State the Magnetic induction field strength and mention its units and dimensionsal formula
4.15 Derive an expression for the moment of couple on a bar magnet placed in a uniform magnetic field
4.16 Derive Magnetic induction field strength at a point on the axial line
4.17 Derive Magnetic induction field strength at a point on the equatorial line
4.18 Solve the related numerical problems

5.0 Understand the concept of Modern physics

5.1 State and Explain Photo-electric effect
5.2 Write Einstein's photoelectric equation and explain
5.3 State laws of photoelectric effect
5.4 Explain the Working of photoelectric cell
5.5 List the Applications of photoelectric effect
5.6 Recapitulate refraction of light and its laws
5.7 Define critical angle
5.8 Explain the Total Internal Reflection
5.9 Explain the principle and working of Optical Fiber
5.10 Mention types of optical fibbers
5.11 List the applications of Optical Fiber
5.12 Define super conductor and superconductivity and mention examples for superconductors
5.13 State the properties of superconducting materials
5.14 List the applications of superconductors

COURSE CONTENT:

1. **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

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

3. **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

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

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

REFERENCE BOOKS

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

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ENGINEERING CHEMISTRY & ENVIRONMENTAL STUDIES-II

COURSE TITLE : ENGINEERING CHEMISTRY & ENVIRONMENTAL STUDIES-II

COURSE CODE : CER - 2111

PERIODS/WEEK : 04

PERIODS / SEMESTER : 60

TIME SCHEDULE

S/NO	Major Topics	Number Of Periods	Weight age Of Marks	Number Of Essay Type Questions	Number Of Short Answer Questions	Remembering	Understanding	Applying/ Analyzing
1	Water Technology	14	26	2	2	2	8	10
2	Corrosion	10	20	2	_	4	10	8
3	Polymers	12	26	2	2	3	2	8
4	Fules	8	09	_	3	5	5	8
5	Environ Mental Studies	16	29	2	3	13	15	9
	Total	60	110	08	10	27	40	43

Objectives

- **Upon Completion of the Course the Student Shall be able to**

(A) Engineering Chemistry

1. 0 Understand the concept of Water Technology

1.1 State the various Source soft water like Surface water and sub-surface water.

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

1.3 Define the term hardness of water

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

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

1.6 State the disadvantages of using hard watering industries

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

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

1.9 Concept of Osmosis and Reverse Osmosis with examples .

1.10 State the applications of Reverse Osmosis.

1.11 State essential qualities of drinking water.

2.0 Understand the concept of Corrosion

2.1 Define the term corrosion

2.2 state the Factors in fluencing the rate of corrosion

2.3 Describetheformationofa)compositioncell,b)stresscell,c)concentrationcell during corrosion.

2.4 Define rusting of iron and Explain the mechanism of rusting ofiron.

2.5 Explain the methods of prevention of corrosion:

a) Protective coatings (anodic and cathodic coaitings)

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

3.0 Understand the concepts of Polymers

3.1 Explain the concept of polymerisation

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

3.3 Define the term plastic

3.4 Classify the plastics with examples

3.5 Distinguish between thermo and thermo setting plastics

3.6 List the Characteristics of plastics

3.7 State the advantages of plastics over traditional materials

3.8 State the disadvantages of using plastics.

3.9 Explain the methods of preparation of the following plastics:

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

3.10 Explain the use soft the following plastics:

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

3.11 Define the term natural rubber

3.12 write the structural formula of Natural rubber

3.13 Explain the processing of Natural rubber from latex

3.14 List the Characteristics of natural rubber

3.15 Explain the process of Vulcanization

3.16 List the Characteristics of Vulcanized rubber

3.17 Define the term Elastomer

3.18 Describe the preparation of the following synthetic rubbers a) Buna-s and b)Neoprene rubber

3.19 List the uses of the following synthetic rubbers a) Buna-s and b)Neoprene rubber

4.0 Understand the concepts of Fuels

4.1 Define the term fuel

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

4.3 Classify the fuels based on occurrence – primary and secondary fuels

4.4 List the characteristics of good fuel

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

5.0 Environmental studies frm common C-16 syllabus

5.1 Define the term environment

5.2 Explain the scope and importance of environmental studies

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

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

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

5.6 Define the terms:
1).Producers, 2).Consumers and 3).Decomposers with examples.

5.7 Explain biodiversity and threats to biodiversity

5.8 Define air pollution

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

5.10 Explain the causes of Air pollution.

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

5.12 State the uses of forest resources.

5.13 State the deforestation and its causes and effects.

5.14 Explain the 1.) Green house effect , 2) Ozone layer depletion and 3) Acid rain.

5.15 Explain the methods of control of Air pollution

5.16 Define Water pollution

5.17 Explain the causes of Water pollution

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

5.19 Explain the methods of control of Water pollution.

6.0 Understand the concept of Corrosion

6.1 Define the term corrosion

6.2 state the Factors in fluencing the rate of corrosion

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

during corrosion.

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

6.5 Explain the methods of prevention of corrosion:

a)Protective coatings (anodic and cathodic coaitings)

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

COURSE CONTENT

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

2. Water technology

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

3. Polymers

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

4. Fuels

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

5. ENVIRONMENTALSTUDIES

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

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

REFERENCEBOOKS

1.	Intermediate chemistry Vol 1&2	Telugu Academy
2.	Intermediate chemistry Vol 1&2	Vikram Publishers
3.	Intermediate chemistry Vol 1&2	Vignan Publishers &Deepthi Publishers
4.	Engineering Chemistry	Jain & Jain
5.	Engineering Chemistry	O.P. Agarwal, Hi-Tech.
6.	Engineering Chemistry	Sharma
7.	Engineering Chemistry	A.K. De

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ELEMENTS OF CERAMIC TECHNOLOGY-II

SUBJECT NAME : ELEMENTS OF CERAMIC TECHNOLOGY-II

SUBJECT CODE : CER-2204

PERIODS/ WEEK : 05

PERIODS / SEMESTER : 75

TIME SHEDULE

S.No	Major Topic	No. of Periods	Weightage of Marks	No. of Short Questions	No. of Essay Questions
1	Refractories	18	26	2	2
2	Glass	20	26	2	2
3	Special Glasses	10	16	2	1
4	Enamels	10	23	1	2
5	Cement	10	16	2	1
6	Basic Concepts of Nano-Materials	07	03	1	--
	TOTAL	75	110	10	08

OBJECTIVES:

On completion of the course the student should be able to know the following:

1.0 **REFRACTORIES:**

1.1 Name the Natural and Synthetic Refractory materials.

1.2 Know the uses of refractory materials.

1.3 Define the term Refractory.

1.4 Understand the importance of Refractories in metal and Non-metal industries.

1.5 Know the Treatment of raw materials used in the Refractories.

1.6 Classify the Refractories.

1.7 List the varieties of refractory products like bricks, wool, cements, etc.

1.8 Know the Flow diagram for the manufacture of Fireclay, Dolomite, Magnesite, chrome Magnesite and Silica Refractories.

1.9 Know the Drying of Refractories.

1.10 Name the Kilns for Firing of Refractories.

1.11 List the properties of Refractories.

1.12 List the tests conducted on Refractories.

1.13 Define the terms of each test

2.0 GLASS:

2.1 Know the difference between glass and ceramics.

2.2 Define the term glass.

2.3 Classify glass, by batch and oxide composition.

2.4 List the different types of glass.

2.5 Know the classification of glass making raw materials.

2.6 Know the function of each raw material in glass making

2.7 Know the schematic diagram of glass making oxides.

2.8 Know the term cullet and its importance.

2.9 Know the Glass batch preparation.

2.10 Know the Importance of weighing and mixing of batch materials.

2.11 Know the flow diagram of Glass melting and terminology used in melting of glass

2.12 Name the furnaces used for melting glass batch.

2.13 Name the fabrication techniques for glass products like pressing, blowing, drawing etc…

2.14 Know the Importance of annealing of glass.

3.0 SPECIAL GLASSES

3.1 Introduction to Special glasses

3.2 Know the composition and uses of fiber glass

3.3 Know the composition and uses of Pyrex glass

3.4 Know the composition and uses of flint glass

3.5 Know the composition and uses of crown glass

3.6 Know the composition and uses of amber glass

3.7 Know the composition and uses of optical glass

3.8 Know the composition and uses of safety glasses

3.9 Know the difference between glass and glass-ceramics

3.10 Know the composition and uses of glass ceramics

4.0 ENAMELS:

4.2 Define the term Enamels.

4.3 Know the classification of enamel compositions

4.4 List the types of metals used in enamel industry.

4.5 Know the Preparation of metal surface for enameling.

4.6 Know the Flow diagram of frit making process.

4.7 List the frit making smelters and melters.

4.8 Know the Preparation of enamel slip.

4.8 Know the Flow diagram of Manufacture of Enamel ware

4.9 List the methods of enamel slip application techniques for enameling.

4.10 List the furnaces used in Firing of Enamel ware

4.11 Names the defects in enamel

5.0 CEMENT:

5.1 Define the term Cement.

5.2 Know the natural cement.

5.3 know the setting of cement.

5.4 Write the function of gypsum in the making of cement.

5.6 Classify the raw materials used in the Cement making.

5.7 Know the types of kilns used in cement manufacture

5.8 Draw the flow diagram of Manufacturing process of Wet and Dry methods.

5.8 Know the term Clinker

5.9 Know the classification of the cements by composition

5.10 Know the Properties of different types of cements

5.11. Know the uses of cements

6.0 BASIC CONCEPTS OF NANO-MATERIALS

6.1 Know the Introduction of Nano-materials

6.2 Know the Applications of Nano-materials

6.3 List the preparation methods of Nano-materials

COURSE CONTENTS:

1. **REFRACTORIES:** Introduction to Refractories-Classification-Examples for Refractories- Treatment of Raw materials- Manufacturing process- Drying - Firing - Properties of Refractories -Test of Refractories.

2. **GLASS:** Introduction- Classification - Varieties of Glass Products- (Bottle glass- sheet glass- fiberglass etc.) Raw materials used in Glass- Cullet- Glass Batch and Chemical composition- Glass batch mixing & Weighing- Glass melting - Shaping Techniques of – Annealing.

3. **SPECIAL GLASSES**: Introduction- composition, definition, uses of fiber glass, optical glass, pyrex glass, safety glass, crown glass, flint glass, glass ceramics etc…

4. **ENAMELS:** Introduction- Types of Enamels [Cast Iron, Sheet iron, and Steel]. Formation of metal shapes-Preparation of the metal surface for enameling- Enamel Compositions- Frit making & Frit making smelters- Milling & Mill additions-Methods of application of enamels- Firing.

5. **CEMENT:** Introduction- Raw materials, Types of cements, Flow diagram of manufacturing process, Properties and uses.

6. **BASIC CONCEPTS OF NANO-MATERIALS:** Introduction to Nanomaterials, Preparation and applications of Nanomaterials.

REFERENCE BOOKS:

1. R.CHARAN, Hand Book of Glass Technology,
2. FAY V. TOOLEY, Handbook of Glass Manufacture Volume I & II, Ogden Publishing Company, New York, 1960.
3. SAMUEL R SCHOLES, Modern Glass Practice, Industrial Publications, Inc., Chicago, 1952.
4. ANDREWS I. ANDREWS, Enamels –The preparation, Application and Properties of Vitreous Enamels, The Garrard Press, Publishers, Champaign, Illionois, 1949.
5. A RASHID CHESTI, Refractories, Prentice Hall of Inida Pvt Ltd, New Delhi, 1986
6. D N NANDI, Hand Book on Refractories, Tata McGraw-Hill Publishing Co. New Delhi, 1991.
7. Dr. M. L. MISRA, Refractories, Clear Type Press, Allahabad, 1975.
8. H N BANERJEA, Technology of Portland cement and Blended Cement

GENERAL ENGINEERING

SUBJECT NAME : GENERAL ENGINEERING

SUBJECT CODE : CER-2205

PERIODS/ WEEK : 06

PERIODS / SEMESTER : 90

TIME SHEDULE

SL No.	Major Topics	No. of Periods	Weightage of Marks	Short Type	Essay Type
	ELECTRICAL ENGINEERING				
1	Basic Principles Of Electricity	10	14	1	1
2	D.C.Machines	12	11	1	1
3	A.C.Fundamentals &A.C.Circuits	07	08	1	½
4	A.C.Machines	13	14	1	1
5	Storage Batteries And Safety Procedures	05	08	1	½
	MECHANICAL ENGINEERING*:*				
6	Basic Workshop Tools	10	11	1	1
7	Mechanical Working Of Metals	07	08	1	½
8	Simple Stresses And Strains	10	14	1	1
9	Fundamentals Of Thermodynamics	06	08	1	½
10	Internal Combustion Engines	10	14	1	1
	TOTAL	**90**	**110**	**10**	**8**

OBJECTIVES:

On completion of the course the student should be able to know the following:

1.0 BASIC PRINCIPLES OF ELECTRICITY

1.1. Definition and units of electric potential, potential difference, voltage, electromotive force and electric current.

1.2. State the Ohm's law

1.3.Compute resistance of a conductor given its length, area of cross section and resistivity.

1.4. State the Kirchoff's laws.

1.5. Difference between series and parallel circuits.

1.6. Definition and units of electric power and electrical energy.

1.7. Definitions of magnetic flux, magnetic field strength, permeability and reluctance.

1.8. State Faraday's laws of electromagnetic induction.

1.9. State Lenz's law.

1.10. Definition of dynamically induced e.m.f. and statically induced e.m.f.

1.11. Definition of self inductance and Mutual inductance.

1.12. Definition of electric field, electric flux, electric field intensity and capacitance.

2.0 D.C. MACHINES

2.1. State constructional features of D.C.Machines.

2.2. Discuss working principle of D.C.Generator.

2.3. State formula for E.M.F equation of D.C.Generator (derivation is not required).

2.4. Solve the simple problems of E.M.F.

2.5. State types of D.C.Generator.

2.6. Draw the sketches of different types of D.C.Generator.

2.7. Working principle of D.C.Motor.

2.8. State types of D.C.Motors.

2.9. Draw the schematic diagram of the above D.C.Motors.

2.10 State the applications of D.C.Motors.

2.11. State necessity of starter for D.C.Motor.

3.0. A.C.FUNDAMENTALS & A.C.CIRCUITS

3.1. Define Alternating current, cycle, amplitude, periodic time, frequency, instantaneous value and angular velocity.

3.2. Define phase and phase difference.

3.3. Define average value, RMS value, form factor and peak factor.

3.4. Solve simple series circuits containing R,L and C.

4.0. A.C.MACHINES

4.1. Discuss working Principle of Alternator.

4.2. e.m.f. Equation of an alternator (derivation not required) and solve simple problems.

4.3. Describe the working principle of transformer.

4.4. Write the e.m.f. Equation pf transformer and solve simple problems (derivation not required).

4.5. Describe the definition of Turn ratio.

4.6. Describe the working principle of 3ø induction motor.

4.7. State different types of 3ø induction motors and their applications.

4.8. Describe working principle of 1ø induction motor.

4.9. State the different types of 1ø induction motors and their applications.

4.10. State the principle of operation of Synchronous motor.

4.11. State the applications of synchronous motor.

5.0. STORAGE BATTERIES AND SAFETEY PROCEDURES:

5.1. State different types of cells.

5.2. State the active materials of Lead acid cell.

5.3. State the chemical reaction during charging and discharging of a Lead acid cell.

5.4. Write difference between lead acid cell and Nickel Iron cell.

5.5. Write the usage of storage batteries.

5.6. State the effect of electrical shock and burns.

5.7. State the precautions to be taken against electrical shock.

5.8. Discuss the procedures to be adopted in case of electric shock.

6.0. BASIC WORKSHOP TOOLS

6.1 State the Classification of various workshop tools.

6.2 Sketch the various marking and measuring tools in workshop as such steel rule, calipers, divider, Vernier calipers, sine bar, filler gauge. Wire gauge, plate gauge, Tri square, Marking knife, scriber, pick punch.

6.3 Describe with neat sketches the various cutting tools used in workshop such as saw, snips, chisels, drills, wheels brace, jackplane, File etc.

6.4 Describe with neat sketches the various striking tools used in work shop such as Warrington hammer, claw hammer, sledge hammer, mallet etc.

6.5 Describe with neat sketches the various holding tools used in work shop such as bench vice, pipe vice, hand vice etc.

6.6 Describe with neat sketches the various miscellaneous tools used in workshop such as pincer, screwdriver, spanners, pliers.

6.7 Describe with neat sketches the various machine tools like lathe, drilling machine used in workshop.

7.0 MECHANICAL WORKING OF METALS

7.1 Define hot working.

7.2 List the advantages and disadvantages of hot working.

7.3 Illustrate the working principle of various hot working processes like rolling, extrusion, forging, piercing, reeling, spinning, drawing etc.

7.4 Define Cold working.

7.5 List the advantages and disadvantages of cold working.

7.6 Illustrate the working principle of various cold working processes like rolling, drawing, extrusion, embossing, joining, bending etc.

7.7 Comparison of hot working with cold working.

8.0 SIMPLE STRESSES AND STRAINS

8.1 Define the stress.

8.2 Define the Strain.

8.3 State the Poisson's ratio.

8.4 State the different types of stresses and strains.

8.5 Discuss about elastic limit.

8.6 State Hook's law.

8.7 Define Modulus of elasticity.

8.8 State and explain Thermal stresses.

8.9 Compute stress and strain relating bodies of uniform section, changes in lateral and volumetric dimensions of bodies of uniform section under the action of normal forces and thermal stress as in bodies of uniform section.

9.0 FUNDAMENTALS OF THERMODYNAMICS

9.1. Define the term of Heat.

9.2. Discuss about Temperature.

9.3. Discuss about Specific heat.

9.4. State the laws of thermodynamics.

9.5. State and explain law of perfect gases.

9.6. Define internal energy.

9.7. State law of internal energy.

9.8. State law of conservation of energy.

10.0. INTERNAL COMBUSTION ENGINES

10.1 Define Heat engine.

10.2 Classify of heat engines with examples.

10.3 Discuss internal combustion engine terminology.

10.4 Explain with a line diagram of the working of a Four-stroke petrol engine with a neat line diagram.

10.5 Explain with a line diagram of the working of a Four-stroke diesel engine.

10.6 Explain with line diagram the working of Two-stroke petrol engine.

10.7 Explain with line diagram the working of Two-stroke diesel engine.

10.8 Compare two-stroke engine with four-stroke engine.

10.9 Compare diesel engine with petrol engine.

10.10 Draw the Line diagram of fuel supply system in petrol engine.

10.11 Draw the Line diagram of fuel injection system for C.I engines.

10.12 Understand the necessity of cooling for I.C engine.

10.13 Describe the methods of cooling like air-cooling system and water-cooling system.

COURSE CONTENTS:

1. **BASIC PRINCIPELS OF ELECTRICITY:** Define and state units of electric potential, potential difference, voltage, electromotive force and electric current.Ohm's law. Compute resistance of a conductor given its length, area of cross section and resistivity. Kirchoff's laws. Series and parallel circuits. Definitions of electric power and electrical energy, magnetic flux, magnetic field strength, permeability and reluctance. Faraday's laws of electromagnetic induction.Lenz's law. Dynamically induced e.m.f. and statically induced e.m.f. Sel inductance and Mutual inductance. Define electric field, electric flux, electric field intensity and capacitance.

2. **D.C. MACHINES:** D.C.Machines. D.C.Generator.Formula for E.M.F equation of D.C.Generator and solve the simple equations. Types of D.C.Generator.Working principle of D.C.Motor, Types of D.C.Motors, uses all D.C.Motors.Starter of a D.C.Motor.

3. **A.C.FUNDAMENTALS & A.C.CIRCUITS:** Define Alternating current, cycle,amplitude, periodic time, frequency, instantaneous value and angular velocity.Phase and phase difference, Define average value, RMS value, form factor and peak factor, Solve simple series circuits containing R,L and C.

4. **A.C.MACHINES:** Working Principle of Alternator. E.M.F. Equation of an alternator and Solve simple problems.Working principle of transformer. E.M.F. Equation of transformer and solve simple problems. Define Turn ratio, working principle of 3ø induction motor and single phase induction motor and its types and uses. Synchronous motor and its applications.

5. **STORAGE BATTERIES AND SAFETEY PROCEDURES:** Types of Cells, active materials of Lead acid cell, Nickel Iron cell, uses of storage batteries. Electrical shock and burns and its effects. Precautions for electrical shock.

6. **BASIC WORK SHOP TOOLS:** Classification, hand tools, marking, and measuring tools, striking tools, holding tools, miscellaneous tools and uses.

7. **MECHANICAL WORKING OF METALS:** Hot working process, cold working process, advantages and disadvantages of both and comparison.

8. **SIMPLE STRESSES AND STRAINS:** Stress, Strain, Various types of stresses and strains. Hook's law, Module of elasticity, lateral strain, Poisson's ratio,calculation of stress, strain and dimensional changes in bodies, thermal stresses.

9. **FUNDAMENTALS OF THERMODYNAMICS:** Heat, temperature, specific heat, loss of thermodynamics, loss of perfect gases, internal energy, law of conservation of energy.

10. **INTERNAL COMBUSTION ENGINES:** Definition, examples, classification, I.C. engine parts, engine terminology, four stoke (petrol and diesel) engines, Two stroke (petrol and diesel) engines, Four stroke vs. two stroke, petrol va. Diesel engines, fuel supply system in a petrol engines, fuel injections system for diesel engines, cooling system of I.C. engine, necessity of cooling and methods of cooling.

REFERENCE BOOKS:

1. BL Theroja and AKTheroja, Electrical Technology Volume I and II
2. Theraja, B.L., Fundamentals of Electrical Engineering", NirajPrakashma 1966.
3. RS Khurmi, Strength of Materials,
4. RS Khurmi, A text book on Mechanical technology,
5. BL Theroja and AKTheroja, Electrical Technology Volume I and II
6. Hajra Choudhery, Elements of Workshop Technology.
7. B.S. Raghuvamsi, Workshop Technology.

PHYSICS LABORATORY-II

SUBJECT TITLE : PHYSICS LABORATORY-II
SUBJECT CODE : CER-2112
PERIODS / WEEK : 03 (PER 2 WEEKS)
TOTAL PERIODS /SEMESTER : 22 ½

TIME SCHEDULE

S.No	Name of the Experiment	No. of Periods
1.	Refractive index of solid using traveling microscope	03
2.	Surface tension of liquid using traveling microscope	03
3.	Coefficient of viscosity by capillary method	03
4.	Boyle's law verification	03
5.	Meter bridge	03
6.	Mapping of magnet lines of force	03
	Revision	03
	Test	1 ½
	Total:	**22 ½**

Objectives:

Upon completion of the course the student shall be able to

1.0 Determine the refractive index of a solid using travelling microscope

2.0 Determine the surface tension of a liquid using travelling microscope

3.0 Determine the viscosity of a liquid using capillary method

4.0 Verify the Boyle's law employing a Quill tube

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

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

Competencies and Key competencies to be achieved by the student

Name of the Experiment(Periods)	Competencies	Key competencies
1. 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
2. Surface tension of liquid using traveling microscope(03)	• Find the least count of vernier on microscope • Focus the microscope to the lower meniscus & bent pin • Read the scale • Calculate height of liquid rise • Calculate the surface	• Read the scale • Calculate height of liquid rise • Calculate the surface tension of water
3. 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

4. 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
5. 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
6. 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	• Draw magnetic lines of force • Locate the neutral points along equatorial and axial lines

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CHEMISTRY LABORATORY-II

SUBJECT TITLE : CHEMISTRY LABORATORY-II
SUBJECT CODE : CER-2113
PERIODS/ WEEK : 03 (PER 2 WEEKS)
PERIODS/ SEMESTER : 22 ½

TIME SCHEDULE

S.N	Name of the Experiment	No. of Periods
1.	Estimation of Mohr's Salt using Std. $KMnO_4$	03
2.	Determination of acidity of water sample	03
3.	Determination of alkalinity of water sample	03
4.	Determination of total hardness of water using Std. EDTA	03
5.	Estimation of Chlorides present in water sample	03
6.	Estimation of Dissolved Oxygen (D.O) in water sample	03
7.	Determination of turbidity of water	02
8.	Estimation of total solids present in water sample	02 ½
	Total:	**22 ½**

Objectives:

Upon completion of the course the student shall be able to

1.0 Conduct titrations adopting standard procedures and using Std. $KMnO_4$ solution for estimation of Mohr's Salt
2.0 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)
3.0 Conduct titrations adopting standard procedures to determine the alkalinity of given samples of water (One ground water and one surface / tap water)
4.0 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
5.0 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)
6.0 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)
7.0 Conduct the test on given samples of solutions (coloured and non coloured) to determine their turbidity in NTU
8.0 Conduct titrations adopting standard procedures to determine the total solids present in given samples of water (One ground water and one surface / tap water)

Competencies and Key competencies to be achieved by the student

Name of the Experiment (No of Periods)	Competencies	Key competencies
Estimation of Mohr's Salt using Std. $KMnO_4$ (03) Determination of acidity of water sample (03) Determination of alkalinity of water sample (03) Determination of total hardness of water using Std. EDTA solution (03) Estimation of Chlorides present in water sample (03) Estimation of Dissolved Oxygen (D.O) in water sample (By titration method) (03)	▪ Cleaning the glassware and rinsing with appropriate solutions ▪ Making standard solutions ▪ Measuring accurately the standard solutions and titrants ▪ Filling the burette with titrant ▪ Fixing the burette to the stand ▪ Effectively Controlling the flow of the titrant ▪ Identifying the end point ▪ Making accurate observations ▪ Calculating the results	▪ Making standard solutions ▪ Measuring accurately the standard solutions and titrants ▪ Effectively Controlling the flow of the titrant ▪ Identifying the end point ▪ Making accurate observations
Estimation of Dissolved Oxygen (D.O) in water sample (By electrometric method) (03) Determination of turbidity of water (02)	▪ 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

Estimation of total solids present in water sample (02 ½)	▪ 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

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ENGINEERING DRAWING-II

SUBJECT TITLE : ENGINEERING DRAWING-II
SUBJECT CODE : CER-2114
PERIODS/WEEK : 07
PERIODS / SEMESTER : 105

TIME SCHEDULE

Sno	Major Topics	No. of Periods	Weightage of marks	Short Answer Questions	Essay type Questions
1	Sectional views	15	10		1
2	Orthographic Projection	22	20	1	1 ½
3	Pictorial drawing	30	20	1	1 ½
4	Development of surfaces	18	15	1	1
5.	Ceramic Drawing	20	15	1	1
	Total	**105**	**80**	**04**	**06**

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

OBJECTIVES

Upon completion of the subject the student shall be able to

1) Appreciate the need of Sectional Views

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

2)Apply principles of orthographic projection

j) Explain the principles of orthographic projection with simple sketches
k) Draw the orthographic view of an object from its pictorial drawing
l) Draw the minimum number of views needed to represent a given object fully

3)Prepare pictorial drawings

m) State the need of pictorial drawings
n) Differentiate between isometric scale and true scale
o) Prepare Isometric views for the given orthographic drawings

4) Interpret Development of surfaces of different solids

p) State the need for preparing development drawing
q) Prepare development of simple engineering objects (cubes, prisms, cylinders, cones, pyramids) using parallel line and radial line methods
r) Prepare development of surface of engineering components like trays, funnels, 90^0 elbows & rectangular ducts

5.Ceramic Drawings

5.1 Draw the plan and elevation of all types of Bricks and Blocks
5.2 Draw the plan and elevation of Continuous Glass tank furnace.
5.3 Draw the plan and elevation of Day Tank Furnace
5.4 Draw the plan and elevation of Enamel Modern Muffle furnace.
5.5 Draw the plan and elevation of Rotary smelter for frit making.
5.6 Draw the plan and elevation of Round Down draft kiln.
5.7 Draw the plan and elevation of Rectangular Down draft kiln.
5.8 Draw the plan and elevation of Muffle Tunnel kiln.
5.9 Draw the plan and elevation of Rotary kiln.
5.10 Draw the diagram of Spray drier for preparation of granules
5.11 Draw the diagram of Gas burner and Oil burner
5.12 Draw the plan and elevation of Roller Hearth Kiln for Tiles firing
5.13 Draw the diagram of Ball mill

COURSE CONTENT

NOTE

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

1) **Sectional views**

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

<u>Drawing Plate 11</u>: Consisting of six exercises on sections of solids

2) **Orthographic Projections**

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

<u>Drawing Plate 12</u>: Consisting of 12 exercises on orthographic projections of engineering objects

3) Pictorial Drawings

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

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

4) Development of Surfaces

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

Drawing plate 14: Consisting of 5 exercises on development problems

5.0 Ceramic Drawings

Draw the plan and elevation of all types of Bricks and Blocs - Draw the plan and elevation of Continuous Glass tank furnace - Draw the plan and elevation of Enamel Modern Muffle furnace - Draw the plan and elevation of Rotary smelter - Draw the plan and elevation of Round Down draft kiln - Draw the plan and elevation of Rectangular Down drat kiln - Draw the plan and elevation of Muffle Tunnel kiln - Draw the plan and elevation of Rotary kiln - Draw the plan and elevation of Shaft kiln

REFERENCE BOOKS

Engineering Graphics by P I Varghese – (McGraw-hill)
Engineering Drawing by Basant Agarwal & C.M Agarwal - (McGraw-hill)
Engineering Drawing by N.D.Bhatt.
T.S.M. & S.S.M on " Technical Drawing" prepared by T.T.T.I., Madras.
SP-46-1998 – Bureau of Indian Standards.
Refractories by Rashid Chesti
A Handbook of Refractories by Nandi
Fuels, Furnaces and Refractories by O.P Gupta
Hand book of Glass Manufacturing, Volime-I & II by F.V Tooley
Ceramic White wares, Sudhir sen

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COMPUTER FUNDEMENTALS LABORATORY-II

SUBJECT TITLE : COMPUTER FUNDAMENTALS LABORATORY-II

SUBJECT CODE : CER- 2206

PERIODS/WEEK : 05

PERIODS/SEMESTER : 75

Time Schedule

S. No.	Major Topics	No. of sessions each of 3 periods duration	No. of Periods
I.	MS Excel	10	50
II.	MS PowerPoint	5	25
	Total	15	75

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

I. Practice with MS-EXCEL

1. To familiarize with MS-EXCEL layout
2. To access and Enter data in the cells
3. To edit a spread sheet- Copy, Cut, Paste, and selecting Cells
4. To use built in functions and Formatting Data
5. To create Excel Functions, Filling Cells
6. To enter a Formula for automatic calculations
7. To practice Excel Graphs and Charts
8. To format a Worksheet in Excel, Page Setup and Print

2. Practice with MS-POWERPOINT

1. To familiarize with Ribbon layout features of PowerPoint 2007.
2. To create a simple PowerPoint Presentation
3. To set up a Master Slide in PowerPoint
4. To insert Text and Objects
5. To insert a Flow Charts
6. To insert a Table
7. To insert a Charts/Graphs
8. To insert video and audio
9. To practice Animating text and objects
10. To Review presentation

Competencies and Key Competencies to be achieved by the students

Exp No.	Name of the Experiment	Competencies	Key Competencies
1.	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
2.	To access and Enter data in the cells	a. Move around a Worksheet-Quick access -Select Cells b. Enter Data-Edit a Cell-Wrap Text-Delete a Cell Entry-Save a File-Close Excel	a. Access and select the required cells by various addressing methods b. Enter data and edit
3.	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
4.	To use built in functions and Formatting Data	a. Sort and filter data in a worksheet b. Perform Mathematical Calculations verify -AutoSum c. Perform Automatic Calculations-Align Cell Entries	Use built in functions in Excel
5.	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
6.	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

Exp No.	Name of the Experiment	Competencies	Key Competencies
7	To Practice Excel Graphs and Charts	a. Produce an Excel Pie Chart b. Produce an Excel Column Chart c. Practice creating any Chart	a. Use data in Excel sheet to Create technical charts and graphs Produce Excel Line Graph b. Produce a Pictograph in Excel
8	To format a Worksheet in Excel, page setup and print	a. Shade alternate rows of data b. Add currency and percent symbols c. Change height of a row and width of a column d. Change data alignment e. Insert Headers and Footers f. Set Print Options and Print	a. Format Excel sheet b. Insert headers &footers and print
9	To familiarize with Ribbon layout &features of PowerPoint 2007.	Use various options in Home, insert, design, animation , slideshow, Review &View in the PowerPoint	Access required options in the tool bar
10	To create a simple PowerPoint Presentation	a. Insert a New Slide into PowerPoint b. Change the Title of a PowerPoint Slide c. PowerPoint Bullets d. Add an Image to a PowerPoint Slide e. Add a Textbox to a PowerPoint slide	a. Create simple PowerPoint presentation with photographs/ClipArt and text boxes b. Use bullets option
11	To Set up a Master Slide in PowerPoint and add notes	a. Create a PowerPoint Design Template b. Modify themes c. Switch between Slide master view and Normal view d. Format a Design Template Master Slide e. Add a Title Slide to a Design Template f. The Slide Show Footer in PowerPoint f. Add Notes to a PowerPoint Presentation	a. Setup Masterslide and format b. Add notes
12	To Insert Text and Objects	a. Insert Text and objects b. Set Indents and line spacing c. Insert pictures/ clipart d. Format pictures e. Insert shapes and WordArt f. Use 3d features g. Arrange objects	Inset Text and Objects Use 3d features
13	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

14.	To insert a Table	a. PowerPoint Tables b. Format the Table Data c. Change Table Background d. Format Series Legend	Insert tables and format
15.	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.
16	To Insert audio &video, Hyperlinks in a slide Add narration to the slide	a. Insert sounds in the slide and hide the audio symbol b. Adjust the volume in the settings c. Insert video file in the format supported by PowerPoint in a slide d. Use automatic and on click options e. Add narration to the slide f. Insert Hyperlinks	a. Insert Sounds and Video in appropriate format. b. Add narration to the slide c. Use hyperlinks to switch to different slides and files
17	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
18.	Reviewing presentation	a. Checking spelling and grammar b. Previewing presentation c. Set up slide show d. Set up resolution e. Exercise with Rehearse Timings feature in PowerPoint f. Use PowerPoint Pen Tool during slide show g. Saving h. Printing presentation (a) Slides (b) Handout	a. Use Spell check and Grammar feature b. Setup slide show c. Add timing to the slides d. Setup automatic slide show

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DIPLOMA IN

CERAMIC TECHNOLOGY

(3 ½ YEAR SANDWICH)

UNDER MPEC

THIRD SEMESTER

CURRICULUM – 2016
(C-16)

STATE BOARD OF
TECHNICAL EDUCATION & TRAINING
ANDHRA PRADESH

STATE BOARD OF TECHNICAL EDUCATION & TRAINING
ANDHRA PRADESH
DIPLOMA IN CERAMIC TECHNOLAGY
3 ½ YEAR SANDWICH COURSE
(MPEC SYSTEM)

THIRD SEMESTER

Subject Code	Name of the Subject	Instruction Periods/Week		Total Periods/	Scheme of Examination				
		Theory	Practical	Semester	Duration **(Hrs)**	Sessional Marks	End Exam Marks	Total Marks	Credits
	THEORY SUBJECTS								
CER-3115	Engineering Mathematics – III	5	--	75	3	20	80	100	5
CER-3207	Fuels and Furnace Technology	4	--	60	3	20	80	100	4
CER-3208	Ceramic Tests & Quality Control	5	--	75	3	20	80	100	5
CER-3302	Glass Engineering - I	4	--	60	3	20	80	100	4
CER-3303	White ware & Heavy Clay Ware-I	5	--	75	3	20	80	100	5
CER-3304	Refractories-I	4	--	60	3	20	80	100	4
	PRACTICAL SUBJECTS								
CER-3209	Communication Skills	--	3	45	3	40	60	100	1.5
CER-3305	Glass Engineering-I Lab	--	4	60	3	40	60	100	2
CER-3306	White ware & Heavy Clay Ware-I Lab	--	4	60	3	40	60	100	2
CER-3307	Refractories Lab	--	4	60	3	40	60	100	2
	TOTAL	**27**	**15**	**630**	**-**	**280**	**720**	**1000**	**34.5**

ENGINEERING MATHEMATICS – III
(COMMON SUBJECT)

SUBJECT TITLE : ENGINEERING MATHEMATICS -III

SUBJECT CODE : CER-3115

PERIODS/ WEEK : 05

PERIODS / SEMESTER : 75

TIME SCHEDULE

S.No	Major Topic	No of Periods	Weightage of Marks	Short Type			Essay Type		
	Unit – I			R	U	App	R	U	App
1	Indefinite Integration	18	34	2	1	0	1	1	½
	Unit - II								
2	Definite Integration and its Applications	17	31	0	1	1	0	1	1 1/2
	Unit - III								
3	Differential Equations of first order	15	29	2	1	0	1/2	1/2	1
	Unit - IV								
4	Statistical Methods	10	16	1	1	0	1	0	0
	TOTAL	**60**	**110**	**5**	**4**	**1**	**2½**	**2½**	**3**
	MARKS			**15**	**12**	**3**	**25**	**25**	**30**

R: **Remembering**
U: **Understanding**
App: **Application**

FUELS AND FURNACE TECHNOLOGY

SUBJECT NAME : FUELS AND FURNACE TECHNOLOGY

SUBJECT CODE : CER-3207

PERIODS/ WEEK : 04

PERIODS / SEMESTER : 60

TIME SCHEDULE

S.No	Major Topic	No. of Periods	Weightage of Marks	No. of Short Questions	No. of Essay Questions
	FUELS:				
1	Conventional Fuels	10	16	2	1
2	Renewable Energy Sources	04	13	1	1
3	Testing of Fuels	05	13	1	1
4	Combustion of Fuels	06	13	1	1
	FURNACE TECHNOLOGY				
5	Kilns in Ceramics	15	26	02	02
6	Furnaces in Glass	16	26	02	02
7	Burners	04	03	01	--
	Total	60	110	10	08

OBJECTIVES:

On completion of the course the student should be able to know the following:

1.0 CONVENTIONAL FUELS:

1.1 Define the term Fuel

1.2 Classify the fuels.

1.3 Classify the coal.

1.4 Describe the Analysis of coal by proximate and ultimate analysis

1.5 Describe the Coal formation, mineral matter, classification, storage, washing of coal

1.6 Know the Properties and uses of coal

1.7 Describe the Carbonization of coal and wood.

1.8 Know the merits and demerits of solid fuels.

1.9 Know the Liquid fuels.

1.10 Classify the liquid fuels.

1.11 Describe the Refining, storage, handling, and by products of liquid fuels.

1.12 Know the merits and demerits of liquid fuels.

1.13 Classify the Gaseous fuels.

1.14 Explain the manufacture of Producer Gas

1.15 Know the manufacture of water gas

1.16 Know the Natural gas

1.17 Know the Gobar gas

2.0 RENEWABLE ENERGY SOURCES

2.1 Introduction to RES

2.2 Define the term Energy

2.3 Define NCES & RES.

2.4 List the fuels under NCES.

2.5 List the fuels under RES.

2.6 Know the Biogas Energy.

2.7 Know the Solar Thermal energy.

2.8 Know the Solar Photovoltaic Energy.

2.9 Know the Wind energy.

2.10 Know the Ocean energy.

2.11 Know the Biomass Energy

2.12 Know the Hydrogen energy scope and approximate potential.

2.13 Know the preparation of the Hydrogen gas.

3.0 TESTING OF FUELS

3.1 List the Tests of fuels.

3.2 Know the calorific value

3.3 Differentiate Gross Calorific and Net calorific Value of Fuels

3.4 Determination of Calorific values of Fuel with the help of Bomb calorimeter.

3.5 Know the calorific value of gaseous fuel with the help of Junker's gas calorimeter

3.6 Describe about the Viscosity of Liquid fuels.

3.7 Know the flash Point of Fuel.

3.8 Test the Flash Point of Fuel.

3.9 Know the Fire point of Fuel.

3.10 Test the Fire point of Fuel.

3.11 Define the Pour point of Fuel.

3.11 Test the Pour point of Fuel

4.0 COMBUSTION OF FUELS

4.1 Introduction to Combustion.

4.2 Define the combustion..

4.3 Calculate the quantity of air required for combustion based on mass analysis

4.4 Calculate the quantity of air required for combustion based on volume analysis

4.5 Know the products of combustions

4.6 Know the mass of carbon in flue glass

4.7 Know the flue gas analysis by Orsat's apparatus

4.8 Know the Flow of gases

4.9 Name the Heat transfer methods in a furnace / Kiln

4.10 Describe the Heat Conduction in a furnace / Kiln.

4.11 Describe the Heat Convection in a furnace / Kiln.

4.12 Describe the Heat Radiation in a furnace / Kiln.

4.13 Know the Heat loses in Furnace / Kiln

4.14 Explain the Heat recovery in a Furnace / Kiln

4.15 Know the Working Principals of Recuperators.

4.16 Know the Working Principal of Regenerator.

5.0 KILNS IN CERAMICS

5.1 Know the Introduction to kilns

5.2 Define the kiln.

5.3. Classify the kilns.

5.4. List of periodical kilns

5.5 List of Continuous kilns.

5.6 Know List of Modern kilns.

5.7 Know the Materials used in Kilns foundation / Construction

5.8 Know the Design, Operation and Construction of Scove and Clamp Kiln.

5.9 Know the Design, Operation and Construction of Bottle neck Updraft Kiln in detail.

5.10 Know the Design, Operation and Construction of Down draft Kilns in detail.

5.11 Know the Design, Operation and Construction of Chamber Kiln/Ring chamber kiln in detail.

5.12 Know the Design, Operation and Construction of Car Tunnel Muffle Kilns in detail.

5.13 Know the Design, Operation and Construction of Roller Hearth Kiln for fast firing in detail.

5.14 Know the Design, Operation and Construction of Rotary kiln in detail.

5.15 Know the Design, operation and Construction of Shaft kiln in detail.

5.16 Know the Design, Operation and Construction of Modern Periodical Kilns like Shuttle, Top hat kiln, Zigzag kiln etc.,

6.0 FURNACES IN GLASS :

6.1 Define the furnace.

6.2 Classify the furnace used in Glass industry.

6.3 Know the Materials used in Furnaces foundation and Construction

6.4 Know the Design, Operation and Construction of Crucible furnace in detail.

6.5 Know the Design, Operation and Construction of Pot arch in detail.

6.6 Know the Design, Operation and Construction of Pot Furnace in detail.

6.7 Know the Design, Operation and Construction of Day-tank furnace in detail.

6.8 Know the Design, Operation and Construction of Continues Glass-tank furnace in detail for Fiber, Container and Sheet glasses.

6.9 List the types of Continuous furnaces for container and sheet glass.

6.10 Know the Working Principles of the continuous tank furnace.

6.11 Know the Temperature distribution in tank furnace

6.12 Know the Heat losses in continuous tank furnace.

6.13 Sketch / diagram of container and sheet glass tank furnace.

` 6.14 Know the Melting area and depth in relation to pull of glass and type of glass.

6.15 List the types of throats.

6.16 Know the Refining area of the tank furnace.

6.17 Know the Ports.

6.18 Know the Understand Heat exchangers.

6.19 Know the Operation of Fuel reversing values.

6.20 Know the Stack and its height and construction.

6.21 Know the Types of Dampers.

6.22 Know the Construction materials for foundation, Arch, thrust and bracing.

6.23 Know the Flue system, cooling system.

6.24 Explain Light up and shut down procedure of the fuurnace.

6.25 Know the Design, Operation and Construction of Electrical glass melting furnace in detail

6.26 Classify the Furnaces used in Enamel industry.

6.27 Know the Design, Operation and Construction of Unit melters and Smelters.

6.28 Know the Design, Operation and Construction of Hearth or Box type furnaces in enamels frit making.

6.29 Know the Design, Operation and Construction of Rotary smelter.

6.30 Know the Design; Operation and Construction of Muffle furnaces in enamel industry

6.31 Know the Design, Operation and Construction of Modern Muffle furnaces in enamel industry.

6.32 Know the Design, Operation and Construction of Electrical furnaces in enamel industry for firing of enamelware.

7.0 BURNERS

7.1 Define the term Burner.

7.2 Know the term Atomization.

7.3 Classify the Burners.

7.4 List the Types of Low pressure Burners with neat sketch for Gaseous fuels.

7.5 List the Types of High pressure Burners with neat sketch for Liquid fuels.

7.6 Know the Advantages and disadvantages of different types of Burners.

COURSE CONTENTS:

1. **CONVENTIONAL FUELS:** Definition-Classification-Theory of formation of coal-Solid fuels-coal, Coal formation-mineral matter-classification-storage-washing-properties-Carbonization of coal and wood-properties of coke Advantages and disadvantages of solid fuels-Combustion of coal-Analysis of coal –Liquid fuels-Classification of liquid fuels- Refining-storage-handling-by products-Advantages of liquid fuels-gaseous fuels- Classification of Gaseous Fuels-Manufacture of Producer Gas.

2. **RENEWABLE ENERGY SOURCES:**
Introduction-Solar Thermal energy-Solar Photo Voltaic Energy-Wind energy-Mini Micro Hydro Energy-Ocean Energy-Bio-mass gasifiers-Hydrogen energy scopes and approximate potential.

3. **TESTING OF FUELS:** Introduction-Flash Point-Fire Point-Pour point-Viscosity of Liquid fuels-Calorific value of Fuels-Gross Calorific value of Fuels-Gross Calorific value of Fuels- measurement of Calorific value by Bomb calorimeter and Junker's calorimeter

4. **COMBUSTION OF FUELS :**Introduction-Calculation of air required for combustion by mass and volume analysis –Analysis of flue glass- flue gas analysis by Orsaat's apparatus - Flow of gasses-Heat transfer-Conduction in a furnace/Kiln-Convection in a furnace / Kiln- Radiation in a furnace / Kiln-Factors governing in Heat transfer-Heat loses- Heat Loses from furnace walls –Heat recovery-Principles of Recuperators-Principle of Regenerator.

5. **KILNS IN CERAMICS :**Introduction- Relevant definition-Classification of Kilns-Scove Kiln- Updraft Kiln- Round down draft kiln- Chamber Kiln- Tunnel Kiln- Roller Kiln. Rotary Kiln- Continuous Kiln- Modern Periodicals Kilns like shuttle and top hat - Materials used in kilns foundation/Construction

6.0 FURNACES IN GLASS: Classification of furnaces- Crucible furnace- Day-tank furnace pot furnaceTank furnace- distribution of heat-Heat losses- Melting area- Refining area-Throats

Ports- Heatexchangers dampers- stack- arch- foundation- Heating up of continuous Tank Furnaces for container and sheet glasses-Pot arches f Unit smelters / Smelters- Furnaces in enamel industryHearth or box types and rotary smelter- Types of refractories and Materials used in Furnacesfoundation/Construction.

7.0 BURNERS: Types Burners for liquids and gaseous Fuels-Automization- Advantages and disadvantages of different types of burners.

REFERENCE BOOKS:

1. Chas R Darling, Pyrometry, E & F.N Spon Ltd., London, 1920.
2. JSS Brane and JG King, Fules, 5th Edition, Edward Arnold Publishers Ltd., 1956.
3. O P Guptha Elements of Fuels, Furnaces and Refractories, Kanna Publishers, Delhi, 1991.
4. Donald P. eckman, Industrial Instrumentation, John Wiley & Sons New York, 1991.
5. Shaha, A.K., Combustion Engineering and Fuel Technology, Oxford & IBH Publishing Co., New Delhi, 1974.
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7. Samir Sarkar, Fuels and Combustion, 2 nd Edition, orient Longman, Bombay, 1990.
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9. Donald P. Eckman, Industrial Instrumentation, Willey- Eastern Limited, Hyderabad

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CERAMIC TESTS AND QUALITY CONTROL

SUBJECT TITLE : CERAMIC TESTS AND QUALITY CONTROL

SUBJECT CODE : CER - 3208

PERIODS/WEEK : 05

PERIODS/SEMESTER : 75

TIME SCHEDULE

S. No	Major Topics	Periods	Weightage of marks	Short Answer Questions	Essay type Questions
1	Testing Of Ceramic Raw Materials	12	26	02	02
2	Determinationof Physical Properties Of Clays & Bodies	15	26	02	02
3	Physical Properties After Firing Of Clay Ware	13	16	02	01
4	Testing Of Glazes	05	13	01	01
5	Testing Of Body/Glaze Fit	12	13	01	01
6	Testing of Refractories	13	13	01	01
7	Quality Control	05	03	01	--
TOTAL		**75**	**110**	**10**	**08**

OBJECTIVES: On completion of the course the student should be able to know the following:

1.0 TESTING OF CERAMIC RAW MATERIALS.

1.1 Know the Sampling of raw material by Coning and Quartering.

1.2 Know the determination of moisture in raw material by Infra-red Moisture Balance.

1.3 Know the testingof the Moisture by "Speedy" Moisture Tester".

1.4 Understand the determination of particle size by sieve analysis (Dry method).

1.5 Know the different types of standard sieves ASTM, BSS and ISS and know the calculation of micron from mesh no.

1.6 Know the determination of particle size by sedimentation method using Stokes' Law.

1.7 Know the determination of particle size by Andreasen Pipette Method.

1.8 Know the determination of Particle size by Hydrometer Method.

2.0 DETERMINATION OF PHYSICAL PROPERTIES OF CLAYS AND BODIES.

2.1 Know the determination of surface area by Permeametry and Gas adsorption.

2.2 Know the determination of plasticity of clay and clay bodies by Pefferkorn Test method.

2.3 Understandplasticity by "Atterberg Number" test method and BCR compression plastometer

2.4 Know the determination of percent Drying Linear shrinkage of clays and clay bodies.

2.5 Know the determination of percent Fired Linear shrinkage of clay and clay bodies.

2.6 Know the term Volume drying shrinkage.

2.7 Know the determination of percentage Volume Firing shrinkage.

2.8 Know the measuring of Viscosity of slips by Viscometer and Torsion Viscometer

2.9 Know the measuring of Sp. Gr. By using Hydrometer.

2.10 Calculatesolid content in clay slips by knowing pint weight of the slip.

3.0 PHYSICAL PROPERTIES AFTER FIRING OF CLAY WARE

3.1 Know the determination of Bulk Density of fired bodies.

3.2 Know the determination of Apparent Exterior volume of the test pieces.

3.3 Know the determination of True volume of the solids.

3.4 Know the determination of apparent porosity.

3.5 Know the determination of True porosity.

3.6 Know the determination of Volume of sealed pores.

3.7 Know the determination of Water absorption.

3.8 Know the determination of True density of the material.

4.0 TESTING OF GLAZES

4.1 Know the Testing of Glaze.

4.2 Know the Harman's methods for glaze slip control by measuring "COHERENCE", "RECEPTIVITY", PICK-UP".

4.3 Know the testing of viscosity of glazes at low temperatures (500 to 800^0C)

4.4 Test the viscosity of glazes at high temperatures (800 to 1300^0C)

4.5 Test the solubility of lead frits and glazes.

4.6 Test the measurement of lead solubility.

5.0 TESTING OF BODY/ GLAZE FIT:

5.1 Know the Deflection of Glazed bars.

5.2 Know the Ring test.

5.3 Know the Flat Plate Test.

5.4 Know the determination of Thermal Expansion of body and glaze (Reversible Thermal Expansion).

5.5 Know the determination of Thermal Expansion of body and glaze test procedure by Dilatometer.

5.6 Prepare the Glaze Test Specimen.

5.7 Know the Assessment of body/glaze compatibility using a Malkin's glaze/body fit instrument.

5.8 Know the Autoclave crazing Test and glaze fit measurements.

5.9 Know the Hardness of a glaze and body by Moh's scale.

5.10 Know the thermal shock resistance of a glaze quenching method.

5.11 Know the determination of Abrasion resistance.

5.12 Know the measurement ofthe thickness of glaze applied on the test piece by thickness gauge.

5.13 Testing of Sanitaryware as per IS 2556(PartI:1994)

6.0 TESTING OF REFRACTORIES.

6.1 Know the determination of Sp. Gr., Bulk Density, Porosity, and Permeability of refractory material

6.2 Know the determination of refractoriness by Refractoriness Under Load Test.

6.3 Know the determination of refractoriness by Pyrometeric Cone Equivalent Test.

6.4 Know the determination of Cold Crushing Strength Test.

6.5 Know the determination of Modulus of Rupture and Hot Modulus of Rupture

6.6 Know the determination of Permanent Linear Changes on reheating.

6.7 Know the determination of Spalling Resistance (OR) Thermal shock Resistance of a Refractory material.

6.8 Know the determination of Thermal Conductivity.

6.9 Know the determination of Slag resistance/Slag Attack of a refractory material by (a). Pill Test (b). Impingement Method, (c).Immersion Method, (d) Fusion Method.

7.0 QUALITY CONTROL.

7.1 Know the Quality control basic concepts.

7.2 Know the Definition of quality control.

7.3 Know the Zero defects.

7.4 Know the IS quality control techniques

7.5 Know the Quality marking and certification scheme like ISO 9000 etc.

COURSE CONTENT:

1. TESTING OF CERAMIC RAW MATERIALS:

Coning and quartering of sample- sampling on delivery- measurement of moisture content by Infra-Red Moisture Balance and the "Speedy" moisture test- Particle size analysis by sieve test and sedimentation methods with stokes and Andreasen Pipette.

2. DETERMINATION OF PHYSICAL PROPERTIES OF CLAYS AND BODIES:

Determination of surface area by Permeametry- plasticity Pefferkon test and Atterberg plasticity test-contraction wet to dry- dry to fired and wet to fired contractions for clays and body's- Modulus of rupture of clays- bodies- fired and unfired and comments- Control of casting slips- fluidity- Thixotropy and specific gravity- use of torsion viscometer and measurement of slip concentration.

3. PHYSICAL PROPERTIES AFTER FIRING OF CLAY WARE:

Firing Control- use of Pyroscopes (cones etc.) Vitrification test- testing of density- apparent volume- true volume- apparent volume and porosity and sealed pores- Water absorption- apparent porosity and true density.

4. TESTING OF GLAZES:

Testing of Glaze, Measuring "COHERENCE", "RECEPTIVITY", PICK-UP"-Testing of viscosity of glazes at low temperatures (500 to 800^0C) and high temperatures (800 to 1300^0C)-Tests of the solubility of lead frits and glazes-measurement of lead solubility.

5. TESTING OF BODYS/GLAZE FIT:

Procedure, production of test specimen- using glaze fit instrument- preparation of ceramic test bars and operation of instrument- effect of various variables like thickness etc., - hardness testing- glaze thickness- autoclave and crazing- Thermal shock measurement- Loss and quality control schemes for white wares-Testing of Sanitary ware.

6. TESTING OFREFRACTORIES:

Determination of Refractoriness (PCE)- Refractoriness Under Load- Cold Crushing Strength-MOR-HMOR -Permanent Linear Change on reheating- Spalling Resistance- Thermal Expansion reversible- Thermal conductivity Sp. Gravity- Bulk Density- Slag Resistance Test.

7. QUALITY CONTROL: Basic concept- Indian Standards for ceramic materials- ISO 9000 -zero defects- concept quality marking and certification scheme- Total quality management in ceramic industries.

REFERENCE BOOKS:

1. Ceramic Tests and Calculations, A .I Andrews,
2. W. Ryan and C Radford, White wares Production, Testing and Quality Control, The Institute of ceramics by Pergaman press, Oxford, 1987.
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GLASS ENGINEERING-I

SUBJECT TITL : GLASS ENGINEERING-I

SUBJECT CODE : CER-3302

PERIODS/ WEEK : 4

PERIODS/ SEMESTER : 60

TIME SCHEDULE

S. No	Major Topics	Periods	Weightage of marks	Short Answer Questions	Essay type Questions
1	Introduction to Glass	03	03	01	--
2	Glass batch preparation	15	16	02	02
3	Glass Melting Process	15	26	02	02
4	Fabrication Process of Glass	15	26	02	02
5	Annealing And Tempering.	12	13	02	01
6	Testing And Quality Control.	10	13	01	01
TOTAL		**60**	**110**	**10**	**08**

OBJECTIVES:*On completion of the course, the student should be able to know the following:*

1.0 INTRODUCTION TO GLASS

1.1 Define the term Glass.

1.2 Define the term glassy state.

1.3 Know the Common uses of glasses.

2.0 GLASS BATCH PREPARATION

2.1 Know theZacharaiasen's rules.

2.2 Know the Importance of Zacharaiasen's rules.

2.3 Name the network formers, network modifiers and intermittent oxides used for making of glass.

2.4 List of glass making Raw materials.

2.5 Select the Raw materials for glass making.

2.6 State the glass composition.

2.7 Classification of commercial glasses.

2.8 Know the Functions of all glass making materials.

2.9 Name the major ingredients in glass melting.

2.10 Name the minor ingredients in glass batch.

2.11 Specification of glass sand for making Glass.

2.12 Know the Functions of soda ash, salt cake and sodium nitrate in glass making

2.13 Compare soda ash to salt cake in Glass making process.

2.14 Know the Functions of Limestone, Dolomite in Glass making process.

2.15 Know the Functions of Feldspar and Nepheline syenite etc.

2.16 Write the Effect of impurities in raw materials used in the Glass Batch.

2.17 List the melting Accelerators.

2.18 Know the Function of Oxidizing agents.

2.19 Know the Function of Reducing agents.

2.20 Know the Function of Decolorizing agents.

2.21 List the Physical Decolorizers.

2.22 List the chemical Decolorizers.

2.23 Know the Mechanical Decolorizers.

2.24 Know the Flame control.

2.25 Know the Uses of cullet in glass batches.

2.26 Classify thecullet.

2.28 Know the Quality of glass by using cullet.

2.29 Know the Effect of cullet during melting.

3.0 GLASS MELTING PROCESS.

3.1 Know the Process of charging

3.2 Know the Hand charging of batch.

3.3 Know the Mechanical charging.

3.4 Explain the four phases involved in glass making processes.

3.5 Know the Effect of temperature on the glass melting.

3.6 Explain the mechanism of melting of glass.

3.7 Know the effect of particle size on melting.

3.8 Know the Conditions governing on Devitrification.

3.9 Know the Paddle’s limit of Devitrification

3.10 Know the silica on Devitrification.

3.11 Know the stabilizing oxides on Devitrification

3.12 Know the period of danger in melting and working.

3.13 Know the volatilization.

3.14 Know the effect of pre sintering of glass.

3.15 Write the Source of gas bubbles.

3.16 Study the identification of gases.

3.17 Know the Solubility gases.

3.18 Know the Growth and raise of bubbles.

3.19 Know the refining agents.

3.20 Know the Chemistry of refining action.

3.21 Know the rate of refining in relation to minor ingredients.

3.22 Know Homogenizing of glass.

3.23 Know the Source of Inhomogeinity.

3.24 Know the rate of Homogenization in relation to kinetics.

3.25 Know the Convention currents.

4.0 FABRICATION PROCESS OF GLASS.

4.1 Know the Principles of glass working.

4.2 Know the Preparation of glass.

4.3 Write the function of rings and boots.

4.4 Describe the Blow -pipe.

4.5 Write the Use of gathering rod.

4.6 Describe the marvering.

4.7 Describe the puffing and blowing.

4.8 Know the off- hand working of glassware.

4.9 Explain the bottle making by hand method.

4.10 Define the term viscosity.

4.11 Explain fining and viscosity.

4.12 Explain the viscosity and working of glass.

4.13 Explain the composition and viscosity

4.14 Know the viscosity of glass at various stages of fabrication.

4.15 Know the standard viscosity points.

4.16 Relate the viscosity in relation to temperature.

4.17 Explain the necessity for durability of glass.

4.18 Know the weathering and chemical attack.

4.19 Explain the methods for improving of durability of glass.

4.20 Relate the composition and durability of glass.

5.0 ANNEALING AND TEMPERING

5.1 Define the term Annealing.

5.2 Knowthe strain in glass.

5.3 Know the Sources of strain in glass.

5.4 Name the types of strain in glass

5.5 Know the temporary strains.

5.6 Know the permanent strains.

5.7 Explain the annealing process.

5.8 Explain the release of stress.

5.9 Describe the Annealing schedule for slabs, plates & Containers.

5.10 Know thetempering.

5.11 Explain the process of tempering of glassware.

5.12 Know the composition of glass and it's annealing temperature.

5.13 Know the permissible strain in glass.

6.0 TESTING AND QUALITY CONTROL

6.1 Name the defects in glass ware.

6.2 Know the Causes of stones in glassware.

6.3 Know the usual sources of stones.

6.4 Know the Prevention of stones in glassware.

6.5 Know the Devitrification stones.

6.6 Know the cords and their remedies.

6.7 Know the blisters & seeds.

6.8 Know the Remedies of blisters and seeds.

6.9 Write the Causes of bad color in glass and its remedies.

6.10 Name the defects by bad workmanship.

6.11 Name the Tests conducted for Q.C of bottles.

6.12 Know the Importance of weight and capacity of bottles.

6.13 Know the Impact strength of bottles and sheet glass.

6.14 Know the Bursting pressure resistance of containers.

6.15 Know the Thermal shock resistance of containers.

6.16 Alkalinity of glass product.

6.17 List the Physical properties of glass.

6.18 List the Mechanical properties of glass.

6.19 Know the Chemical, Optical and Electrical properties of glass.

COURSE CONTENT:

1. **INTRODUCTION:**Introduction – Common uses of glass.

2. **GLASS BATCH PREPARATION:** Selection of glass composition: - Prerequisites of a satisfactory commercial composition – Melting and fabrication characteristics- properties and cost- composition range- silica- fluxes and stabilizing oxides- changes in properties in relation to composition variation-Zacharaiasen's rules of glass formation.

   Major Ingredients – Sand- Limestone-Dolomites- Soda Ash- Feldspar- Nepheline Syenite etc.- quality specifications

   Minor Ingredients: Melting Accelerators- Refining Agents-De –colourisers.

   Cullet: Effect of cullet of the quality and melting of glass-Beneficiation of foreign cullet-Crushing and charging.

3. **GLASS MELTING PROCESS:** Process leading to glass formation. Particle size and melting of composition-volatilization- effect of pre-sintering.

   Refining: Sources of gas bubbles – fused batch interfaces and reboil Identification of gases- Solubility of gases in glass- Growth and rise of bubbles- Refining agents chemistry of the factors of minor ingredients.

   Homogenization – Source of homogeneity- rate of homogenization in relation to diffusion kinetics- Convectional currents and rise of bubbles- straie and cords- their nature and classification- Devitrification stones.

4. **FABRICATION PROCESS OF GLASS:** Outline of the Methods: Conditioning of glass- feeding- blowing and pressing- rolling and Drawing.

   Viscosity: Viscosity of glass at various stages of fabrication- standard viscosity points-

working characteristics- Viscosity temperature relationship for common glasses.

Durability: The necessity for high durability of the glass- nature of the weathering and chemical attack- improving the durability of glasses-composition and durability.

5. ANNEALING AND TEMPERING: Release of stress- Annealing constant- Determination of annealing schedule for Slabs-continuous plate and containers- tempering-detection and measurement of strain – strength of glass

6. TESTING AND CONTROL: Defects in glass: Seeds and Blisters- Cords- Straie- strain and stones- causes and remedies.

Fabrication defects: Various Fabrication defects of container ware- their causes and remedies.

Testing of container glass: weight and capacity- Impact strength- Bursting Pressure and Thermal shock resistance-Alkalinity of glass – Testing of Flat glass.

REFERENCE BOOKS:

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12.Donald P. Eckman, Industrial Instrumentation, Willey- Eastern Limited, Hyderabad

WHITE WARE & HEAVY CLAY WARE-I

SUBJECT TITLE : WHITE WARE & HEAVY CLAY WARE – I

SUBJECT CODE : CER-3303

PERIODS/ WEEK : 05

PERIODS/ SEMESTER : 75

TIME SCHEDULE

S. No	Major Topics	Periods	Weightage of marks	Short Answer Questions	Essay type Questions
1	Introduction	03	03	01	-
2	Machinery for Crushing and Grinding	15	26	02	02
3	Body Preparation	15	23	01	02
4	Fabrication Methods	18	26	02	02
5	Drying of Clay Products	06	13	01	01
6	Glazing on Clay products	04	03	01	--
7	Setting of Clay Products	04	03	01	--
8	Firing of Clay Products	10	13	01	01
TOTAL		**75**	**110**	**10**	**08**

OBJECTIVES:

On completion of the course, the student should be able to know the following:

1. 0 INTRODUCTION

1.1 Understand about the term Whiteware and Heavy clay ware

1.2 Understand the flow diagram of manufacturing White ware

1.3 Name the products comes under White ware and Heavy clay Ware

1.4 Know the machinery required for White ware and Heavy clay ware

2.0 MACHINERY FOR CRUSHING AND GRINDING:

2.1 Know the Importance of machinery and equipment used in ceramic/pottery industry.

2.2 Know the Crushing operation.

2.3 Name the Classification of Primary and Secondary crushers.

2.4 Explain the working of Jaw crusher.

2.5 Explain the working of Gyratory Crusher

2.6 Explain the working of different Roller mills

2.7 Explain the working of Pan Mill/Edge runner

2.8 Explain the working of Disintigrator

2.9 Explain the working of impact crusher /Hammer mill

2.10 Discuss the grinding operation.

2.11 Explain the working of Ball mill

2.12 Explain the working of Hardinge conical ball mill

2.13 Describe the Tube mill

2.14 Describe the Centrifugal/Raymond mill

2.15 Describe the Jet mill/Fluid energy mill

2.16 Describe the Vibro energy mill

2.17 Know about Dust collector/air separator

3.0 BODY PREPARATION

3.1 Know the Body preparation &Select the pottery body composition.

3.2 Know the Weighing & Mixing of body materials and equipment used for it

3.3 Classify the Mixers.

3.4 Explain the working of Blunger.

3.5 Know the working of agitator

3.6 Know the working of pug mill.

3.7. Know the working of V-type mixer.

3.8 Know the Muller mixers

3.9 Know the preparation of casting slip.

3.10 Know the Preparation of plastic body by advanced methods involving intensive mixer.

i). Dry preparation,

ii). Based on spray drying,

iii). Computerized body preparation etc,

3.11 Know the working of magnetic separator.

3.12 Know the working of vibrating sieves.

3.13 Know the working of Filter Press.

3.14 Know the working of diaphragm Pump.

3.15 Know the Preparation of granules.

4.0 FABRICATION METHODS

4.1 Classify the fabrication methods used in clay industry.
4.2 Know the rheological properties of casting slip.
4.3 Explain the factors affecting the castability of slip
4.4 Know the Slip casting technique
4.5 Know the Mechanism of slip formation.
4.6 Explain rate of casting control.
4.7 Know the traditional methods of slip casting.
4.8 Know the advanced methods of shaping in the liquid state like bench casting and battery casting.
4.9 Know Ethyl silicate casting process
4.10 List the casting defects
4.11 Name the Traditional plastic forming methods like hand molding and molding, plastic pressing, throwing, jiggering and jollying, extrusion etc.
4.12 Know about Hand moulding, throwing, plastic pressing
4.13 Know the details of all Extruders.
   a. Augur Extruder.
   b. Piston Extruder.
   c. Vacuum Extruder.
4.14 Know about manual and automatic Jiggering & Jollying machines.
4.15 Know in detail Mechanical Presses like Toggle press, screw press etc.,.
4.16 Explain Hydraulic Presses, and Isostatic Pressing.
4.17 Know the Die - materials & design.
4.18 Know the advanced methods of shaping in the plastic state like forming by roller machines, ram pressing impact forming, injection molding etc.,.
4.19 Know the hot pressing and Isostatic pressing.
4.20 Know the turning process.
4.21 Know the dry pressing.
4.22 Know the particle size distribution in slip

5.0 DRYING OF CLAY PRODUCTS

5.1 Classify the driers.

5.2 Explain in detail intermittent dryers like lofts, hot floors, compartment or chamber type, humidity drier etc.,

5.3 Know the continuous dryers like tunnel, mangle, rotary, drum driers etc.,

5.4 Know the Mechanism of drying.

5.5 Know the factors affecting on drying.

5.6 Know the critical moisture content.

5.7 Explain drying of Plastic & Non-Plastic Ceramic bodies.

5.8 Describe the Shrinkage of the body during drying.

5.9 List the drying defects, its causes and remedies.

6.0 GLAZING

6.1 Know about Glaze

6.2 Name the glazing machines.

6.3 Describe the working of Automatic glazing machine.

6.4 Know the Design and Printing machines.

7.0 SETTING OF CLAY PRODUCTS:

7.1 List the kiln furniture and supports.

7.2 Name the Construction material for Kiln furniture.

7.3 Know the setting of common brick in the kiln

7.4 Know the setting of unflashed bricks in the kiln.

7.5 Know the setting of glazed brick in the Kilns.

7.6 Know the setting of sewer pipes in the Kilns

7.7 Know the setting of bricks in the Scove Kilns

7. 8 Know the setting of bricks on tunnel cars.

7.9 Know the setting of white ware in saggers for biscuit firing.

7.10 Know the setting of glaze ware in saggers and without saggers.

8.0 FIRING OF CLAY WARE

8.1 Describe briefly the classification of the kilns.

8.2 Know the bisque firing

8.3 Know the glost firing

8.4 Know the fast firing

8.5 Know the Theoretical justification for fast firing.

8.6 Know the the practical aspects which make fast firing possible.

8.7 Know the Reasons for fast firing

8.8 Know the Effect of heat on ceramic bodies.

8.9 Know the Thermal decomposition materials in the ceramic body.

8.10 Know the Sintering and vitrification of the body.

8.11 Know the physical changes in ceramic body after firing.

8.12 Know the Kilns used for firing of Ceramic ware

COURSE CONTENT:

1.0 INTRODUCTION

The term White ware and Heavy clay ware -flow diagram of manufacturing White ware - Name the products comes under White ware and Heavy clay Ware -the machinery required for White ware and Heavy clay ware

2.0 MACHINERY FOR CRUSHING AND GRINDING:

Importance of machinery and equipment used in ceramic/pottery industry-Crushing operation.-Classification of Primary and Secondary crushers.-working of Jaw crusher.-working of Gyratory Crusher-Roller mills-Pan Mill/Edge runner-Disintegrator -impact crusher /Hammer mill-grinding operation-.Ball mill-Hardinge conical ball mill-Tube mill- Centrifugal/Raymond mill -Jet mill/Fluid energy mill -Vibro energy mill-Dust collector/air separator

3.0 BODY PREPARATION

Body preparation &Select the pottery body composition-.Weighing & Mixing- Mixers. Blunger.-agitator-pug mill-.V-type mixer.-Muller mixers-preparation of casting slip.-plastic body- .magnetic separator.-vibrating sieves.-Filter Press.-diaphragm Pump.-granules.

4.0 FABRICATION METHODS

fabrication methods.-rheological properties of casting slip.-factors affecting the castability of slip -Slip casting technique -Mechanism of slip formation.-rate of casting control.-traditional methods of slip casting.-advanced methods of shaping in the liquid state like bench casting and battery casting.-Ethyl silicate casting process -casting

defects-Traditional plastic forming methods like hand molding and molding, plastic pressing, throwing, jiggering and jollying, extrusion -Hand moulding, throwing, plastic pressing-details of all Extruders.-manual and automatic Jiggering & Jollying machines.-Mechanical Presses like Toggle press, screw press -
Hydraulic Presses, and Isostatic Pressing.-Die - materials & design.-advanced methods of shaping in the plastic state like forming by roller machines, ram pressing impact forming, injection molding -hot pressing and Isostatic pressing.- turning process.-dry pressing.-particle size distribution in slip

5.0 DRYING OF CLAY PRODUCTS

driers.-Mechanism of drying.-factors affecting on drying.-critical moisture content.-drying of Plastic & Non-Plastic Ceramic bodies.-Shrinkage of the body during drying.-drying defects, its causes and remedies.

6.0 GLAZING

Glaze-glazing machines.-Automatic glazing machine.-Design and Printing machines

7.0 SETTING OF CLAY PRODUCTS:

kiln furniture and supports.-Kiln furniture.-common brick in the kiln-unflashed bricks in the kiln.-glazed brick in the Kilns.-sewer pipes in the Kilns-bricks in the Scove Kilns bricks on tunnel cars-.white ware in saggers for biscuit firing.-glaze ware in saggers and without saggers.

8.0 FIRING OF CLAY WARE

classification of the kilns. - bisque firing-glost firing-fast firing-Theoretical justification for fast firing-.practical aspects which make fast firing possible.-Reasons for fast firing-Effect of heat on ceramic bodies.-Thermal decomposition materials in the ceramic body.-Sintering and vitrification of the body.-the physical changes in ceramic body after firing.-Kilns used for firing of Ceramic ware

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2. Singer F and Singer S. S., Industrial Ceramics. Oxford and IBH Publishing Limited, New Delhi, 1963 -

3. S.Kumar Hand book of Ceramics Volume I to IV, Kumar and Associates, Kolkata, 1994 to 1997.

4. Rosenthal, Pottery and Ceramics, Ernst, Britain for Penguin books ltd, 1949.

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13. A Handbook for Production of Vitreous China sanitary wares by Dr.K.N.Maiti

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REFRACTORIES-I

SUBJECT TITLE : REFRACTORIES - I

SUBJECT CODE : CER - 3304

PERIODS/ WEEK : 04

PERIODS / SEMESTER : 60

TIME SCHEDULE

S. No	Major Topics	Periods	Weightage of marks	Short Answer Questions	Essay type Questions
1	Introduction to Refractories	03	03	01	--
2	Alumino- Silicate Refractories	08	16	02	01
3	Silica Refractories	08	13	01	01
4	Dolomite Refractories	06	13	01	01
5	Magnesite Refractories	06	13	01	01
6	Chromite Refractories.	06	13	01	01
7	Chrome – Magnesite & Mag-Chrome Refractories.	06	13	01	01
8	Heat Measurements in Ceramic Industry	17	26	02	02
TOTAL		**60**	**110**	**10**	**08**

OBJECTIVES:*On completion of the course, the student should be able to know the following:*

1.0 INTRODUCTION TO REFRACTORIES.

1.1 Define the Refractory.
1.2 List the Properties of a good Refractory material.
1.3 Know the Factors for the selection of Refractories.
1.4 Classify the Refractories.
1.5 List the Acidic, Basic and Neutral Refractories.
1.6 Know the Properties of Acidic basic & Neutral Refractories.
1.7 Draw the Layout of Modern Refractory Plant.

2.0 ALUMINO SILICATE REFRACTORIES.

2.1 Know the raw materials for the fireclay Refractories.
2.2 Know the Preparation and Properties of grog.
2.3 Know the Fabrication techniques for Refractories.

2.4 Know the Drying of Refractories.
2.5 Know the Burning stages of Refractories.
2.6 List the other Alumino silicate Refractories.
2.7 Know the Properties and uses of Alumino silicate Refractories.
2.8 Name the Kilns used in Refractory industry for firing different types of Refractory Products.
2.9 Know the High Alumina Refractories like Bauxite etc.,
2.10 Know the all related raw materials for High Alumina Refractories.
2.11 Know the Electro cast Alumino-Silicate Refractories/Fused Alumino-Silicate blocks.
2.12 Know the Corhart Standard blocks.
2.13 Know the Corhart ZAC blocks.
2.14 Know the Monofrax Refractories.

3.0 SILICA REFRACTORIES:

3.1 Know the Raw materials for the Silica Refractories.
3.2 Know the Bonding Agents of Silica Refractories.
3.3 Know the Mineralizer used in Silica Refractories.
3.4 Know the Manufacturing of Silica Refractories.
3.5 Know the Properties of Silica Refractories.
3.6 Know the Applications of Silica Refractories.
3.7 List the Semi Silica Refractories.
3.8 Know the Tempering, mixing and making of silica bricks.
3.9 Know the Drying and setting of silica bricks.
3.10 Know the Firing of silica bricks.
3.11 List the Kilns used for firing of silica bricks.
3.12 Draw the temperature schedule curve.
3.13 Know the Cooling of silica Refractories after firing.
3.14 Know the Properties and uses of silica and semi silica Refractories.

4.0 DOLOMITE REFRACTORIES:

4.1 Know the Raw materials for the Dolomite Refractories.
4.2 Know the Calcinations of Raw materials.
4.3 Know the Soaking of Dolomite bricks and its control.
4.4 Know the Bonding Agents for Dolomite Bricks.
4.5 Know the Manufacturing of Dolomite Bricks.
4.6 Know the Properties and Applications of Dolomite Bricks.

5.0 MAGNESITE REFRACTORIES:

5.1 Name the Raw materials for the Magnesite Refractories.
5.2 Know the Dead burnt and Calcined Magnesite.
5.3 Know the Bonding Agents and Additives for the Magnesite Refractories.

5.4 Explain the Manufacturing process of Magnesite Refractories.
5.5 Know the Properties of Magnesite Refractories.
5.6 Know the Applications of Magnesite Refractories.

6.0 CHROMITE REFRACTORIES.

6.1 Name theRaw materials used for chromites Refractories.
6.2 List the Bonds used for Chromite Refractories.
6.3 Know the preparation of Chromite body.
6.4 Know the methods of shaping of Chromite Refractories.
6.5 Know the Properties and uses of Chromite Refractories.

7.0 CHROME – MAGNESITEAND MAG-CHROME REFRACTORIES.

7.1 List the raw materials used for chrome - magnesite Refractories.
7.2 List the types of bonds used for chrome - magnesite Refractories.
7.3 Explain the preparation of Chromite and magnesite for the chrome magnesite bricks.
7.4 Explain details about body preparation.
7.5 Know the Forming methods of chrome-magnesite Refractories.
7.6 Know the Bursting problem in chrome -magnesite Refractories.
7.7 Know the Properties and uses of Chrome-Magnesite Refractories.
7.8 Know the metal case bricks such as Mag-chrome refractories..
7.9 Write the uses and properties of metal case bricks.

8.0 TEMPERATURE MEASUREMENTS

8.1 Know the Importance of Pyrometry.
8.2 Classify the Pyrometry.
8.3 Name the Temperature Scales
8.4 Know the Functions of Thermometers
8.5 List the Types of Industrial Pyrometers.
8.6 PYROSCOPES
  8.6.1 Introduction of Pyroscopes
  8.6.2 Define the term Pyro Scopes
  8.6.3 Classify the Pyroscopes
  8.6.4 Know types of the Contraction pyroscopes
  8.6.5 Know types of the Fusible pyroscopes
8.7 RADIATION PYROMETER
  8.7.1 Know the Principle of Black body radiation.
  8.7.2 Know the construction, and working of Total Radiation pyrometer.
  8.7.3 Know the merits and demerits of Radiation pyrometer.
8.8 RESISTANCE PYROMETER
  8.8.1 Know the principle, construction, and Wheat stone bridge.
  8.8.2 Know the principle of moving coil indicator

8.8.3 Know the construction, and working of Resistance pyrometer/Resistance thermometer.

8.8.4 Know the merits and demerits of Resistance pyrometer.

8.9. THERMO ELECTRIC PYROMETER

8.9.1 Know the Thermoelectric current

8.9.2 Know the Peltier and Thomson emf

8.9.3 Write the Advantage and Disadvantages of Thermocouple pyrometer.

8.9.4 Know the Millivoltmeter

8.9.5 Know the Potentiometer

8.9.6 Know the Line resistance and Cold junction

8.9.7 Know the Thermal Wells.

8.9.8 Know the Thermo-Piles.

8.9.9 Know the function of Thermocouple lead wires.

8.9.10 Know the construction, and working of Thermocouple pyrometer.

8.10 OPTICAL PYROMETER

8.10.1 Define the term Optical pyrometer

8.10.2 Know the principle of photoelectric pyrometer

8.10.3 Know the construction, and working of Optical pyrometer like Ferry's optical and Filament Disappear optical pyrometer

8.10.4 Know the merits and demerits of optical pyrometer.

COURSE CONTENT:

1.0 INTRODUCTION TO REFRACTORIES: Definition- properties of good refractory material and factors affecting selection of Refractories-classification- layout..

2.0 ALUMINO SILICATE REFRACTORIES: Types of Raw materials, Grog, Fabrication methods, drying, burning stages, Properties and uses, high Alumina Refractories, Bauxite Refractories, Electro casting Coherent ZAC blocks, Monofrax Refractions.

3.0 SILICA REFRACTORIES: Raw materials, Properties, Composition, Additives / bonds, Mineralizes, Body Preparation, Tempering, mixing, making methods drying setting, firing, tempering schedule curve, cooling / Annealing of Silica Refractories, Properties and uses semi-silica & silica bricks.

4.0 DOLOMITE REFRACTORIES: Raw materials- Body composition- Bonds- Manufacturing
methods- drying- firing- Properties and uses of Dolomite Refractories.

5.0 MAGNESITE REFRACTORIES: Raw materials-Compositions- bonds- Making methods-drying- firing- Properties and the uses of Magnesite Refractories- Dead burn and Calcined Magnesite.

6.0 CHROMITE REFRACTORIES: Raw materials- Bonds- Body preparation- Method of Shaping- Properties and uses of Chromite Refractories.

7.0 CHROME –MAGENSITEAND MAG-CHROME REFRACTORIES: Rawmaterials bonds- Proportionate-Body preparation- Forming methods- Properties- defects and uses-Metalcase Refractories:- Raw material- bonds- body preparation-fabrication methods properties anduses.

8.0 HEAT MEASUREMENTS IN CERAMIC INDUSTRY

Introduction-Classification-Fixed points of temperature, Temperature Scales, Thermometers-Types of industrial Pyrometers. Pyroscopes- contraction pyroscopes-fusible pyroscope. Radiation pyrometer-Principle Blackbody radiation -Resistance measurement by Wheat stone's bridge and its principle – Advantages and disadvantages of industrial pyrometer- Principals of Thermocouple Thermocouples lead wires- Thermal wells –Thermo-Piles-Thermocouples leads wires.-Optical Pyrometer-Principle of Optical Pyrometer-Design-Construction of Optical Pyrometer-Types of Optical Pyrometers-Radiation Pyrometer-Principle Pyrometer-Black body radiation –Design –Construction of Radiation Pyrometer.

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3. A.Rashid Chesti Refractories, Prentice Hall of India pvt ltd., New Delhi, 1986.
4. M.L.Misra Refractories, Clear Type Press, Allahabad, 1975,
5. Nandi, D.N. Handbook of Refractories, Tata McGraw-Hill Publishing Co., New Delhi, 1991.
6. O P Gupta Element of Fuels, Furnace and Refractories, Kanna publishers, Delhi, 1991.
7. Singer F and Singer S S., Industrial Ceramics, Oxford & IBH Publishing Co., 1963.
8. Subrata Banerjee, Monolithic refractories, T V Prasad Indian Refracory makers association, Kolkata, 1972.
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11. Rudolf Gunther, Glass Melting Tank Furnace, Society of Glass Technology, Sheffield, 1958
12. Suhir Sen, Ceramic White Wares, Oxford & IBH Publishing Co., 1992.
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COMMUNICATION SKILLS

SUBJECT TITLE : COMMUNICATION SKILLS

SUBJECT CODE : CER – 3209

PERIODS / WEEK : 3

PERIODS / SEMESTER : 45

Introduction:

In the context of globalization, competence in speaking skills is the need of the hour The gap between the needs of the industry and the curriculum can be bridged by enabling the students to hone their speaking and listening skills. This course aims at providing opportunities for practicing speaking.

Objectives:

On completion of the course the students will be able to

- Strengthen their listening skills
- Strengthen their speaking skills

TIME SCHEDULE

Sno.	Topic	Periods	Weightage of marks (End Exam)	Sessional marks	Total
1	Listening I	3	10	10	20
2	Listening II	3			
3	Introducing oneself	3	50	30	80
4	Describing objects	3			
5	Describing events	3			
6	Reporting past incidents	3			
7	Speaking from observation / reading	3			
8	JAM	6			
9	Group discussion	6			
10	Mock interviews	6			
11	Making presentations	6			
		45	60	40	100

Competencies and key competencies to be achieved by the student

Topic	Teacher's input/ methodology	Students competence
Listening I Listening II	Pre- Listening –eliciting, pictures While - Listening Post –Listening –project , writing	Identifying the main idea, Identifying specific details, Identifying parallel and contradictory ideas Drawing inferences, Reasoning
Introducing oneself	Kinds of introduction --official/ personal, dynamic vocabulary, Body language, Model introduction, Use of line ups	Use of simple present tense, Sequencing, Appropriate vocabulary
Reporting incidents	Group work /pair work, Elicit, Use of past tense, Student presentations	Use of past tense, Relevant vocabulary
Describing objects	Vocabulary , Use of adjectives, Games—I spy, Group presentations	Use of adjectives, Dimensions,shapes Compare and contrast, sequence
Describing events	Group work/pair work Use of appropriate tense	Use of appropriate tense, sequencing
Reporting past incidents	Use of past tense, Vocabulary Student presentations	Use of past tense , sequencing
Speaking from observation/reading	Group work/pair work, Reading techniques ,	Use of past tense, Summarising , evaluating, comprehension
JAM	Effective techniques , Good beginning , conclusion, tips, Use of line ups	Vocabulary, Sequencing, Fluency, Thinking spontaneously
Group discussion	Expressing opinion, body language,	Expressing opinion, agree/ disagree, fluency,Persuasive and leadership skills
Mock interview	FAQs , body language	Role play, body language,
Making presentations	Student presentations	Using charts , pictures, interpreting data, sequencing,PPTs

Communicative methodology (CLT) should be used to create an interactive class. Apart from the suggestions given teachers are free to innovate to use any activity to improve the language competence of students . Attention can also be given to improve the accent and intonation of students.

Note:
* This subject is a theory subject.
** The workload should be calculated as theory workload.
***Examinations in the subject will be treated as a practical one.

GLASS ENGINEERING -I LAB

SUBJECT	**:**	**GLASS ENGINEERING-I LAB**
SUBJECTCODE	**:**	**CER-3305**
PERIODS/ WEEK	**:**	**04**
PERIODS/ SEMESTER	**:**	**60**

List of Experiments:

1. Determination of Particle size of a given Sand by Rotap sieve shaker.
2. Leaching of Glass Sand by Alkali solutions.
3. Leaching of Glass Sand by Acid solution like Hydrochloric Acid and Sulphuric Acid.
4. Preparation of Sodium Silicate by using Electrical crucible furnace
5. Preparation of Soda Lime Silica Glass,Transparent/flint glass and Crystal Glass.
6. Preparation of Colored glasses.
7. Preparation of Opal and Opal colored glass.
8. Determination of Strain by Strain viewer/Polariscope.
9. Determination of Surface alkalinity/durability of given Glass Bottle by Autoclave Tests.
10. Determination of alkalinity of given Glass Powder by Autoclave Test.
11. Determination of impact strength of Container and Float glass.
12. Determination of the DENSITY of a given GLASS by Boiling method and Steel walker yard balance.
13. Determination of the DENSITY of a given GLASS ware by Density Comparator.
14. Determination of the DENSITY of a given GLASS Powder by Pycnometer/ specific gravity bottle method
15. Determination of the seeds present in a given sample by SEEDOSCOPE Method.
16. Determination of Thermal Shock Resistance Test for containers.
17. Determination of Refractive Index of given glass by Abbe refractometer.
18. Determination the thermal expansion
    1) By using Dilatometer (IS: 5623-1970, ASTM: C-337-57)
    2) Under controlled heating rate

S.NO	OBJECTIVE	COMPETENCY	KEY COMPETENCY
1.	Determination of particle size of a given sample.	-Accurate the quantity of sand weighed. -Dispersed the sand particle shake the rotape sieve. -Each sieve retains content measured accurate and have sieve no. -Sum of all sieve retained sand.	-Know the different types of standard sieves and quantity.
2.	Leaching of glass sand by alkali solutions.	-Varieties of glass sand. -Soaking period. -Alkali content wise loss of materials.	-Know the handling alkalis. -Any side effect of human body.
3.	Leaching of glass sand by acid solution like Hydrochloric acid and sulphuric acid.	-Concentration of acids. -Ratio between acid and water. -Time taken to leaching. -Washing of glass sand. -Dry glass sand weighed. -Find out the loss of glass sand.	-Know the handling of weak and strong acid. -During handling what are the precaution steps.
4.	Preparation of sodium silicate by using electric crucible furnace.	-Identification minerals for test. -Mixing of raw materials and heat treatment between 1100-1200^{0}C steams to create high pressure environment in which dissolves water call as water glass.	-Know the forming solution. -Use of solution.
5.	Preparation of soda lime silicate glass, transparent /flint glass and crystal glass	-Identification of physical and chemical properties raw materials. -Preparation of batch. -Oxides melting temperature. -Melting behavior of material. -shaping technique of gob drawing, rolling, annealing, testing and packing of the ware	-Know the preparation of glass. -Our domestic glass prepared procedure.
6.	Preparation of colored glass.	-Raw material varieties of net formers, network modifiers intermediate oxide, refining agents, oxidizing & colored oxide(Coo,Cuo,Fe$_2$O3) used as a batch. -Coloring agent in terms of percentage calculation. -According to batch mixing, melting using fabricating technique through colored glass articles prepared.	Know the different types of colored glasses.

7.	Preparation of opal and opal colored glass.	-Take glass composition and addition opacifier like zircosil, $BaCO_{3,}TiO_2$.etc., Remaining things are similar to glass. -further steps like mixing, melting, making, annealing & testing, packing of opal glass.	-Know the opacifier and milky white glass making techniques.
8.	Determination of strain by strain viewers/polariscope.	-After fabrication internal strain forming it invisible to the naked eye. -Strain cause potential point of failure. -By view through two polarized filters held in varying orientation one can visualized the strain pattern in specimen second filter is adjustable holder (smaller diameter window glass pate). -Color and intensity of light changed by rotating of specimen.	-Know the strain forming of bottle or glass.
9.	Determination of surface alkalinity/durability of a given glass bottle by auto clave test.	-Take distilled water in a bottle and kept in a auto clave chamber filled tap water to the base. -Pressure slowly rised i.e., $1kg/cm^2$ for 2 hour and then calculate alkalinity by titration.	-Know the student alkalinity of bottle reaction between H_2O and glass surface.
10.	Determination of alkalinity of given glass powder by auto clave test.	-Crush the glass and take required quantity. -Prepare a solution of 50ml. -Use auto clave 30 minutes. -Analyze the result.	- prepare glass powder and visual color, auto clave.
11.	Determination of impact, strength of given glass.	-To see the resistance of physical breakages or damage. -Take glass specimen and steel wall from certain height to free falling of steel ball. -Under the gravity -Measure the rate of fracture.	-Know the crack propagation.
12.	Determinations of the density of given glassware by boiling method.	-Take the glass specimen. -Measure the first weight. -Boiling the specimen and -Then second weight and third weight of specimen. -According to formula. -Calculate the density.	-Know the differences between dry weight, suspended and soaked weight.

13.	Determinations of the density of given glassware by density comparator.	-Take tube contain liquid of known density and immerse specimen. -Tube immerse in variable bath. -Initially standard specimen both float in the solution. -Temperature rise standard specimen gradually sink or settle in -Liquid solution temperature measure compare to reference one. -Calculate the density through formula	Know the Comparison of Solution Temperature and Reference to standard and Specimen.
14.	Determination of the density of a given glass powder by pycnometer/specific gravity bottle method.	-Take glass and crushed small quantity of glass pieces is weighed. -Note the weights of w_1, w_2, w_3, w_4. Similarly take specific gravity bottle take weights of w_1, w_2, w_3, w_4.	-Know the mineral specific gravity.
15.	Determination of the seeds present in a given sample by seedoscope method.	-End product of glassware presence of seeds and bubble identification purpose.	-Know the differentiate bubble and seeds.
16.	Determination of thermal shock resistance test for containers.	-The cyclic testing of product from hot temperature to cold temperature until failure in order to calculation.	-Know the between hot and cold container temperature gradient & behaviors.
17.	Determination of refractive index of given glass.	-The light beam pass through glass surface at angle other than the perpencular. -The beam will bent towards perpencular. -Calculate according formula.	-Know the optical glass light penetration or transmission of light.
18.	Determination the thermal expansion 1.By using diatometer. 2.Under controlled heating rate.	-Volume change cause by physical. -One stationary rod another movable rod - the gap between the rods specimen exposed to temperature likely expand it used to minimize the influence of connecting rod expands.	-Know the specimen linear coefficient thermal expansion measurement calculation.

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WHITEWARE & HEAVY CLAY WARE-I LAB

SUBJECT	**:**	**WHITE WARE & HEAVY CLAYWARE-I LAB**
SUBJECT CODE	**:**	**CER 3306**
PERIODS/ WEEK	**:**	**04**
PERIODS/ SEMESTER	**:**	**60**

LIST OF EXPERIMENTS:

1. Determination of grit content of given sample by Wet method
2. Determination the Atterburg Number of the following materials:
    a). Ball Clay,
    b). Fire Clay,
    c). China Clay.
3. Preparation of Mono piece Plaster of Paris Moulds.
4. Preparation of Multiple piece Plaster of Paris Moulds
5. Prepare a suitable body slip by using Ball mill
6. Find out the Rheological properties of various body slips
7. Cast the articles with the different body slips by the method of solid casting.
8. Cast the articles with the different body slips by the method of hollow casting
9. Preparation of Plastic body with Earthen ware, Porcelain and Stone ware for pressing
10. Prepare a tile with Earthen ware
11. Prepare a glazed roofing tile with Terracotta and common clay bodies.
12. Preparation of common bricks with different sizes by Hand /Semi- automatic method.
13. Preparation of Flower pots by Turning process using Potters wheel
14. Firing of above products at Suitable temperatures.
15. Routine tests for fired ceramic samples.

S.NO	OBJECTIVE	COMPETENCY	KEY COMPETENCY
1.	Determination of grit content of given sample by wet method.	-Take the sample and passed in the 240 mesh -Weigh the material retained in the 240 mesh	-Know the relation between grinding time and grit present in the sample
2.	Determination of Atterburg Number of the following materials a.)Ball Clay b.)Fire Clay c.)China Clay	-Take the sample and convert it into Rolling state, plastic state and fluid state with the addition of water -Then find out the Atter burg number by using formula.	-Know the Atterburg Number of different clays i.e., plastic and non plastic clays.
3.	Preparation of Mono piece plaster molds.	-Prepare a suitable model /Take the model supplied. -Then construct the supports beside of the model with suitable material with specified method. -Lubricate the model and supports. -Pour the plaster slip inside of the supported walls. -After setting gently remove the model then do the necessary finishing	-Know the selection of model for making mold. -Find out the inside volume of the supports for poring correct amount of plaster slip. -Proper finishing techniques to be apply while removing the model from supports.
4.	Preparation of multiple piece plaster of Paris molds.	-Take the right model for making mold. -Half of the model is inserted in to the clay bat. -Then construct the supports beside of the model at the right distances. -Plaster Slip is poured inside of the support and make the half of the portion. -Make the notches upon the half mold. -After constructing the support walls upon the prepared half portion mold the plaster slip has to be drained. -After Proper finishing remove the mold then take the model.	-Select the right model for making mold. -Proper lubrication has to be apply. -Know proper finishing techniques for making mold. -Uniform thickness has to be maintained in all sides etc.,

5.	Prepare a suitable body slip by using Ball Mill.	-Select the suitable body composition for making slip. -Fed the raw materials into the ball mill. -After getting suitable properties unload it.	-Know the function of each raw material -Know the maximum amount of electrolyte to make the slip. -Know the grinding time.
6.	Find out the Rheological properties of various body slips.	-Take the sample of slip -stir properly by using lab stirrer -check the density by Density bottle -Check the viscosity by viscometer _Check the residue by specified mesh	-Know the relation slip between densities, viscosity, residue of thixotropy. Know the flocculation and deflocculation.
7.	Cast the articles with different body slips by the method of Casting i.e., solid casting.	-Take the suitable plaster mold for casting. Select the type of casting to be needed. -Then cast the articles by using different body slips.	Know the various type of casting systems**.** -Observe the casting rate to various type of bodies.
8.	Cast the articles with different body slips by the method of Hallow casting.	-After selection and suitable Lubrication of the mold, the slip is poured into the mold. -Different techniques are employed for casting. -Drain the excess slip.	-Find out the proper thickness is achieved or not -Know proper drying system for removal of the article from the mold.
9.	Preparation of plastic body with Earthen ware,porcelain and stone ware for pressing.	-Prepare the plastic body with the Earthen ware, Porcelain and Stone ware -Pressing was carried out in the molds by different techniques.	-Know the handmade process technique. -Know the machines used for plastic forming.
10.	Prepare a tile with Earthenware	-Choose the Earthenware composition which was suitable for different fabrication techniques. -Fabricate the tile by using different techniques.	-Know the different fabrication techniques for making tile i.e., casting, plastic forming of dry pressing
11.	Prepare a roofing tile with Terra cotta	-Select the body composition of Terracotta for making roofing tile. -The raw materials are converted into plastic form by suitable processing. -Fabricate the tile in the Tile Pressing machine.	-Compare the study of raw material used for making floor tile and roofing tile.

12.	Manufacturing Common bricks	-Fabricate the brick in the suitable mold. -Then dry and fired in the suitable kiln.	-Know about seove kiln.
13.	Preparation of Flower pots by Turning process using Potters wheel	- Fabricate the flower potby Turning process using Potters wheel -Then dry and fired in the suitable kiln.	- Know Potters wheel
14.	Firing of dried/ glazed articles in suitable Kiln.	-The dried articles are loaded into the different kilns for firing. -The articles are fired at different temperatures to get required properties.	-Know the types of Kilns for firing process.
15.	Routine Test for fired Ceramic products.	-Take the specimen which was used to determine the specific property i.e., Density, porosity, Specific Gravity, etc	-Compare the properties exhibited by the different bodies.

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REFRACTORIES LAB

SUBJECT	**:**	**REFRACTORIES LAB**
SUBJECT CODE	**:**	**CER-3307**
PERIODS/ WEEK	**:**	**04**
PERIODS PER SEM	**:**	**60**

Refractories practical are designed in a manner that every student will prepare his own samples, conduct all ND tests and lastly will perform Destructive tests on the same. Student will understand the manufacturing and Testing of Refractory shapes like (special bricks, blocks, Kiln furniture etc.).

List of Experiments:

1. Prepare a brick with a given refractory mixture
2. Prepare a different shape of fire bricks with given refractory mixture
3. Prepare a fire clay bricks with the given composition.
4. Prepare a cellular /Insulation brick with vermiculite.
5. Prepare a cellular /Insulation brick with rice husk.
6. Prepare a cellular /Insulation brick with mica powder.
7. Preparation of 2" cubes with ¾" x ¾"x ¾" opening at the Top center for Slag Attack Test.
8. Prepare a sager.
9. Prepare a crucible.
10. Determination of Porosity, Apparent Density, Specific Gravity of the given Refractory bricks.
11. Compare the specific gravity with lump and powder state.
12. Finding C.C.S. of Refractory bricks.
13. Determination of Slag attack by Glass and Frit on the above Refractories.
14. Determination of Spalling resistance of Refractory materials by Quenching Test
15. Determination of Spalling resistance of Refractory materials by Panel Test.

S.NO	OBJECTIVE	COMPETENCY	KEY COMPETENCY
1.	Prepare a brick with a given refractory mixture.	-Take the refractory mixture and press in brick mould.	-Know the brick making.
2.	Prepare a different shape of fired bricks with given composition.	-To set up batch composition and mixed it. -Take the refractory mixed-lump and press in different mould. -drying and firing check the parameters	- drafting of the composition and observe different shape and size refractory bricks.
3.	Prepare a fire clay bricks with the given composition.	-According to composition batch has prepared. -mix with water and additives -Lump is press in mould. -Required shape is achieved.	-Know the ingredients of fire clay refractory and properties along fixing temperatures and schedule.
4.	Prepare a cellular/insulation brick with vermiculite.	-Take porous raw material and check properties. -Mix with refractory paste. -Dry the shape.	- Purpose of insulation in refractory industry. -How much porosity maintained in production.
5.	Prepare a cellular/insulation brick with rice husk.	-Raw material are not only in earth crust but also used in our daily life like cultivate products (rise husk and saw dust). -Batch make the paste and dry it.	-Know the agriculture product also used as a raw materials.
6.	Prepare a Cellular/Insulation brick with mica.	-Take the mica and prepare the batch. -Paste poured in mould and dried it.	- The physical and chemical properties of mica and acts as insulation.
7.	Preparation of 2'' cubes with ¾" x ¾" x ¾" opening at the top centre for slag attack test.	-Prepare refractory cube and groove of the centre at any direction it visual square groove for slag test.	- prepared specimen for testing of spalling resistance.
8.	Prepare a sager.	-high temperature fire clay body prepare and then paste is shape like sagar and circular plate it is used for white ware article firing purpose.	-Student prepare sager.
9.	Prepare crucible.	-First take high temperature batch composition and then mixing making of crucible for making frit or glass.	- crucible for high temperature melting application.
10.	Determination of porosity, apparent density specific gravity of the given refractory brick.	-Take fired refractory specimen and then specimen kept in pycnometer bottle and filled with water take w_1, w_2, w_3, $w_4$calculation according formula.	- learned porosity, apparent density, specific gravity of the specimen.

11.	Compare the specific gravity lump and power state.	-The result of pycnometer method and the result of the specific gravity bottle method compare and which is accurate we know.	- the procedure of two method along with result variation between solid and powder methods.
12.	Finding C.C.S of refractory brick.	-Take refractory specimen for C.C.S -Specimen fix at center of Enkey Hydraulic 20 Ton press gradual load is applied when micro-line cracks or major cracks visual to naked eye. - Take reading and calculate result.	-packing of brick and load bearing capacity.
13.	Determination of slag attack by glass and frit on the above refractory.	-take slag attack test cube and glass or frit powder poured into square groove of top centre and then fired at 1450^{o}C. -After cooling the Cube cut into centre and observe how much corroded under refractory material.	- the reaction between refractory and glass/frit.
14.	Determination of spalling resistance of refractory materials by quenching test.	-To take refractory bar and heat in furnace at 1400^{o}C by 2hr soaking and then remove from the furnace the bar quench into water bucket take out it. -Absorb any micro-crack or not. -Absorb how many cycles are withstanding the bar.	- refractory material withstand number of cycles of hot & cold.
15.	Determination of spalling resistance of refractory material by panel test.	-take 50 no. of fire clay bricks 16 no. of bricks used super duty 28 no. of bricks used high heat duty. -06 no. of bricks used intermediate heat duty. -Bricks are placed at panel and also contact bricks with water. -After rise the temperatures 1600^{o}C for 5 hour soaking -another schedule 1400^{o}C only. -Two firing schedule absorb are investigate the volume change.	- the various temperature bricks conduct spalling test results.

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DIPLOMA IN

CERAMIC TECHNOLOGY

(3 ½ YEAR SANDWICH)

UNDER MPEC

FOURTH SEMESTER

CURRICULUM – 2016
(C-16)

STATE BOARD OF
TECHNICAL EDUCATION & TRAINING
ANDHRA PRADESH

STATE BOARD OF TECHNICAL EDUCATION & TRAINING
ANDHRA PRADESH
DIPLOMA IN CERAMIC TECHNOLAGY
3 ½ YEAR SANDWICH COURSE
(MPEC SYSTEM)

FOURTH SEMESTER

Subject Code	Name of the Subject	Instruction Periods/Week		Total Periods/	Scheme of Examination				
		Theory	Practical	Semester	Duration (Hrs)	Sessional Marks	End Exam Marks	Total Marks	Credits
	THEORY SUBJECTS								
CER-4210	Ceramic Calculations	5	--	75	3	20	80	100	5
CER-4308	Glass Engineering - II	5	--	75	3	20	80	100	5
CER-4309	White Ware & Heavy Ware-II	5	--	75	3	20	80	100	5
CER-4310	Refractories-II	5	--	75	3	20	80	100	5
CER-4311	Cement Technology	5	--	75	3	20	80	100	5
	PRACTICAL SUBJECTS								
CER-4211	Life Skills	--	3	45	3	40	60	100	1.5
CER-4312	Cement Technology Lab	--	4	60	3	40	60	100	2
CER-4313	Glass Engineering – II Lab	--	5	75	3	40	60	100	2.5
CER-4314	White Ware & Heavy Clay Ware-II Lab	--	5	75	3	40	60	100	2.5
	TOTAL	**25**	**17**	**630**	**-**	**260**	**640**	**900**	**33.5**

CERAMIC CALCULATIONS

SUBJECT TITLE : CERAMIC CALCULATIONS.

SUBJECT CODE : CER- 4210

PERIODS/ WEEK : 05

PERIODS / SEMESTER : 75

TIME SCHEDULE

S. No	Major Topics	Periods	Weightage of marks	Short Answer Questions	Essay type Questions
1	Dimensional Changes	06	06	02	--
2	Density And Specific Gravity	06	06	02	--
3	Porous Solids	08	13	01	01
4	Suspensions	08	13	01	01
5	Triaxial Diagram	02	03	01	--
6	Body Calculations	10	13	01	01
7	Introduction To Glaze Calculations	10	20	--	02
8	Fritted Glazes	09	20	--	02
9	Miscellaneous Glaze Calculations	04	03	01	--
10	Ultimate And Proximate Analysis	05	03	01	--
11	Introduction To Glass Calculations	07	10	--	01
TOTAL		**75**	**110**	**10**	**08**

OBJECTIVES: *On completion of the subject the student should be able to understand and solve the problems to related topics:-*

1.0 DIMENSIONAL CHANGES

1.1 Calculate the Drying Shrinkage (Wet-Dry Contraction).
1.2 Calculate the Firing Shrinkage (Dry-Fired Contraction).
1.3 Calculate the Total Shrinkage (Wet-Fired Contraction).
1.4 Calculate the Volume Shrinkages of Ceramic bodies.
1.5 Calculate the Moisture content.
1.6 Calculate the Relationship between percentage Moisture content (Dry Basis) and Volume Shrinkage.
1.7 Calculate the Loss on Ignition.

2.0 DENSITY AND SPECIFIC GRAVITY

2.1 Define Density.
2.2 Know the Comparison of Densities.
2.3 Know the Specific Gravity/Relative Density.
2.4 Know the Archimedes Principle.

3.0 POROUS SOLIDS:

3.1 Define the term Porosity.
3.2 Know the Effect of Porosity on the Function of Ceramic Materials.
3.3 Know the Pore structure calculations.
3.4 Calculate theDensity, Apparent Density and True density of porous solids.
3.5 Calculate thePorosity, Apparent Porosity and True Porosity of porous solids.
3.6 Calculate theWater Absorption of porous bodies.
3.7 Calculate theSealed Pores..

4.0 SUSPENSIONS:

4.1 Know the Density of slip.
4.2 Solve the calculations relating mixtures of solid particles and water.
4.3 Know the Dilution Formula and Solve the Dilution Problems.
4.4 Know the Brongniart's formula and Solve the related Problems.
4.5 Know the "Standard" SlopPeck calculation.

5.0 TRIAXIAL DIAGRAM:

5.1 Know the Triaxial diagram.
5.2 Explain Plotting of Triaxial diagram.
5.3 Know the Point the different Proportions of materials or ceramic products.

6.0 BODY CALCULATIONS:

6.1 . Know the Body mixing calculations.
6.2 . Know the Dry and Wet Measurements.
6.3 . Know the Effect of Specific Gravity of body slip.
6.4 Know the Effect of Density of body slip.
6.5 Know the Problems on Dimensions of the Mixing Ark.
6.6 Know the Substitution to the Wet Recipe.

7.0 INTRODUCTION TO GLAZE CALCULATIONS:

7.1 Calculatethe Molecular weight of oxides, Raw materials and Minerals used in Ceramics.
7.2 Calculatethe Formula weight.
7.3 Know the Use of Chemical Equations, Oxides.
7.4 Know the Relationships between percentage Composition and Formula.
7.5 Calculate the percentage composition from the given formula.
7.6 Calculate the recipe from the given Glaze Formula.
7.7 Calculate the Glaze formula from the given glaze recipe.
7.8 Calculate the recipe from the given percentage composition of glaze.
7.9 Calculate the percentage composition from the given Glaze recipe.

8.0 FRITTED GLAZES:

8.1 Define the term Frit.
8.2 Know the Reasons for Fritting.
8.3 Know the Frit Rules.
8.4 Know the Fritting Factors and its uses.
8.5 Calculate the Recipe from the given Formula.
8.6 Calculate the Formula for a Fritted glaze from the given recipe.
8.7 Calculate the Percentage composition of the Mill Batch from the given Recipe.

9.0 MISCELLANEOUS GLAZE CALCULATIONS:

9.1 Know the Substitutions.
9.2 Know the Glaze calculations involving the Addition of a Coloring Oxides.
9.3 Calculate the glaze formula when the components of the glaze are quoted in term of Percentage composition.

10.0 ULTIMATE AND PROXIMATE ANALYSIS:

10.1 Definitions of Ultimate and Proximate and Rational Analysis.
10.2 Calculate the Rational Analysis of clay by the method of Feldspar Convention.
10.3 Calculate the Rational Analysis of clay by the method of Mica Convention.
10.4 Substitution of clays in Body Recipes.

11.0 INTRODUCTION TO GLASS CALCULATIONS

11.1 Calculate the Batch composition from the given molecular formula.
11.2 Calculate the Molecular formula from the given Batch compositions**.**
11.3 Calculatethe Molecular formula from the given chemical composition.
11.4 Calculate the Chemical composition from the given Molecular formula.
11.5 Calculate the batch composition from the given chemical composition.
11.6 Calculate the chemical composition from the given batch composition.
11.7 Calculate the problems related to introducing cullet in batch composition.

COURSE CONTENT:

1.0 DIMENSIONAL CHANGES: Shrinkage (Wet to Dry)- Shrinkage (Dry to Fired)- Volume shrinkage- Moisture contents- LOI and related Problems.

2.0 DENSITY AND SP.GRAVITY: Archimedes Principle- Calculations applicable to ideal solids and Liquids and related problems.

3.0 POROUS SOLIDS: Effect of Porosity on the function of Ceramic materials- Pore structure
Density- Apparent and True density- Apparent Solid Density-Porosity- Apparent Porosity- Water Absorption- True Porosity and related Problems.

4.0 SUSPENSIONS: Density of slips- calculations relating mixtures of solid particles and water- dilution problems- Brongniart's formula- "Standard" Sloppeck and related problems.

5.0 TRIAXIAL DIAGRAM: Plotting Triaxial diagram and the point the different proportions of materials/ceramic products.

6.0 BODY CALCULATIONS: Dry and wet measurements of materials for body mixing- Wet inches- effect of sp.gr.- density of the body slips- dimensions of the mixing ark- adjustments to the wet recipe and related Problems.

7.0 INTRODUCTION TO GLAZE CALCULATIONS: Molecular weights- formula and uses of chemical equations- oxides- Percentage composition and formula- Calculation of a recipe from simple glaze formula- given the recipe of a glaze calculate the formula and related problems.

8.0 FRITTED GLAZES: Given the formulacalculate a Recipe- fritting factor- given the recipe calculate a formula- and given the recipe calculate the percentage composition of the Mill batch and related problems.

9.0 MISCELLANEOUS GLAZE CALCULATION: Substitution Problems- additions of coloring oxides to glazes and frits- to calculate a glaze formula when the percentage composition is given and related problems.

10.0 ULTIMATE AND PROXIMATE ANALYSIS: Ultimate and Proximate analysis of clays- ultimate analysis and percentage composition-Calculation of rational analysis of clays by feldspar- Mica conventions- substitution of clays in body recipes and related problems.

11.0 INTRODUCTION TO GLASS CALCULATIONS: Determination of molecular formula of glass from chemical composition of the glass-and from the batch composition- Determination of batch from molecular formula of glass- Determination of batch produces a glass from the given chemical composition.

REFERENCE BOOKS:

1. A I Andrews, Ceramic Tests and Calculations, John wiley and sons, Inc.,New York, 1928

2. R Griffith, Calculations in ceramics, Livesey ltd., St.John's Hill, Shrewsbury, England, 1965

3. R Charan, Hand book of Glass Technology.

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GLASS ENGINEERING - II

SUBJECT TITLE : GLASS ENGINEERING - II

SUBJECT CODE : CER - 4308

PERIODS/ WEEK : 05

PERIODS / SEMESTER : 75

TIME SCHEDULE

S. No	Major Topics	Periods	Weightage of marks	Short Answer Questions	Essay type Questions
1	Layout Of Modern Glass Plant	05	10	--	01
2	Glass Batch House	17	29	03	02
3	Glass Melting Furnace	15	13	01	01
4	Glass Fabrication Process	25	45	05	03
5	Special Process	13	13	01	01
TOTAL		**75**	**110**	**10**	**08**

OBJECTIVES:*On completion of the course, the student should be able to know the following:*

1.0 LAYOUT OF MODERN GLASS PLANT.

1.1 Draw a flow diagram of modern Glass plants.
1.2 Know the Site selection for modern glass plant.
1.3 Know the Infrastructure facilitates.

2.0 GLASS BATCH HOUSE.

2.1 Define the term Batch House.
2.2 Know the Shipment of Raw materials.
2.3 Explain the unloading of Raw materials.
2.4 Know the Batch House equipment and machinery. .
2.5 Know the Storage of materials.
2.6 Know the Conveying of the materials to stores and furnace.
2.7 Know the Handling and Storage of cullet.
2.8 Know the Crushing and washing of cullet.
2.9 Explain the Crushing and grinding Raw materials.
2.10 Know the Principles of fracture the Raw materials.
2.11 Know the Mixtures and mixing methods of batch materials.
2.12 Know the Mixing and weighing equipment of batch.
2.13 Know the Handling of batch materials.
2.14 Know the Charging of glass batch materials to the furnace.
2.15 Know the Important Batch house equipments.
2.16 Know about Briquetting & Pelletization of glass batch.

3.0 GLASS MELTING FURNACES:

3.1 List the types of Continuous furnaces for container and sheet glass
3.2 Know the Thermal efficiency of continuous tank furnace and construction.
3.3 Sketch / diagram of container and sheet glass tank furnace.
3.4 Know the Melting area and depth in relation to pull of glass and type of glass.
3.5 Know the working of End fired and cross fired regenerative type tank furnace used in the container glass manufacturing.
3.6 Understand Heat Exchangers
3.7 Know the operation of Fuel revering valves
3.6 Explain about Electric glass melting furnace

4.0 GLASS FABRICATION PROCESS:

4.1 List the types moulds used in the glass industry.
4.2 Know about the wooden moulds and carbon moulds.
4.3 Know about the cast iron mould.
4.4 Know about the Paste moulds.
4.5 Know the flashing and explain different types of flashing of glass.
4.6 Know the Jug making by handmade process.
4.7 Know the Preparation of glass rods and tubes by hand.
4.8 Know the Flat glass by handmade process.
4.9 Know the Moulds in glass industry to make containers and others.
4.10 Know the Blow mould, Parison and neckring moulds.
4.11 Explain the Semi-automatic process for making containers, chimneys and Jars.
4.12 Know the Operation of press and blow machine.
4.13 Know the Construction of forehearth of the furnace.
4.14 Know the Distribution of temp in forehearth of the furnace.
4.15 Know the Feeders, Gob and Gob sizes and shapes.
4.16 Know the Maintenance of glass level related to pull.
4.17 Know the Operation of different types of feeders.
4.18 Know the Dimensions of spout and orifice in relation to size of gob.
4.19 Know the Blow & Blow process, Press& blow process, Drawing process.
4.20 Know in detail operation, control, Principal and efficiency of the following Automatic machines.

a. I.S.machine.
b. Lynch machine.
c. Owens machine.

d.'O'Nills machine for wide & narrow neck bottles.

4.21 Know in detail the process, operation and control of the following machines for drawing of sheet.

a. Colburn's process
b. Pittsberg process
c. Fourcault Process.

4.22 Explain about the Float glass manufacturing.

5.0 SPECIAL PROCESS.

5.1 Know the Tempering of glasses.
5.2 Know the Chemical process of surface crystallization.
5.3 Know the Laminated glass.
5.4 List the different types of surface coatings of glass surface and its advantages.

5.5 List the application methods of surface coatings like silver coating on glass.
5.6 Know about Cutting, Engraving, Etching, Enameling, Staining, Sand blasting, and Frosting of glass.
5.7 Know about polishing, grinding and selection of media for this operation.
5.8 Know the Metallization of glass.
5.9 Know the Methods of Glass blowing operation.
5.9 List the types of glass used for scientific glass, and its compositions and applications.

COURSE CONTENT:

1. LAYOUT OF MODERN GLASS PLANT: Glass manufacture flow diagram- site selection-infrastructure facilities.

2. BATCH HOUSE: Handing of Raw materials- Batch House equipment and machinery-crushing- grinding- Principles of fracture- Batch mixing and changing- Working Principles of mixtures- Handling- storage and charging equipments- Briquetting and Pelletizing.

3. GLASS MELTING FURNACES: Types of tank furnaces- Principle- working-construction End port and cross fired regenerative type tank furnace.

4. FABRICATION PROCESS: Types of Fabrication methods of glass ware- Hand made Process- Glass gathering rod- moulds- nickering Process by hand made- flashing etc.- classification of moulds- glass rods- tubes- sheet by hand made process feeders and Fore hearth-Gob size and Shape etc.- Spout and Orifice.

Machines for Blow ware: Principles of operation and Control of I.S- Lynch-'O'Nills and Ownes machine.

Press machines: General description and operation of automatic Press machine.

Drawing of sheet glass: Handmade- Foucault- Pittsberg-Colburn and float process

5. SPECIAL PROCESS: Strengthening: Tempering- Chemical process and surface crystallization-Lamination.
Surface coatings: Different methods of surface coatings con glassware and its uses.
Decoration: Engobing- cutting- Engraving- Etching- Enamel Printing-Sand Blasting etc.
Other operations: Polishing- grinding- Types of grinding media-Metallization of glass.
SCIENTIFIC GLASS: Types of glasses and its composition.

REFERENCE BOOKS:

1.R. Charan, Hand Book of Glass Technology,

2. Tooley F V, Hand book of Glass Manufacture Volume I & II, Ogden Publishing Company, New York 36. New York.1960.

3. Chappeman and Hall, Schott Guide to Glass, Chappeman and Hall, London, 1996.

4. Samuel R Scholes, Moderns Glass Practice, industrial publication, Inc., Chicago, 1952.

5. Rudolf Gunther, Glass Melting Tank Furnaces, Society of Glass Technology, Sheffield, 1958.

6. Paul A, Chemistry of Glasses, 2nd edition, Chapman and Hall, New York, 1990.

7. George W. McLellan and E B Shand, Glass Engineering Hand Book, McGraw – Hill book company, New York, 1984.

8. Charles H. Grene, Modern Glass Practice, Cahuers books, Boston, 1975.

9. Alexis G. Pinkas, Meting Furnace Operation in the Glass Industry, Magazines for industry inc., New York, 1980.

10.Raw materials in the Glass Industry. Part 1&2 (Minor and Major ingredients) Alexis G.Pincus, David H. Davies, and Books for Industry and the glass industry magazine, 1981.

11.Batching in the Glass Industry, Alexis G.Pincus, David H. Davies, and Books for Industry and the glass industry magazine, 1981

WHITEWARE AND HEAVY CLAYWARE - II

SUBJECT TITLE : WHITEWARE & HEAVY CLAYWARE - II

SUBJECT CODE : CER - 4309

PERIODS/WEEK : 05

PERIODS/SEMESTER : 75

TIME SCHEDULE

S. No	Major Topics	Periods	Weightage of marks	Short Answer Questions	Essay type Questions
1	Layout of Modern Ceramic Plant	04	03	01	--
2	Porcelain and Special Porcelain Ware	25	39	03	03
3	Sanitary Ware	08	13	01	01
4	Earthen Ware	08	13	01	01
5	Heavy Clay Ware Product	08	16	02	01
6	Floor and Wall Tiles	08	13	01	01
7	Glazes, Colors and Decoration	14	13	01	01
TOTAL		**75**	**110**	**10**	**08**

OBJECTIVES:*On completion of the course, the student should be able to know the following:*

1.0 LAYOUT OF MODERN CERAMIC PLANT:

1.1 Draw the Flow diagram of manufacture of clay product by pressing and casting.
1.2 Know the Factors effecting on Site selection and location of ceramic plant.
1.3 Draw the Modern ceramic Factory layout.

2.0 PORCELAIN AND SPECIAL PORCELAIN WARES.

2.1 Define the term porcelain.
2.2 Classify the porcelain bodies.
2.3 Know the Triaxial bodies.
2.4 Know the Hard and Soft porcelain.
2.5 List the Types of hard porcelain such as Tableware etc.
2.6 Know the Raw materials and body compositions of hard porcelain
2.7 Explain the types of soft porcelain such as Fritted porcelain, Bone china, semi vitreous porcelain.
2.8 Know the Raw materials and Body compositions of soft porcelain.
2.9 Know the process of making porcelain bodies.
2.10 Know the shaping methods of porcelain bodies

2.11 Know the drying of porcelain.
2.12 List the Types of porcelain glazes.
2.13 Know the pre-firing of porcelain bodies.
2.14 Know the Setting of porcelain Dry Ware in the Kiln.
2.15 Know the glost firing of porcelain.
2.16 Know the Properties of all porcelain bodies.
2.17 Know the products of porcelain and where they are used.
2.18 List the types of technical porcelain.
2.19 Know about the chemical porcelain
2.20 List the types of LT & HT electrical insulators
2.21 Know the Insulator body compositions and preparation of insulator bodies.
2.22 Know the Shaping methods and finishing of insulators.
2.23 Know the Process of drying of insulators.
2.24 Know the Glaze application and glost firing of porcelain.
2.25 Know the Properties required for Technical porcelain.
2.26 Explain in detail about the types of technical porcelain products and uses.
2.27 Explain about the following SPECIAL PORCELAIN bodies:
- i. Zircon bodies.
- ii. Titanium ceramics.
- iii. High Alumina ceramics.
- iv. Corundum ceramics.
- v. Mullite porcelain.
- vi. Wallostonite bodies.
- vii. Dental Proclain bodies.
- vii. Lithia porcelain bodies.
- viii. Beryllia bodies.
- ix. Cordierite bodies.

3.0 SANITARY WARE:

3.1 List of products under sanitary ware.
3.2 List the Types of bodies used for the preparation of sanitary ware.
3.3 Know the Raw materials and body compositions.
3.4 Know the body preparation.
3.5 Know the Shaping techniques for the different types of products.
3.6 Know the Finishing techniques.
3.7 Know the Drying and driers.
3.8 List the Types of glazes suitable for sanitary ware.
3.9 Know the Setting and glost firing.
3.10 Know the Properties and uses of sanitary ware.
3.11 Know the Defects in Sanitary ware and its Permitable limites
3.12 Know the performance requirements in Vitreous sanitary ware

4.0 EARTHENWARE:

4.1 Know the Majolica and Terracotta bodies
4.2 Define the term Faience.
4.3 Know the Delft ware/Blue pottery.
4.4 Define the term Earthenware.

4.5 State the classification of Earthenware.
4.6 Know the Raw materials and body compositions for Earthen Ware.
4.7 Know the Body preparation and shaping methods Earthen Ware.
4.8 Know the Finishing techniques.
4.9 Know the Drying of green ware.
4.10 Know the Setting of ware in the Kiln.
4.11 Know the bisque firing.
4.12 List and Explain the methods of glaze applications.
4.13 Explain the glost firing of Earthen Ware.
4.14 Know the Preparation of colored earthenware bodies.
4.15 Know the Preparation flat ware/tiles.
4.16 Know the Properties of earthenware product.
4.17 Know the product of earthenware and uses.

5.0 HEAVY CLAY WARE:

Know in detail about Flow sheet, raw materials, body composition, shaping, drying, firing, properties and uses of the following Heavy Clay Ware products:

5.1 Common bricks.
5.2 Face bricks and paving bricks.
5.3 Hollow tiles and conduits.
5.4 Drain tiles and Roofing tiles.
5.5 Flowerpots.
5.6 Sewer pipes and wall copings.
5.7 Vitrified tiles and Floor tiles.
5.8 Stone ware pipes and salt glazing.
5.9 Electrical stoneware.
5.10 Stoneware vases.

6.0 FLOOR AND WALLTILES:

6.1 Define the term Floor and Wall Tiles.
6.2 Know the raw material for Floor Tiles.
6.3 Know the raw materials for the wall Tiles.
6.4 Know the Body Preparation for the Tiles.
6.5 Explain the process of pressing of Tiles.
6.6 Explain the drying, Engobing, glaze application and firing of tiles.
6.7 Know about polishing of tiles
6.8 Know about Glazed Vitrified, Vitrified and Nano coated tiles
6.7 Know the Quality control for tiles.

7.0 GLAZES, COLOURS AND DECORATION:

I) GLAZES:

7.1 State the classification of glaze.
7.2 Know the lead and lead less glazes.
7.3 Know the Fritted glazes.
7.4 Know the Felspathic glazes.
7.5 Know the calcareous glazes.

7.6 Know the matty and crystalline glazes.
7.7 Know the semiconducting glazes.
7.8 Know the opaque glazes.
7.9 Know the Aventurine glazes.
7.10 List glaze defects, causes and remedies.

II) COLORS:

7.11 Know the coloring agents
7.12 List the various ceramic colors used in the Ceramic industry.
7.13 Know the compositions of different ceramic colors.
7.14 Know the preparation of stains and precaution to be taken to obtain desired colours.
7.15 Know the preparation of Luster.

III) DECORATION:

7.16 Know about metallic luster decoration.
7.17 Know about liquid gold decoration.
7.18 Know about the Decals/lithography
7.19 Know the application of decals.
7.20 Explain the methods of decoration on ceramic ware like printing, spraying, free hand painting, silkscreen printing, dusting, stamping, computerized decoration ect,
7.21 Know the Engobing and advantages on glaze and under glaze decoration.

COURSE CONTENT:

1. **LAYOUT OF MODERN CERAMIC PLANT:** Flow diagram- site selection- Location- layout of Factory.

2. **EARTHENWARE:** Definition- classification- Raw materials- Body compositions- Body preparation- shaping methods- Finishing drying-setting- Bisquiting- Glazes and its application- Glost firing-colored earthenware- Flat ware-properties- and types of the product and uses of earthenware.

3. **PORCELAIN SPECIAL PORCELAIN WARE:** Definition- classification- triaxial bodies- raw materials for porcelain- shaping methods-drying- pre firing- glaze application- glost firing- uses- Technical porcelain-raw materials- body composition- shaping- drying- glazing-glost firing- Special porcelain bodies.

4. **SANITARY WARE:** List of Sanitary ware-Flow sheet- raw materials- Body compositions-shaping methods- drying- finishing- glazes-setting- glost firing- properties and uses of sanitary ware products.

5. **HEAVY CLAY WARE:** List of Heavy clay ware- Flow sheet-Raw materials Body compositions- shaping- drying- setting- firing- properties and applications of Heavy clay products i.e. Face bricks- paving bricks- Hallow Tiles- conduits- Drain tiles- Roofing tiles-Flowerpots-sewer pipes- stoneware pipes- Tiles of vitrified- Floor tiles- electrical stoneware and vases.

6.0 FLOOR AND WALLTILES: Define the term Floor and Wall tiles- raw material for Floor tiles- raw materials for the wall tiles- preparation of body for the Tiles- process of pressing of tiles-drying-Engobing- glaze application and firing of tiles-Quality control for tiles.

7.0. GLAZES, COLOURS AND DECORATION: ***Glazes:*** Classification- preparation- glazes compositions of lead- lead less-Felspathic- calcareous glazes- matty-crystalline-semiconductor- opaque glazes- Glaze defects- and remedies. ***Colors***: Types of colors preparation- stain preparation and its compositions. ***Decoration***: Metallic luster- liquid gold- decals and other decorations and its process of application on ceramic bodies.

REFERENCE BOOKS:

1. Sudhir Sen, Ceramic White Ware, Oxford and IBH Publishing Limited, New Delhi, 1992.
2. Singer F and Singer S. S., Industrial Ceramics. Oxford and IBH Publishing Limited, New Delhi, 1963
3. S.Kumar Hand book of Ceramics Volume I to IV, Kumar & Associate, Kolkata, 1994 to 1997.
4. H.N.Bose, Modern Pottery Manufacture, Southern Bose, Bhagalpur, 1987,
5. P. Vincenzini, Fundamentals of Ceramic Engineering,
6. Allen Dinsdate, Pottery Science; Materials, processes, and products, Ellis Horwood Ltd.New York, 1986.
7. Ryan W and Redford C, White wares production testing and quality control, Pergamon Press New York, 1987.
8. FH Norton, Fine Ceramics – Technology and applications, Robert E. Krieger Publishing co., New York, 1978
9. A Hand book of production of Vitreous china sanitary ware by Dr. K.N Maithi

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REFRACTORIES-II

SUBJECT TITLE : REFRACTORIES-II

SUBJECT CODE : CER -4310

PERIODS/ WEEK : 05

PERIODS / SEMESTER : 75

TIME SCHEDULE

S. No	Major Topics	Periods	Weightage of marks	Short Answer Questions	Essay type Questions
1	Insulating Refractories	04	13	01	--
2	Carbon Refractories	06	13	01	01
3	Special Refractories	18	29	02	02
4	Kiln Furniture	10	16	02	01
5	Refractory Castables	05	13	01	01
6	Refractories in Metal and Non Metal Industries	14	26	01	02
7	High Performance Refractories	14	13	01	01
8	Environmental Health & Safety(EHS) practices for the Ceramic Industry	04	03	01	--
TOTAL		**75**	**110**	**10**	**08**

OBJECTIVES:*On completion of the course, the student should be able to know the following:*

1.0 INSULATING REFRACTORIES:

1.1 Define the term Insulation and Cellularity.
1.2 Know the Raw materials for the manufacture of Insulating Refractories.
1.3 Know the porosity of Insulating bricks and its control.
1.4 Know the Manufacturing of Insulating bricks.
1.5 Know the Properties of Insulating bricks.
1.6 Know the Applications of Insulating bricks.
1.7 Know the Insulating inserts, artifacts and insulating wool, felt, fiber and electro cast Refractories.
1.8 List the Insulating cements and its uses

2.0 CARBON REFRACTORIES.

2.1 List the raw materials used in Carbon Refractories.
2.2 Know the Characteristics of carbon as a refractory material.
2.3 Explain the manufacturing process carbon Refractories.

2.4 Know the properties and uses of carbon Refractories.
2.5 Know the Graphitized clay and its use as a refractory materials.
2.6 Know the standard sizes of graphite crucibles.
2.7 Know the ceramic - graphite Refractories.
2.8 Know the magnesia- graphite Refractories.
2.9 Know the Alumina - graphite Refractories.
2.10 Know the raw materials, manufacturing, properties and uses of Plumbago Refractories.

3.0 SPECIAL REFRACTORIES:

3.1 Know the Importance of special refractoriness**.**
3.2 Explain in details about Silicon carbide Refractories.
3.3 Compare the silicon carbide in Refractories and industrial ceramics.
3.4 Explain indetails about SiAlON.
3.5 Know the term Super Refractories.
3.6 Know the types of Super Refractories like Zirconia, Zircon, Thoria, and Beryllia.
3.7 Know the Fused and Electro cast Refractories.
3.8 Know the Cermets
3.9 Describe in detail about the following super Refractories
a) High Alumina
b) Cordierite
c) Mullite
d) Alumina- Carbon
e) Mag-carbon

4.0 KILN FURNITURE:

4.1 Define the term kiln furniture.
4.2 Know the Types of kiln furniture.
4.3 Know the Manufacturing, Properties and uses of Crucibles.
4.4 Know the Manufacturing, Properties and uses of Muffles.
4.5 Know the Manufacturing, Properties and uses of Saggers.
4.6 Know the Manufacturing, Properties and uses of Glass Pots.
4.7 Know the Manufacturing, Properties and uses of Rollers.

5.0 REFRACTORY CASTABLES:

5.1 Know the terms Refractory cement, Mortar, Castables and Ramming mass
5.2 Know the Monolithic Refractories and its Preparation, composition, Properties and uses.
5.3 Know the Air setting, Heat setting cements.
5.4 Know the Properties and uses of Mortars, Castables and ramming masses.

6.0 REFRACTORIES IN METAL AND NON-METAL INDUSTRIES:

6.1 Name the different types of refractories used for different parts of Ferrous Industries like Blast furnace, Open-hearth furnace, L.D. Process, Nozzles, Stoppers, and Sleeves, Bessemer converter,.

6.2 Name the different types of refractories used for different parts of Non ferrous industries like copper, zinc, lead and titanium industries.

6.3 Name the different types of refractories used for different parts of Non-metal industries like Glass industry, cement Industry, pottery and refractory industry, coke ovens, boilers and chemical industries.

7.0 HIGH PERFORMANCE REFRACTORIES:

7.1 Know the Introduction and function of the Nuclear reactors.

7.2 Know the fuel, control of chain reaction, moderators and reflectors, coolants.

7.3 List the structural materials, ceramic fuel elements, and dense ceramic fuels containing UO_2, ZrO_2 as fuels.

7.4 Know the Ceramets, dense graphite, control rod materials.

7.5 Know the Ceramics in Space materials used in space satellite.

7.6 Know the Ceramic material aspects of missile and satellite recently

7.7 Know the Ceramic materials used in Rocket nozzle technology.

8.0 ENVIRONMENTAL HEALTH & SAFETY (EHS) PRACTICES FOR THE CERAMIC INDUSTRY

8.1 Know the Shop floor safety practice

8.2 Know the occupational health & Safety

8.3 Know environmental issues

8.4 Know the performance indicators & monitoring

COURSE CONTENT:

1.0 INSULATION REFRACTORIES: / LIGHT WEIGHT INSULATORS.
Definition, List of Insulator materials, Preparation of Cellularity in bricks its advantages, shaping of insulating bricks. Properties and uses, firing of insulating bricks.

2.0 CARBON REFRACTORIES: Raw materials- Types of carbon products- Bonds used for carbon Refractories- body mixing- shaping-drying- firing- Properties and uses of graphite bricks- Body mixing- shaping- drying- firing- properties and uses of carbon Refractories- Raw materials- bonds- Body mixing- shaping- properties and uses of Plumbago bricks

3.0 SPECIAL REFRACTORIES: Importance of special refractoriness- Silicon carbide Refractories-SiAlON-Super Refractories- Super Refractories like Zirconia- Zircon-Thoria- and Beryllia- Fused and Electro cast Refractories- Cermets- High alumina-Cordierite- Mullite- Mag-carbon, Alumina-carbon.

4.0 KILN FURNITURE: Definition, Types of kiln furniture, manufacturing, firing, uses of Crucible, muffle, Saggers, glass pots, Rollers etc.

5.0 REFRACTORY CASTABLES: Monolithic Preparation, Refractory Cements, Mortars its Preparation, Composition and uses. Air setting; Heat setting Cements and Motors etc.

6.0 REFRACTORIES IN METAL AND NON-METAL INDUSTRIES:

Types of refractories used for different parts of Ferrous Industries like Blast furnace- Open-hearth furnace- L.D. Process- Nozzles-Stoppers- Sleeves-Bessemer converter- The different types of refractories used for different parts of Non ferrous industries like copper- zinc- lead and titanium industries-the different types of refractories used for different parts of Non-metal industries like Glass industry- cement Industry- pottery and refractory industry- coke ovens-boilers and chemical industries.

7.0 HIGH PERFORMANCE REFRACTORIES:

Introduction- slow, intermediate and fast reactors- fuel- control of chain reaction- moderators and reflectors- coolants- structural materials-ceramic fuel elements- dense ceramic fuels containing UO_2, ZrO_2 as fuels-Ceramets- dense graphite-control rod materials- ceramics in Space materials used in space satellite- material aspects of missile and satellite recently- materials used in Rocket nozzle technology.

8.0 ENVIRONMENTAL HEALTH &SAFETY(EHS) PRACTICES FOR THE CERAMIC INDUSTRY: Shop floor safety practice – occupational health & safety- Environ mental issues- Performance indicators & monitoring

SPECIAL NOTE: The detailed subject of kilns are taught in a separate paper i.e Fuels and Furnace technology.

REFERENCE BOOKS:

1. F.H.Norton, Refractories, McGraw Hill Book Company, Inc., 1949.
2. J.H. Chester's Steel plant Refractories, Sheffield, the united steel companies ltd, 1957.
3. A.Rashid Chesti, Refractories, Prentics- Hall of India pvt ltd., New Delhi, 1986,
4. M.L.Misra Refractories, Clear Type Press, Allahabad, 1975.
5. Robert E Fisher Advances in Refractories Technology Vol.-IV, The American Ceramic Society, Inc., Ohio, 1988.
6. Coope, B.M. and Dickson, E.M, Raw Materials for the Refractories Industry, An Industrial Minerals consumer Survey, 1981.
7. Akira Nishikawa, Technology of Monolithic Refractories., Plibrico, Japan Co. Ltd., Tokyo, 1984.
8. Shaw, K, Refractories and their uses, App. Science publishers, UK, 1972.

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CEMENT TECHNOLOGY

SUBJECT TITLE : CEMENT TECHNOLOGY

SUBJECT CODE : CER-4311

PERIODS/WEEK : 05

PERIODS/SEMESTER : 75

TIME SCHEDULE

S. No	Major Topics	Periods	Weightage of marks	Short Answer Questions	Essay type Questions
1	Introduction of Cement	03	03	01	½
2	Chemistry of Portland Cement	04	03	01	½
3	Raw materials for Manufacturing of Cement	10	13	01	01
4	Preparation of Raw Materials for Cement	10	13	01	01
5	Preparation of Cement Clinker and Grinding	20	29	03	02
6	Manufacturing of Ordinary Portland and Blended Cements	18	26	02	02
7	Quality Control	10	16	01	01
TOTAL		**75**	**110**	**10**	**08**

OBJECTIVES:*On completion of the course, the student should be able to know the following:*

1.0 INTRODUCTION TO CEMENT:

1.1 Define the term Cement
1.2 Know the type of Cement
1.3 Know the general applications of cement
1.4 Understand the importance of Modern cement plant layout
1.5 Know the location and site selection of Cement plant

2.0 CHEMISTRY OF PORTLAND CEMENT:

2.1 Chemical constituents of Cement
2.2 Know the preparation of clinkers
2.3 Know the raw meal and chemical composition of clinker
2.4 Understand the Constituents for setting and hardening of Cement

3.0 RAW MATERIALS FOR MANUFACTURING OF CEMENT:

3.1 Know the types of materials used for manufacturing of Cement
3.2 Know the Classification of Lime based materials
3.3 Know the impurities present in Raw materials

3.4 Know the effect of Raw materials present in Raw mix
3.5 Understand the calculation of Raw mix
3.6 Know the Selection of raw materials for Cement like Wet, dry and semi-dry process
3.7 Know the effect of fluxes in Cement
3.8 Know the importance of Coal, oil or natural gas for making of cement
3.9 Know the importance of Gypsum

4.0 PREPARATION OF RAW MATERIAL FOR CEMENT:

4.1 Know the preliminary Crushing equipment
4.2 Know the storage of Raw materials
4.3 Know the grinding of raw materials by wet and dry process
4.4 know the Storage of ground material
4.5 Know the grinding of coal
4.6 Know the weighing and mixing of Raw materials

5.0 PREPARATION OF CEMENT CLINKERS AND GRINDING:

5.1 Know the preparation of clinker
5.2 Know the mechanism of burning
5.3 Study the fuels used for burning
5.4 Know the kilns used for burning
5.5 Know the refractories used in Rotary kiln and shaft kiln
5.6 Understand the heat efficiency of the kiln
5.7 List of instruments necessary for correct operation of kiln
5.8 Understand the finish grinding of clinker

6.0 MANUFACTURING OF ORDINARY PORTLAND AND BLENDED CEMENTS

6.1 Know the Ordinary Portland cement
6.2 Know the manufacturing of Portland cement by Wet and dry process
6.3 Understand the flow chart of manufacturing of OPC
6.4 Know the physical and chemical properties of OPC
6.5 Understand the different grades of Cements and its applications
6.6 Know the meaning of Blended cement
6.7 Understand the different types of blended cements
(i) Portland Blast funace slag cement (PBFSC)
(ii) Portland Pozzolana cement (PPC)
(iii) Massanory cement (MC)
(iv)Super sulphite cement (SSC)
(v) Rapid hardening cement (RHC)
6.8 Properties and uses of blended cements
6.9 Know process, properties and uses of special cements

7.0 QUALITY CONTROL:

7.1 Know the determination of fineness of cement
7.2 Know the normal consistency of Cement
7.3 Know the initial setting and final setting time of cement
7.4 Know the cold crushing strength of cement
7.5 Know the soundness of cement
7.6 Know the autoclave test for cement

COURSE CONTENT:

1. **INTRODUCTION TO CEMENT:** Definition-Types of Cements-Application Importance, location, site selection and Cement Plant Layout.

2. **CHEMISTRY OF PORTLAND CEMENT:** Chemical Constituents-Preparation of Clinker-Chemical Composition and Setting & Hardening of Cement.

3. **RAW MATERIALS FOR MANUFACTURING OF CEMENT:**Types of materials-its Classification-Impurities in Raw Materials-its effect inRaw Materials-Calculation Raw Mix-selection of Raw Materials-Effect of fluxes in cement-importance of Coal, Oil, Natural Gas- Importance of Gypsum.

4. **PREPARATION OF RAW MATERILS FOR CEMENT:** Preliminary crushing equipments-storage of Raw Materials-Grinding of Raw Materials by Wet & Dry Process-storage of Ground Materials-Grinding of Coal-Batch Weighing and mixing

5. **PREPARATION OF CEMENT CLINKERS AND GRINDING:** Preparation of Clinker-Mechanism of Burning-Fuels Used in Burning-Using of Kilns to Burning Operation- Refractories of Rotary and Shaft Kiln

6. **MANUFACTURUNG OF ORDINARY PORTLAND AND BLENDED CEMENTS:** OPC manufacturing and its methods- flow chats-physical and chemical properties of OPC-different grades and its applications-meant by blended cement-different types of bended cements-properties and uses of cements-processes and properties special cements.

7. **QUALITY CONTROL:**Determination –Fineness-Normal Consistency -Initial and final Setting of Cement-Compressive Strength-Soundness-Autoclave tests for Cement.

REFERENCE BOOKS:

1. H.N. Banerjee, Technology of Portland cement & Blended cements, Wheeler Publishing, Allahabad, 1992
2. Duda, Cement Data book, vol. 1 to 3, Berling, Bauverlag, 1988
3. K Peray, The Rotary Cement kiln, 2nd edition, Chemical publishing co., Inc., London, 1986.
4. Robert S. Boynton, Chemistry and Technology of limestone, John Wiley and sons, Inc., New York, 1980
5. Edwin C. Eckel C.E., Cements, Limes and Plasters, John Wiley and sons, Inc., New York, 1922
6. S.Kumar, Source Book of Ceramics Vol.1 and 2, Dipankar Kumar, kolkata,2003.
7. Textbook of Cement and Concrete- Lee
8. A.M Neville,' Properties of Concrete', Longman,1986

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LIFE SKILLS

SUBJECT : LIFE SKILLS

SUBJECT CODE : CER-4211

PERIODS/ WEEK : 03

PERIODS/ SEMESTER : 45

TIME SCHEDULE

Sl No.	UNITS	No. of periods Allotted		
		Explanation	Activities	Total
1.	ATTITUDE	1	3	4
2.	ADAPTABILITY	1	3	4
3.	GOAL SETTING	1	3	4
4.	MOTIVATION	1	3	4
5.	TIME MANAGEMENT	1	3	4
6.	CRITICAL THINKING	2	3	5
7.	CREATIVITY	1	3	4
8.	PROBLEM SOLVING	1	3	4
9.	TEAM WORK	1	3	4
10.	LEADERSHIP	1	3	4
11.	STRESS MANAGEMENT	1	3	4
TOTAL		12	33	45

Note: No Written Examination; The total 45 hours are to be considered as Theory hours.

Marks: Internal – 40; External – 60

OBJECTIVES:

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

1.0 Understand the concept of Attitude

1.1 Define 'Attitude'
1.2 Explain the importance of Attitude
1.3 Distinguish between Positive and Negative Attitudes
1.4 Life Response: Need for change of Attitude
1.5 Positive Attitude: Key to success in Personal and Professional Lives

2.0 Understand the concept of Adaptability

2.1 Define the term 'Adaptability'
2.2 Explain the concept of Adaptability

2.3 Advantages of Adaptability
2.4 Disadvantages of Lack of Adaptability
2.5 Need for positive response to change

3.0 Understand the concept of Goal setting

3.1 Define the terms 'Goal' and 'Goal Setting'
3.2 Explain the significance of Goal setting &Long and Short term goals
3.3 Explain the following concepts
a) Wish b) Dream c) Goal
3.4 Explain the reasons for and consequences of not setting goals
3.5 The SMART features in Goal setting

4.0 Understand the concept of Motivation

4.1 Define 'Motivation' ; Inspiration Vs Motivation
4.2 Importance of motivation in Goal setting
4.3 Distinguish between Internal (Self) Motivation and External Motivation
4.4 De-motivating Factors and how to overcome them
4.5 Motivating oneself and others

5.0 Understand Time Management skills

5.1 Define 'Time Management'.
5.2 Comprehend the significance of Time Management.
5.3 Explain the Time Quadrant
5.4 Common Time wasters and how to overcome them.
5.5 How to meet deadlines and targets within time

6.0 Understand Critical Thinking

6.1 Define"Critical Thinking",
6.2 Understand the importance of Critical Thinking
6.3 Distinguish between facts and opinions (assumptions)
6.4 Inculcating different perspectives
6.5 Developing Reasoning abilities and form sound judgments

7.0 Understand Creativity

7.1 Understand the importance of and need for creative ideas
7.2 Distinguish between Linear Thinking and Lateral Thinking
7.3 Distinctive qualities of creative people
7.4 Unusual or creative use of familiar objects
7.5 Creative ways of solving problems

8.0 Understand Problem Solving

8.1. Define the concept of Problem solving
8.2 Viewing the problems as challenges
8.3 Different steps in solving a problem
8.4 Selecting the best solution to solve a problem
8.5 Lateral thinking in Problem solving

9.0 Understand Team Work

9.1 Define Team work
9.2 Develop Team skills
9.3 Advantages of team work
9.4 Understand responsibilities as a team player
9.5 Problems of working in a team and possible solutions

10.0 Understand Leadership

10.1 Define Leadership
10.2 Identify Leadership qualities
10.3 Analyze one's strengths and limitations as a leader
10.4 Types of Leadership: Autocratic and Democratic
10.5 Leadership by example

11.0 Understand Stress Management

11.1 Define Stress
11.2 Explain the causes of stress
11.3 Learn Stress Management skills
11.4 Need for positive thinking and self esteem
11.5 Practice Stress Management strategies

CEMENT TECHNOLOGY LAB

SUBJECT TITLE	**:**	**CEMENT TECHNOLOGYLAB**
SUBJECT CODE	**:**	**CER-4312**
PERIODS / WEEK	**:**	**04**
PERIODS / SEMESTER	**:**	**60**

List of Experiments:

1. Determinationof Fineness of Cement by dry sieving
2. Determination of Specific gravity of cement
3. Determination the normal consistency of the cement paste.
4. Determination of initial setting time and final setting time of given mix
5. Determination of setting time of given plaster of paris
6. Determination of soundness of cement by Autoclave test method
7. Determination of soundness of cement by Le- chatleir apparatus
8. Determination of compressive strength of cement
9. Determination of tensile strength of cement
10. Determination of compressive strength of fly ash brick
11. Non-destructive test of cement by rebound hammer.
12. Determination of compressive strength of cement concrete brick

S.NO	OBJECTIVE	COMPATANCY	KEY COMPATANCY
1	Determination of the Finess of the cement by ASTM 325 Sieve.	• Open the cement bag and check the finess by ASTM 325 Sieve	• reactivity of cement and sand along with grinding effect
2	Determination of Specific gravity of cement by Pycnometer method	• Take the fixed quantity of cement pour it into pycnometer • Take the reading of W_2, W_2, W_3, W_4, respectively. • Calculate the specific gravity.	• Studied the particle packing density of cement.
3	Determination of Normal Consistency of the Cement.	• Investigation of normal consistency with the help of vicat apparatus • For cement paste required amount of water Investigating is called Consistency used plunger neddle.	• Cement during three stages forming reactions also determined.
4	Determination ofInitial Setting Time and Final Setting time of the Cement.	• Determined the Initial Setting time of Cement by square neddle • Cement hardening time is investigated called as Final setting Time neddle with annular collar	• Cement during three stages forming reactions also determined.
5	Determination ofSetting Time of plaster of paris	• Determined the setting time of plaster of paris	• Plaster of paris during three stages forming reactions also determined.
6	Soundness of the Cement by Autoclave apparatus	• Cement cubes are placed in autoclave test • Expansion is noted down	• Check the cement will give expansion or not. • To control the crack propagation
7	Soundness of the Cement by Lechtliers apparatus	• Cement paste is filled Lechatlier apparatus. • after 24 hour boiled 1 hour and then measured between two needle gap • expansion of cement measured	• Check the cement will give expansion or not. • To control the crack propagation

8	Determination of Compressive strength of cement	• To determine the strength of the cement cube. • For that cement paste is filled in the mould by 75x75x75mm Cube with the proportion of 1:3: 0.4 of cement, sand and water. • Cube will soaked by 3 days, 7 days and 21 days respectively. • To check the Compressive strength on Hydraulic press of 20 ton of 3 varieties.	• Strength and reactions are studied.
9	Determination Tensile strength of cement	• To determine the tensile strength of the cement cube. • Cube/brick will soaked by 3 days, 7 days and 21 days respectively. • To check the tensile strength.	• Strength and reactions are studied.
10	Determination of Compressive strength of flyash bricks	• To determine the strength of the cement cube. • For that cement paste is filled in the mould by 75x75x75mm Cube with the proportion of 1:3: 0.4 of cement, sand and water. • Cube will soaked by 3 days, 7 days and 21 days respectively. • To check the Compressive strength on Hydraulic press of 20 ton of 3 varieties.	• Strength and reactions are studied.
11	Non-destructive testing of cement by rebound hammer	• Prepare cement brick • Find the strength by rebound hammer	• Know the principle of non-destructive testing
12	Determination of compressive strength of cement concrete brick	• Prepare cement concrete brick • Determine compressive strength	• Know the strength related to composition

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GLASS ENGINEERING - II LAB

SUBJECT TITLE : GLASS ENGINEERING – II LAB

SUBJECT CODE : CER - 4313

PERIODS/ WEEK : 05

PERIODS / SEMESTER : 75

List Experiments:

1. Produce a design on given glass sheet by etching by Hydrofluoric acid.
2. Crystal acid etching on Sheet glass.
3. Decoration of glass by White acid etching and glass painting
4. Prepare a Mirror by silvering process.
5. Produce a design/name on given Mirror by sand blasting process.
6. Preparation of Ethylene Di Amine Tetra Acetic Acid Di solution Salt (EDTA) 0.01 M.
7. Methods of decomposition
    a. Preparation of representative sample
    b. Basic decomposition: with Na_2CO_3 and fusion mixture(Na_2CO_3-K_2CO_3 in 1:2 ratio) Na_2CO_3+$Na_2B_4O_7$- for Kyanite, Silimanite etc..
    c. Acid decomposition: Fusion of residue with alkali fluxes or potassium bisulphate.
8. Preparation of Reagents such as:
    i). Triethanolamaine 500 ml of 50%,
    ii). Potassium Hydroxide 500 ml of 50 %,
    iii). Ammonium Acetate 500 ml of 10%,
    iv). Hydroxyl Ammonium chloride 500 ml of 10 %,
    v). Ammonium Buffer solution 500 ml of 50 %.
9. Preparation of Indicators:
    i). Patron and Readers reagent (P&R),
    ii). Erichrome Black-T/ Solo Chrome Black-T,
    iii). Propanol 2 / Isopropyl Alcohol,
    iv). Salicylic Acid,
    v). Copper PAN.
10. Determination of the Percentage of SiO_2, CaO, MgO, Fe_2O_3 and Al_2O_3 from the given Glass /Feldspar by Volumetric method.
11. Determination of the Percentage of CaO, MgO, Fe_2O_3, Al_2O_3 and SiO_2, from the give Dolomite/Calcite by Volumetric method.
12. Determination of Percentage of Na_2O,K_2O from the given Glass/Feldspar by Spectrophotometer
13. Estimation of SiO_2 in Quartz by Hydroflurosization.
14. Determination of SiO_2, Al_2O_3 Fe_2O_3, TiO_2 &MgOin Aluminosilicates minerals.

S.NO	OBJECT	COMPETENCY	KEYCOMPETENCY
1.	Produce a design on given glass sheet by etching by hydro fluoric acid.	• Use plain glass sheet and coated with hydro fluoric acid • Draw the design with the help of sharp edge needle • Apply HF Acid and 30 minute to soaked (due time corroded the glass) • Wash with hot water • Have a look beautiful design on the glass surface.	• Wax coated on glass surface should be uniform •
2	Produce Crystal acid etching on sheet glass	• Take plain glass mirror and designed draw by coral software • Sticker is pasted and apply the black Japan dry for 30 minutes • Remove the designed cut area • Tray with crystal acid dip into glass mirror and soaked 30 minute • Wash with water and remove sticker • Have a look of crystal acid effect.	• Crystal acid highly concentration than the HF Acid.
3	Decoration of glass by white acid etching and glass painting	• Mirror surface pasted the sticker and stencil cutting is done. • Take the proportionate 1:6 ration mixed the white acid & water. • Tray with white acid glass dip into acid • After 60 minutes soaking remove the sticker and washed mirror • Have a look of smooth milky white design • Painting of colors on surface of glass	• Mirror surface edges apply the boundary with wax to reduce the acid consumption
4	Prepare a mirror by silvering process	• Take the silver nitrate and sodium hydroxide dissolved with water • Material heating in container during heating silver dissolved rate slow • Sugar and ammonia add further reaction continued • Cotton cloth dip into silver solution and apply plain glass • Thin layer applied if any area having over coating clean with HCl.	• Material are in the state of hot condition produces the toxic gasses • Caution should be proper way.
5	Produce a design/name on given mirror by sand blasting process.	• Mirror surface pasted the stencil sticker • Sand is grade by 20# passed and 16# retained • Compressor gun having sand and forcedly impact on mirror surface. • Washed with water and having brilliant designed •	• Fine dust is comes out during the sieving for that mask is must • In the time of Sand blasting goggles protect the eyes.

6	Preparation of 0.01M EDTA solution	• Estimation of EDTA powder required for preparing 0.01M EDTA solution • Weigh the sample and mix with water	• Know the volumetric analysis • Titration against EDTA
7	Decomposition of materials	• Prepare representative sample • Decompose with either basics or acids	• Know the reaction between acids and basics • Know the Composition of precipitations
8	Preparation of Reagents for chemical analysis	• Weigh the reagents according to the concentration required • Mix with water homogenously	• Know the importance of reagents for volumetric analysis • Observe the nature of reagents
9	Preparation of Indicators	• Weigh the indicator according to the concentration required • Mix with water or acetone homogenously	• Know the importance of indicators for volumetric analysis • Color change of indicator will indicate the rate of reaction
10	Determination of the Percentage of SiO_2, CaO, MgO, Fe_2O_3 and Al_2O_3 from the given Glass /Feldspar by Volumetric method	• Grind the glass powder to pass through 325 mech • Weigh 1gm of glass powder and mix with fusion mixture • Melt it and dissolve in Hcl solution • Evaporating the solution • Add water and HCL • Filtering through Wattman filter paper No. 42 • Retained material on filter is used for determination of SiO2 • The solution which is passed through filter paper is used for determination of CaO, MgO, Fe2O3 and Al2O3	• Know the importance of Volumetric analysis for determination of oxides in glass • Know the reaction between solution and EDTA

11	Determination of the Percentage of CaO, MgO, Fe_2O_3, Al_2O_3 and SiO_2, from the give Dolomite/Calcite by Volumetric method	• Grind the Dolomite or calcite to pass through 325 mech • Weigh 1gm of glass powder and mix with fusion mixture • Melt it and dissolve in Hcl solution • Evaporating the solution • Add water and HCL • Filtering through Wattman filter paper No. 42 • Retained material on filter is used for determination of SiO2 • The solution which is passed through filter paper is used for determination of CaO, MgO, Fe_2O_3 and Al_2O_3	• Know the importance of Volumetric analysis for determination of oxides in glass • Know the reaction between solution and EDTA
12	Determination of Percentage of Na_2O,K_2O from the given Glass/Feldspar by Spectrophotometer	• Grind the Dolomite or calcite to pass through 325 mech • Weigh 1gm of glass powder and mix with fusion mixture • Melt it and dissolve in Hcl solution • Evaporating the solution • Add water and HCL • Filtering through Wattman filter paper No. 42 • Retained material on filter is used for determination of SiO_2 • The solution which is passed through filter paper is used for determination of CaO, MgO, Fe_2O_3 and Al_2O_3 by using spectrophotometer	• Know the working principle of spectrophotometer
13	Estimation of SiO_2 in Quartz by Hydroflurosization	• Grind the quartz to fine powder • Mix the quartz powder with Fusion mixture • Melting the above mixture • After cooling add HF • Weigh and calculate	• Know the reactions between SiO2 and HF
14	Determination of SiO_2, Al_2O_3 Fe_2O_3, TiO_2 &MgOin Aluminosilicates minerals	• Grind the Aluminosilicate minerals to pass through 325 mesh • Weigh 1gm of glass powder and mix with fusion mixture • Melt it and dissolve in Hcl solution • Evaporating the solution • Add water and HCL • Filtering through Wattman filter paper No. 42 • Retained material on filter is used for determination of SiO_2 • The solution which is passed through filter paper is used for determination of CaO, MgO, Fe_2O_3 and Al_2O_3	• Know the importance of Volumetric analysis for determination of oxides in glass • Know the reaction between solution and EDTA

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WHITEWARE & HEAVY CLAY WARE-II LAB

SUBJECT	**:**	**WHITEWARE & HEAVY CLAYWARE-II LAB**
SUBJECTCODE	**:**	**CER-4314**
PERIODS/ WEEK	**:**	**05**
PERIODS /SEMESTER	**:**	**75**

List of Experiments:

1. Preparation of Earthen ware / Stone ware slips and making of articles by slip casting
2. Prepare the body for making tiles and estimate Moisture content
3. By using granules prepare Floor/ Wall tiles by pressing
4. Prepare and apply the engobe and glaze on dried ceramic tile by spraying and fired at suitable temperature
5. Cast the Earthen ware articles and apply glaze and fired at suitable temperature
6. Making of roofing tiles with terracotta/ earthen ware body and apply low temperature glaze
7. Preparation of Lead Glaze.
8. Preparation of Lead Less Glazes
9. Preparation of Fritted Glaze.
10. Application of the above Glazes on the Articles by:
    i). Dipping Method,
    ii). Pouring Method,
    iii). Spraying Method. And fired at suitable temperature
11. Determination the Crazing Resistance of the Glazed ware by Autoclave Method.
12. Determination the Thermal shock Resistance of the Ceramic Articles.
13. Determination the Abrasion Resistance of the Floor and Wall Tiles.
14. Determination the Modulus of Rupture to the green, dry and fired Tile.

S.NO	OBJECTIVE	COMPETENCY	KEY COMPETENCY
1.	Preparation of Earthenware/Stoneware Slips and making of articles by slip casting.	-Prepare the slip with Earthenware/Stoneware body -Pore the slip into the suitable plaster mold -Sufficient formation of thickness draw the excess slip -Gently remove the fabricate of shape from the mold by sufficient drying	-Know the properties of the raw materials used for making earthenware/stoneware -Know the castability of the slip
2.	Prepare the body for making tiles and estimate moisture content.	-Select the body for making tiles -Process the body in suitable process -Fabricate the tile by different techniques.	-Know the selection of body which will give the finished properties. -Know the moisture content of the body before fabrication techniques.
3.	Preparing floor/wall tile by pressing By using granules.	-Take the granules -Fabricate the tile in suitable press.	-Know the granulometry to the granules. -Know the effect of granulometry for the making of tile. -Know the pressing pressures.
4.	Prepare and apply the engobe and Glaze on dried ceramic tile by spraying and fired of suitable temperature.	-Take the dried tile. -Then apply the engobe and Glaze upon it by spraying process. -Fire the tile in suitable kiln at suitable temperature.	-Find out the M/C of the dried tile. -know spaying process. -Know the Kilns used for Firing. -Know the physical and chemical changes occurring while firing process.
5.	Casting of the Earthenware articles and apply glaze and fired at suitable temperatures.	-The Earthenware slip is used to cast in the suitable plaster mold. -After removal of the shape from the mold, the blaze is applied upon the article by suitable application technique. -The glazed articles are fired in the suitable kiln at suitable temperature.	-Know the properties of the casting slip. -Know the glaze application techniques. -Know the firing process.
6.	Making of roofing tiles with Terracotta/Earthenware body and apply low temperature glaze.	-Take the raw materials as per the terracotta/earthenware body composition. -After body preparation the material is convert into suitable shape by pressing. -Perform the drying. -Apply the low temperature glaze upon the roofing tile in suitable application technique	-Compare the raw material properties used in earthenware/terracotta. -Know the drying of the roofing tiles. -Know the Application of the roofing tiles.
7.	Preparation of lead glaze.	-Set the lead glaze composition depending upon the maturing temperature. -Perform the weighing , mixing & grinding. -Convert it into suitable form for application on the ware.	-Know about toxic ingredients in the glaze composition. -Know the properties of lead components. -Know the application of lead glazes.

8.	Preparation of lead less glazes.	-Select the lead less glaze composition. -Convert into suitable form for application.	-Know the difference between lead and lead less glazes and its importance.
9.	Preparation of fritted glazes preparation.	-Select the fritted glaze composition. -Convert it into suitable form for application.	-Know the classification of glazes. -Know the process of making frits and purpose.
10.	Application of above glazes on the article by 1.Dipping 2.Pouring 3.Spraying and fired at suitable temperature.	-Take the dried articles which have been for glaze application. -Then do the necessity finishing. -Apply the glaze upon the articles by necessary glaze application technique i.e., dipping ,pouring, spraying etc.,	-Check the thickness of the glaze/ pickup weight.
11.	Determination of crazing resistance of glazed ware by auto clave method.	-Take the test specimens and put into the auto clave machine. -Apply the specified pressure i.e., 50lb/m^2 for a period of 1 hour. -Then check the failure by observing crack formation upon it. -Calculate the mean value.	-Know how many cycles the specimens are withstanding.
12.	Determination of thermal shock resistance of the ceramic articles(i.e., tiles).	-Take the specimen. -Put the specimen in water at room temperature. -Then transferred into the hot water at the temperature of 100^0C -Then Transfer into the water at room temperature. -Note the specimen how many cycles withstand without crack formation.	-Find out how many cycles are withstand by the specimen.
13.	Determination of Abrasion resistance of the floor and wall tile.	-Take the Specimen and take the weight accurately. -Cut the specimen into 7.06cmX 7.06cm -Press the tile in face wise under specific load on a grinding path. -Apply the Abrasive powder on the rotating dise. -The tile is subjected to number of rotations. -The wear of tile is measured in the thickness gauge.	-Know the Abrasion resistance of the different type of tiles.
14.	Determination of the Modulus of rapture of the green, dry and fire tile.	-Take the green/dry/fired tile. -Put into the MOR testing machine -Apply the load upon the tile. -Note the breaking load. -Calculate the corresponding MOR.	-Find out the values of green, dry and fired MOR

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DIPLOMA IN

CERAMIC TECHNOLOGY

(3 ½ YEAR SANDWICH)

UNDER MPEC

FIFTH SEMESTER

CURRICULUM – 2016

(C-16)

INDUSTRIAL TRAINING (I SPELL)

STATE BOARD OF
TECHNICAL EDUCATION & TRAINING
ANDHRA PRADESH
HYDERABAD

DIPLOMA IN CERAMIC TECHNOLOGY

A Sandwich Course

UNDER MPEC SYSTEM

SCHEME OF INSTRUCTION AND EXAMINATION

FIFTH SEMESTER

SUBJECT CODE: 5315

SUBJECT NAME: INDUSTRIAL TRAINING

DURATION : 6 MONTHS

Marks Awarded by the Industry	Seminar Marks	Log Book/ Dairy Marks	Project Record Marks	Total Marks	No. of Credits
200	**40**	**20**	**40**	**300**	**25**

DIPLOMA IN

CERAMIC TECHNOLOGY

(3 ½ YEAR SANDWICH)

SIXTH SEMESTER

CURRICULUM – 2016

(C-16)

INDUSTRIAL TRAINING (IISPELL)

STATE BOARD OF
TECHNICAL EDUCATION & TRAINING
ANDHRA PRADESH
HYDERABAD

DIPLOMA IN CERAMIC TECHNOLOGY

A Sandwich Course

UNDER MPEC SYSTEM

SCHEME OF INSTRUCTION AND EXAMINATION

SIXTH SEMESTER

SUBJECT CODE: 6316

SUBJECT NAME: INDUSTRIAL TRAINING

DURATION: 6 MONTHS

Marks Awarded by the Industry	Seminar Marks	Log Book/ Dairy Marks	Project Record Marks	Total **Marks**	No. of Credits
200	**40**	**20**	**40**	**300**	**25**

DIPLOMA IN

CERAMIC TECHNOLOGY

(3 ½ YEAR SANDWICH)

UNDER MPEC

SEVENTH SEMESTER

CURRICULUM – 2016
(C-16)

STATE BOARD OF
TECHNICAL EDUCATION & TRAINING
ANDHRA PRADESH
HYDERABAD

STATE BOARD OF TECHNICAL EDUCATION & TRAINING

ANDHRA PRADESH
DIPLOMA IN CERAMIC TECHNOLAGY
3 ½ YEAR SANDWICH COURSE
(MPEC SYSTEM)

SEVENTH SEMESTER

Subject Code	Name of the Subject	Instruction Periods/Week		Total Periods/ Semester	Scheme of Examination				
		Theory	Practicals		Duration (Hrs)	Sessional Marks	End Exam Marks	Total Marks	Credits
	THEORY SUBJECTS								
CER-7212	Industrial Management &Smart Technologies	5	--	75	3	20	80	100	5
CER-7213	C Language	5	--	75	3	20	80	100	5
CER-7214	Ceramic Science	5	--	75	3	20	80	100	5
CER-7401	Advanced Ceramics	5	--	75	3	20	80	100	5
CER-7402	Special Glasses & Enamels	5	--	75	3	20	80	100	5
	PRACTICAL SUBJECTS								
CER-7215	C Language Lab	--	6	90	3	40	60	100	3
CER-7216	Computer Applications practice in Ceramic Industry	--	6	90	3	40	60	100	3
CER-7403	Ceramic Coatings Lab	--	5	75	3	40	60	100	2.5
	TOTAL	**25**	**17**	**630**	**-**	**220**	**580**	**800**	**33.5**

Note:1. Subject CER-7212 is same as M-501 of Diploma in Mechanical Engineering.
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Industrial Management & Smart Technologies

Subject Title : Industrial Management & Smart Technologies
Subject Code : CER-7212
Periods/Week : 5
Period/Semester : 75

TIME SCHEDULE

S. No.	Major Topics	Periods	Weightage Of Marks	Short Answer Questions	Essay Type Questions
1.	Basics of Industrial Management	06	13	1	1
2.	Organisation structure & Organisational behaviour	10	18	1	$1^{1/2}$
3.	Production Management	10	18	1	$1^{1/2}$
4.	Materials Management	08	13	1	1
5	Maintenance management & Industrial Safety	08	13	1	1
6	Entrepreneurship Development	08	13	1	1
7	Total Quality Management	05	06	2	
8	Smart technologies	20	16	2	1
	Total	**75**	**110**	**10**	**08**

1. Basics of Industrial Management

On completion of the course the student will be able to

1.0 Understand the principles of management as applied to industry.

1.1 Define industry, commerce (Trade) and business.
1.2 Know the need for management.
1.3 Understand the evolution of management
1.4 Understand functions of Management.
1.5 Explain the principles of scientific management.
1.6 Explain the principles of management.
1.7 Differentiate between management and administration.
1.8 Understand the nature of management as a profession
1.9 Differentiate between supervisory, middle and Top level management
1.10 Explain the importance of managerial skills (Technical, Human, Conceptual)

2. Organisation Structure & organisational behaviour

Know types of ownerships, the organisation structure of an industry and the behaviour of an individual in an organisation.

2.1 Understand the philosophy and need of organisation structure of an industry.
2.2 Understand the line, staff and Functional organisations
2.3 Understand the Authority and Responsibility Relationships
2.4 Understand the differences between Delegation and decentralization
2.5 Explain the factors of effective organisation.
2.6 Outline the communication process
2.7 State motivation theories.
2.8 State Maslow's Hierarchy of needs.
2.9 List out different leadership models.
2.10 Explain the trait theory of leadership.
2.11 Explain behavioural theory of Leadership.
2.12 Explain the process of decision making.
2.13 Assessing Human resource requirements

2.14 Know the concept of Job analysis, Job description and specifications
2.15 Understand the process of recruitment, selection, training and development
2.16 Understand types of business ownerships
2.17 Differentiate between the business ownerships
2.18 Know the objectives of Employee participation
2.19 Understand the meaning and definition social responsibilities
2.20 Corporate social responsibility

3. Production management

Understand the different aspects of production management.

3.1 Identify the factors of Plant Location
3.2 Know the objectives of plant Layout
3.3 Understand the principles of plant Layouts
3.4 Explain the types of plant Layouts
3.5 Relate the production department with other departments.
3.6 State the need for planning and it's advantages.
3.7 Explain the stages of Production, planning and control.
3.8 Know the basic methods demand forecasting
3.9 Explain routing methods.
3.10 Explain scheduling methods.
3.11 Explain dispatching.
3.12 Explain Break Even Analysis
3.13 Define supply chain Management, competitive strategy, Supply chain strategy
3.14 Draw PERT/CPM networks.
3.15 Identify the critical path

4. Materials Management

*Understand the role of materials management industries***.**

4.1 Explain the importance of materials management in Industry.
4.2 Know Functions of Materials Management
4.3 Derive expression for inventory control.
4.4 Explain ABC analysis.
4.5 Define safety stock.
4.6 Define reorder level.
4.7 Derive an expression for economic ordering quantity.
4.8 Know the functions of Stores Management,
4.9 Explain types of store layouts.
4.10 List out stores records.
4.11 Explain the Bin card.
4.12 Describe Cardex method.
4.13 Explain general purchasing procedures
4.14 Explain tendering, E-tendering and E-procurement procedures
4.15 List out purchase records.
4.16 Know the applications of RFID (Radio Frequency Identification Device)
4.17 Understand the applications of RFID in material management

5. Maintenance Management & Industrial Safety

Comprehend the Importance of Maintenance Management & Safety procedures
5.1 Explain the importance of maintenance management in Industry.
5.2 Know the Objectives of maintenance management
5.3 Know the activities of maintenance management

5.4 Understand the importance of Preventive maintenance
5.5 Understand the need for scheduled maintenance
5.6 Differentiate between scheduled and preventive maintenance
5.7 Know the principles of 5 s for good house keeping
5.8 Explain the importance of safety at Work place.
5.9 List out the important provisions related to safety.
5.10 Explain hazard and accident.
5.11 List out different hazards in the Industry.
5.12 Explain the causes of accidents.
5.13 Explain the direct and indirect cost of accidents.
5.14 Understand the types of emission from process Industries, their effects on environment and control
5.15 Understand the principles of solid waste management

6. Entrepreneurship Development.

Understand the role of entrepreneur in economic development and in improving the quality of life.

6.1 Define the word entrepreneur.
6.2 Explain the requirements of an entrepreneur.
6.3 Determine the role of entrepreneurs in promoting Small Scale Industries.
6.4 Describe the details of self-employment schemes.
6.5 Characteristic of successful entrepreneurs
6.6 Explain the method of site selection.
6.7 List the financial assistance programmes.
6.8 List out the organisations that help an entrepreneur
6.9 Know the use of EDP Programmes
6.10 Understand the concept of make in India, Zero defect and zero effect
6.11 Understand the importance for startups
6.12 Explain the conduct of demand surveys
6.13 Explain the conduct of a market survey
6.14 Evaluate Economic and Technical factors.
6.15 Prepare feasibility report study

7. Total Quality Management:

Understand the concepts adopted in total quality management

7.1 Explain the concept of quality.
7.2 List the quality systems and elements of quality systems.
7.3 State the principles of quality Assurance.
7.4 Understand the basic concepts of TQM
7.5 Know the Pillars of TQM
7.6 List the evolution of ISO standards.
7.7 Explain ISO standards and ISO 9000 series of quality systems.
7.8 List the beneficiaries of ISO 9000.
7.9 Explain the concepts of ISO 14000
7.10 Know the overview of PDCA cycle

8. Smart Technologies

8.1 Get an overview of IoT

8.1.1 Define the term IoT
8.1.2 Know how IoT work
8.1.3 List the key features of IoT
8.1.4 List the components of IoT : hardware, software, technology and protocols
8.1.5 List the advantages and disadvantages of IoT

8.2 IoT Applications
- 8.2.1 Smart Cities
- 8.2.2 Smart Energy and the Smart Grid
- 8.2.3 Smart Transportation and Mobility
- 8.2.4 Smart Home, Smart Buildings and Infrastructure
- 8.2.5 Smart Factory and Smart Manufacturing
- 8.2.6 Smart Health
- 8.2.7 Food and Water Tracking and Security
- 8.2.8 Social Networks and IoT

Course Content

1. Basics of Industrial Management

Introduction: Industry, Commerce and Business; Definition of management; Characteristics of management; Functions of management - Planning, Organizing, Staffing, Directing, Co-ordination, Controlling, Motivating, Communication, Decision Making; Principles of scientific management: – F.W.Taylor, Principles of Management: Henry Fayol; Administration and management; Nature of management; levels of management; managerial skills;

2. Organisation Structure & organisational behaviour

Organizing - Process of Organizing; Line/Staff and functional Organizations, Decentralization and Delegation, Effective Organizing; Communication, Motivational Theories; Leadership Models; Human resources development; Forms of Business ownerships: Types – Sole proprietorship, Partnership, Joint Stock Companies, Cooperative types of Organizations; Employee participation in management; Corporate Social responsibility;

3. Production management

Definition and importance; Plant location and layout; Types of production -job, batch and mass; production Planning and Control: Demand forecasting, routing, scheduling, dispatching and follow up; Break even analysis; Supply chain Management (Definition, Competitive strategy Vs Supply chain Strategy, Supply chain drivers); Project scheduling; Application of CPM and PERT techniques; simple numerical problems;

4. Materials Management

Materials in industry, Basic inventory control model, ABC Analysis, Safety stock, re-order level, Economic ordering quantity, Stores Management: Stores layout, stores equipment, Stores records, purchasing procedures, e-tendering, e-procurement; purchase records, Bin card, Cardex RFID (Radio Frequency Identification Device)application in materials management;

5. Maintenance Management & Industrial Safety

Objectives and importance of plant maintenance, Different types of maintenance, Nature of maintenance problems, Range of maintenance activities, Schedules of preventive maintenance, Advantages of preventive maintenance, 5 S principles; Importance of Safety at work places; Causes of accidents-psychological, physiological and other industrial hazards; Domino sequence; methods of promoting safe practices; Pollution control in process industries; Introductory concepts on Solid waste management (General introduction including definitions of solid waste including municipal, hospital and industrial solid waste, Waste reduction at source – municipal and industrial wastes)

6. Entrepreneurship Development.

Definition of Entrepreneur; Role of Entrepreneur; Concept of Make In India, ZERO defect, Zero Effect, Concept of Start-up Company, Entrepreneurial Development: Role of SSI, MSME, DICs, Entrepreneurial development schemes; Institutional support, financial assistance programmes; Market survey and Demand survey; Preparation of Feasibility study reports

7. Total Quality Management:

Total Quality Management (TQM)- Concept of quality discussed by B. Crosby W. Edward,

Deming, Joseph M. Juran, Kooru Ishikawa, Genichi Taguchi, Shigco Shingo. Quality systems – Definitions of the terms used in quality systems like, quality policy, quality management, quality systems, Stages of development of ISO 9000 series , ISO-14000, Deming's PDCA Cycle (Plan, Do, Check and Action). Japanese Quality Management, culture, Kaizen Strategy (continuous improvement).

8. Smart Technologies :

Overview of IoT - Define IoT, how IoT work, key features of IoT, components of IoT : hardware, software, technology and protocols, advantages and disadvantages of IoT - IoT Applications - Smart Cities, Smart Energy and the Smart Grid, Smart Transportation and Mobility, Smart Home, Smart Buildings and Infrastructure, Smart Factory and Smart Manufacturing, Smart Health, Food and Water Tracking and Security, Participatory Sensing, Social Networks and IoT.

REFERENCE BOOKS

1. Industrial Engineering and Management -by O.P Khanna
2. Production Management- by Buffa.
3. Engineering Economics and Management Science - by Banga & Sharma.
4. Personnel Management by Flippo.
5. Production and Operations Management –S.N. Chary
6. Converging_Technologies_for_Smart_Environments_and_Integrated_Ecosystems_IERC_Book_ Open_Access_2013 pages-54-76
7. Supply Chain Management –Sunil Chopra and Meindl, PHI publishers
8 5 S made easy by David Visco

C LANGUAGE

SUBJECT TITLE : C LANGUAGE

SUBJECT CODE : CER-7213

PERIODS / WEEK : 05

PERIODS / SEMESTER : 75

TIME SCHEDULE

S.No.	Major Topics	Periods	Weightage Of Marks	Short Type	Essay Type
1	C Programming Basics	17	26	2	2
2	Decision & Loop Control Statements	17	29	3	2
3	Arrays & Strings	16	26	2	2
4	Functions, Structures, Unions & Pointers	25	29	3	2
	Total	**75**	**110**	**10**	**08**

OBJECTIVES:*On completion of the course, the student should be able to know the following:*

1.0 Understand C Programming Basics .

1.1 Know about the character set.
1.2 List various types of data and give examples
1.3 Explain different Arithmetic operations.
1.4 Define an expression and show how to evaluate.
1.5 Mention about assignment statements,
1.6 Explain an increment and decrement operators.
1.7 Identify compound Assignment Operators.
1.8 Explain the Nested assignments.
1.9 Explain I/P functions printf and scanf
1.10 Know various type conversion techniques and discuss them.
1.11 List various relational operators with their precedence.
1.12 List various logical operators and explain them with their precedence
1.13 Evaluate a logical expression.

2.0 Understand Decision & Loop Control Statements .

2.1 State the importance of conditional expression.
2.2 List various conditional statements and explain .
2.3 Explain Switch statement.
2.4 List the different iterative loops while, do for and explain them.

2.5 Define nesting and implement it.
2.6 Differentiate break and continue statements.
2.7 Mention about null statements and comma operator.

3.0 Understand Arrays & Strings .

3.1 Define an 1 – D & 2 – D Arrays.
3.2 Know how to initialize the above arrays& Access Array elements.
3.3 Pass array elements as arguments and arrays as arguments.
3.4 Define string.
3.5 Understand various string operations.

4.0 Understand functions ,structures, unions and pointers in 'C'

4.1 Define a function.
4.2 State the use of return statement
4.3 Write programs using function call technique.
4.4 Discuss the importance of function proto types in programming
4.5 Differentiate local and external variables.
4.6 Identify automatic and static variables and discuss them in detail
4.7 State the application of external declaration.
4.8 Define Recursion and Explain with examples.
4.9 Define a structure
4.10 Describe about structure variable.
4.11 Explain about structure initialization.
4.12 Access structure members.
4.13 Illustrate concept of structure assignment
4.14 Explain how to find size of a structure.
4.15 Discuss nested structure concept.
4.16 Summarize concept of pointer to structure.
4.17 Illustrate concept of structures containing pointers.
4.18 Define a Union and Illustrate use of a union.
4.19 Differentiate address and de referencing operators.
4.20 Declare a pointer, assign a pointer, and initialize a pointer.
4.21 Discus pointer arithmetic.
4.22 Illustrate with example how pointer can be used to realize the effect of parameter passing by reference.
4.23 Illustrate with examples the relationship between arrays and pointers.
4.24 Discuss pointer arrays with example.
4.25 Describe concept of pointers to functions.

COURSE CONTENTS:

1. C-Programming Basics

Structure of a C programme, Programming rules, Character Set, Delimiters Keywords, Constants, Variables, Data types, Type conversion.

Arithmetic, Logical, Relational operators and precedences – Assignment, Increment, Decrement operators, evaluation of=89 expressions. Console IO formatted and unformatted functions.

2. Decision and Loop control Statements

If, If-else, Nested If else, Break, Continue, Go to and Switch statements
Loops:- For, While, Do-while, Nesting of Loops

3. Arrays and Strings

1 D Array declaration, Initialization, 2 D Array declaration, Initialization, Accessing of Array elements, Character Arrays declaration and Initialization of Strings, Display of strings with format.

4. Functions, Structures, Unions and pointers

Definition, Declaration, Function Prototypes, Return statements, Function types Function calls, Nesting of functions and Recursion Storage classes of variables, Scope and visibility Structure features, Declaration and Initialization, Structure within a structure, Array of structure, Accessing of Structure members, Structures and functions, Unions.Pointer declaration, Arithmetic operations and pointers, Pointers and Arrays, Array of pointers, Pointers to pointers, Pointer to structures, Pointers and functions.

REFERENCE BOOKS:

1. Programming in ANSI C,TMH, III Edition - Balaguru Swamy. E TMH
2. Programming In C by Samarjit Ghosh-PHI
3. Programming with ANSI and Turbo C by Kamthane, pearson Education
4. Programming In C by Gottfried (Scham Series).
5. Information Technology and Programming in C – by M.V.S.S.N. Prasad – Published by Radiant Publishing House, Hyderabad.

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CERAMIC SCIENCE

SUBJECT TITLE : CERAMIC SCIENCE

SUBJECT CODE : CER - 7214

PERIODS / WEEK : 05

PERIODS/ SEMESTER : 75

TIME SCHEDULE

S. No	Major Topics	Periods	Weightage of marks	Short Answer Questions	Essay type Questions
1	Atomic Structure	05	01	1	0
2	Chemical Bonding	05	01	1	0
3	Crystal structures	10	13	1	1
4	Structure of solids	08	13	1	1
5	Crystal imperfections	10	13	1	1
6	Diffusion in solids	08	13	1	1
7	Phase rule and phase diagrams	10	16	2	1
8	Phase transformations	07	13	1	1
9	Colloidal state	05	13	1	1
10	Thermodynamics	07	10	0	1
TOTAL		**75**	**110**	**10**	**08**

OBJECTIVES:

On completion of the course, the student should be able to know the following:

1.0 ATOMIC STRUCTURE

1.1 Know the Periodic table
1.2 Know the Hund's rule
1.3 Know the Ionization Potential
1.4 Know the Electron affinity
1.5 Know the Electronegativity

2.0 CHEMICAL BONDING

2.1 Know the Chemical bond and Bond energy
2.2 Define the types of Bonds
2.3 Know the Bond length
2.4 Know the Ionic bond.
2.5 Know the Covalent Bond
2.6 Know the Metallic bond
2.7 Know the Hydrogen bond
2.8 Know the Vander Walls bond.

3.0 CRYSTAL STRUCTURES

3.1 Know the Crystallography
3.2 Define the Space Lattice and Unit cell
3.3 Know the Bravais lattices and its Crystal system.
3.4 Know the Crystal System, Edges of Crystal system, Packing Factor & Density.
3.5 Know the Introduction about the Crystal Direction and Planes /Miller indices
3.6 Know the structure of determination Bragg Law of X- ray diffraction
3.7 Know the Introduction of Structure determination by the Powder Method.

4.0 STRUCTURE OF SOLIDS:

4.1 Know the crystalline state materials
4.2 Know the Non crystalline state materials
4.3 Differentiate the crystalline and non crystalline.
4.4 Know the factors, which promote the formation of non-crystalline state materials
4.5 Know the Structure of SC, FCC and BCC
4.6 Know the Structures of covalent solids/C (Diamond).
4.7 Know the Structure of Metals and Alloys
4.8 Know the Structure of Ionic Solids/NaCl
4.9 Know the Structure of Silica and Silicates.
4.10 Know the Structure of Spinal ($Mg\ Al_2O_4$)
4.11 Define Polymer
4.12 Explain the Crystallinity of Polymer

5.0 CRYSTAL IMPERFECTIONS:

5.1 Know the imperfections
5.2 List the types of crystalline imperfections
5.3 Know the different kinds of point imperfections
5.4 Know the vacancy, substitutional and interstitial imperfection
5.5 Know the Frenkel imperfection and Schotty imperfection
5.6 Know the Geometry of dislocations
5.7 Know the Edge dislocation and screw dislocation
5.8 Know the Burger Vector and Burger Circuit
5.9 Know the Grain boundaries and stacking faults

6.0 DIFFUSION IN SOLIDS:

6.1 Define Diffusion
6.2 Know the Fick's laws of diffusion

6.3 Know the Kirkendal effect
6.4 Know the Atomic model of diffusion
6.5 Know the Vacancy diffusion
6.6 Know the Interstitial diffusion
6.7 Know the Interstitialcy diffusion
6.8 Know the Ring mechanism

7.0 PHASE RULE AND PHASE DIAGRAMS:

7.1 Know the Phase Rule or Gibbs Phase rule.
7.2 Define the term Phase .
7.3 Draw Pressure-Temperature Diagram
7.4 Know the One Component System
7.5 Know the Polymorphic Transformation
7.6 Draw the Binary Phase Diagrams
7.7 Discuss Micro structural changes in binary phase
7.8 Know the Tie line rule
7.9 Know the Lever Rule
7.10 Draw Binary Diagram of Al_2O_3 and SiO_2.
7.11 Draw Binary diagram of SiO_2& Na_2O

8.0 PHASE TRANSFORMATIONS:

8.1 Know the phase transformation
8.2 Know the Nucleation
8.3 Know the Nucleation Kinetics
8.4 Know the growth process
8.5 Know the growth kinetics
8.6 Know about Precipitation,solidification and crystallization
8.7 Know the Glass transition.
8.8 Know the Recovery, Recrystallization and Grain growth

9.0 COLLOIDAL STATE:

9.1 Define colloids and colloidal states
9.2 Know the types of colloidal systems and their properties.
9.3 Know the Preparative methods of colloids
9.4 Differentiate the Lyophobicsols and Lyophillicsols.
9.5 Write the terms coagulation, Precipitation, Flocculation and Deflocculation.
9.6 Define Hardy and Schultz law with examples.
9.7 Know the term “Gold number”.
9.8 Know the Preparation and Properties of Gels and Emulsions.

10.0 THERMO DYNAMICS:

10.1 Define the term Thermo Dynamics.
10.2 Know the laws of Thermo dynamics.
10.3 Know the Heat of reactions.
10.4 Define Hess’s law of constant heat summation.
10.5 Define adiabatic process and Isothermal process.
10.6 Derive the expression C_p-C_v = R for an ideal gas.
10.7 State and explain the Joule Thompson effect.

10.8 Know the heat of formation.
10.9 Know the heat of combustion.
10.10 Know the heat of dilution.
10.11 Know the Gibb's Free energy and Helmholtz free energy

COURSE CONTENTS:

1.0 ATOMIC STRUCTURE: Periodic Table- Hund's rule- Inozation Potential- Electron affinity- Electronnegativity

2.0 CHEMICAL BONDING: Chemical bonding and Bond energy- Types of Bonds- Bond length- Ionic Bonding – Covalent Bonding- Metallic Bonding – Hydrogen bond- Van der Waals bonds

3.0 CRYSTAL STRUCTURES: Crystallography- Definition of Space Lattice- Definition of the Unit cell- Bravais lattices and its Crystal system-Crystal Faces, Edges of Crystal system, Packing Factor & Density-Introduction of Crystal Direction and Planes /Miller indices--Structure determination by the Bragg Law of X- ray diffraction-Introduction of Structure determination by the Powder Method.

4.0 STRUCTURE OF SOLIDS: Crystalline sate materials- Non crystalline state materials-non-crystalline state materials simple structure SC, FCC, BCC-covalent solids/C (Diamond- Metals and Alloys-structure of Ionic Solids/NaCl- structure of Silica and Silicates- structure of Spinel (Mg Al_2O_4)-Polymer , Crystallinity of Polymers.

5.0 CRYSTAL IMPERFECTIONS: To understand Imperfections Types of crystalline imperfections- Point imperfection/Zero dimensional imperfection-different kinds of point imperfections -vacancy, substitutional and interstitial imperfection-Frenkel imperfection and Schottky imperfection- Line imperfection/Geometry of dislocations-Edge dislocation and screw dislocation-Burger Vector and Burger Circuit, grain boundaries and stacking faults.

6.0 DIFFUSION IN SOLIDS: Definition of Diffusion-Fick's laws of diffusion- Kirkendal effect-Atomic model of diffusion-Vacancy diffusion- interstitial diffusion-Interstitialcy diffusion - Ring mechanism.

7.0 PHASE RULE AND PHASE DIAGRAMS: Phase Rule/Gibbs Phase rule-Phase, Number of Components, and Degrees of Freedom-independent variables- One Component System-Polymorphic Transformation-Pressure-Temperature Diagram-Binary Phase Diagrams- micro structural changes in binary phase-Tie line rule- Lever Rule-Binary Diagram of Al_2O_3 - SiO_2- binary diagram of SiO_2 -Na_2O .

8.0 PHASE TRANSFORMATIONS: Introduction of phase transformation Nucleation-Nucleation Kinetics-growth process- growth kinetics-precipitation solidification and crystallization- Glass transition- recovery-recrystallization and grain growth

9.0 COLLOIDAL STATE: Types of colloidal systems and their properties-know the preparative methods of colloids-Lyophobicsols and Lyophillicsols-coagulation, Precipitation, Flocculation and Deflocculation-Hardy and Schultz law with examples-

"Gold number- Preparation and Properties of Gels and Emulsions.

10.0 THERMO DYNAMICS: Thermodynamics-laws of Thermo dynamics. Heat of reactions- Hess's law of constant heat summation-adiabatic process and Isothermal – process-C_p-C_v = R for an ideal gas-Joule Thompson effect- heat of formation- heat of combustion-heat of dilution- Gibb's Free energy and Helmholtz free energy.

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1. V. Raghavan, Material science and engineering, Prentice-Hall of India pvt ltd., New Delhi, 2000.
2. W.D.kingary, H.K.Bowen and D R Uhlmann, Introduction to Ceramics, John wiley and son's, 1965.
3. L.H.Vanvlack, Physical ceramics for engineers, Addison Wesley, Massachusetts, 1964.
4. L.H.Vanvlack, Materials Science for engineers, Addison Wesley, Massachusetts, 1985.
5. B.S.Bahl & G.D.Thtuli, Essentials of physical chemistry, 22nd edition, S.Chand and Co. ltd, New Delhi, 1986.

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ADVANCED CERAMICS

SUBJECT TITLE : ADVANCED CERAMICS

SUBJECT CODE : CER - 7401

PERIODS/WEEK : 05

PERIODS/SEMESTER : 75

TIME SCHEDULE

S. No	Major Topics	Periods	Weightage of marks	Short Answer Questions	Essay type Questions
1	Introduction To Advanced Ceramics	04	03	01	--
2	Structural Ceramics	15	26	02	02
3	Electrical Behavior Of Ceramic Materials	13	26	02	02
4	Dielectric Behavior Of Ceramic Materials	12	16	02	01
5	Magnetic And Optical Behavior Of Ceramics	12	13	01	01
6	Bioceramics	09	13	01	01
7	Ceramic Composites	10	13	01	01
TOTAL		**75**	**110**	**10**	**08**

OBJECTIVES:

On completion of the course, the student should be able to know the following:

1.0 INTRODUCTION TO ADVANCED CERAMICS:

1.1 Define the term Advanced Ceramics
1.2 Difference between Advanced Ceramics and Traditional ceramics
1.3 Know the Importance of Technical ceramics
1.4 List the properties and uses of Technical Ceramics.

2.0 STRUCTURAL CERAMICS:

2.1 Know the different types of New Ceramics according to their Function.
2.2 Know the advanced powder preparation techniques
2.3 Know the Major Compaction Techniques used for Ceramic Fabrication.

2.4 Draw the flow sheet for fabrication by pressing method.
2.5 Know the process of Uniaxial, Isostatic, Hot pressing, Hot Isostatic pressing of ceramic products, Tape casting/Doctor blade, Injection molding.
2.6 Know the Properties of Structural Ceramics.
2.7 Know the Mechanical properties of Structural Ceramics such as Elastic properties/Modulus of elasticity, Brittle Fracture, Fracture Toughness, Toughening Mechanism, Strength of ceramics, Hardness,
2.8 Know the Creep and its measurements.
2.9 Know the Fatigue of Ceramics.
2.10 Know the Thermal properties of New Ceramics such as Thermal stress, Thermal shock, Thermal Conductivity and Thermal expansion.

2.11 OXIDES CERAMICS

2.11.1 List of Ceramic/Refractory Oxides having Melting Point above 1500^0 C.
2.11.2 Know the Alumina Ceramics - its Mineralogical properties and Applications.
2.11.3 Know the types of Alumina used in Alumina ceramics manufacture.
2.11.4 Know the Electrical and Electronics applications of Alumina Ceramics.
2.11.5 Know the Chemical applications of Alumina Ceramics.
2.11.6 Know the Mechanical applications of Alumina ceramics.
2.11.7 Know the Properties and application of Zirconia Ceramics including Stabilized Zirconia.
2.11.8 List the Raw material for Automotive Components like ceramic engines etc...
2.11.9 Know the production process of Alumina for ceramic engines.
2.11.10 Know the Role of Zirconia in automotive industry
2.11.11 Know the Advantages of advanced ceramics for car engines.
2.11.12 Know the Classification of Advance ceramic material for automobile engines.
2.11.13 Know beryllia and Magnesia ceramics

2.12 NON-OXIDES CERAMICS

2.12.1 List of important non-oxide ceramics materials.
2.12.2 Know the manufacturing, applications and properties of Silicon Carbide.
2.12.3 Know the manufacturing, applications and properties of Silicon Nitride.
2.12.4 Know the Si C Engine components.
2.12.5 Know the Si_3N_4 based ceramics as engine parts.
2.12.6 Know the Comparisons of silicon carbide and Silicon Nitride for application in car engine.
2.12.7 Know the Potential advance ceramic application in Internal combustion engines.
2.12.8 Know the manufacturing, applications and properties of SIALON.
2.12.9 Know the manufacturing, applications and properties of Boron Nitride.
2.12.10 Know the Cermets and their types and applications.
2.12.11 Know the Comparison of the above industrial ceramics in respect of physical and mechanical properties.

3.0 ELECTRICAL BEHAVIOR OF CERAMIC MATERILS

3.1 Know the Understand the Electrical properties of Ceramic materials.

3.2 Know the Fundamentals and Definitions of Electricity.
3.3 Know the Electronic Conductivity.
3.4 Know the Ionic Conductivity.
3.5 Know the Mechanisms of Ionic Conductivity.
3.6 Know the different applications of Ironically conductive Ceramics.
3.7 Know the energy bands in a insulator.
3.8 Know the Applications of as an Electrical Insulators.
3.9 Define the term Semiconductor.
3.10 Know the Mechanisms of Semiconductor.
3.11 Know the Applications of Ceramic Semiconductors.
3.12 Definition of Superconductivity.
3.13 Know the Messiner effect of Superconductivity.
3.14 Know the Characteristics of Superductor.
3.15 Know the Applications of Superconductors.

4.0 DIELECTRIC BEHAVIOUR OF CERAMIC MATERIALS:

4.1 Know the Dielectric properties of Ceramic Materials.
4.2 Know the Polarization.
4.3 Know themechanisms of polarization.
4.4 Know the Dielectric Constant.
4.5 Know the Dielectric Strength.
4.6 Know the Dielectrics Loss.
4.7 Know the Capacitance.
4.8 Know the functions of a Capacitor.
4.9 Know the History of capacitors.
4.10 Know the Mechanism of High Dielectric Constant.
4.11 List the types of Capacitors.
4.12 Definition of Electrocermics.
4.13 Definitions of Electrocermics such as Piezoelectric, Pyroelectricity and Ferroelectric.
4.14 Know the Piezoelectricity.
4.15 Know thePyroelectricity.
4.16 Know thee Ferro electricity.
4.17 List the types of Ferroelectric Crystals.
4.18 Know the Applications of Ferro electricity and Piezoelectricity.

5.0 MAGNETIC AND OPTICAL BEHAVIOR OF CERAMICS:

5.1 Know the Magnetic behavior of Materials.
5.2 Know the Source of Magnetism
5.3 Know the Terminology of magnetic ceramics.
5.4 Know the Applications of Magnetic Ceramics
5.5 Know the classification of Ferrites.
5.6 Know the process of Manufacture of Ferrites and its specific applications.
5.7 Know the optical behavior of materials.
5.8 Know the Lasers and their application in communication systems.

6.0 BIOCERAMICS:

6.1 Define the term Bioceramics.
6.2 Know the Biomaterials and their fields of applications.

6.3 Know the Ceramic Bones.
6.4 Know the Relevance of Bioceramics.
6.5 Know the Ceramic devices and Industrials.
6.6 Know the ceramic coatings, ceramic composites, Bioglass.
6.7 Know the Carbon and its composites

7.0 CERAMIC COMPOSITES:

8.1 Define the term Composites.
8.2 Classification of Composites.
8.3 Know the different Fibers as composite material such as Glass fibers, Carbon fiber,
8.4 Know the Silicon Carbide Fiber and Alumina Fiber.
8.5 Know the Comparison of Fiber properties.
8.6 List the Ceramic Matrices uses as high temperature composites.
8.7 List the properties of Ceramic Matrix materials.
8.8 Know the Glass-Ceramics as composite material.
8.9 Know the Carbon-Carbon as composite material.
8.10 Know the Nanocomposites.
8.11 Know the Joining of Ceramics.
8.12 Know the Sealing Glasses.
8.13 Know the Ceramic Adhesives.
8.14 Know the applications of composites.

COURSE CONTENT:

1.0 INTRODUDCTION: Definition of Technical/Advanced Ceramic Materials- Economic importance of Technical Ceramics/Advanced Ceramics- Important uses and Applications of Technical ceramics- industry of Ceramic Segments with common examples- properties of Technical Ceramics- General characteristics of Ceramics- Future of Advanced ceramics.

2.0 STRUCTURAL CERAMICS:

Types of New Ceramics according to their function- Characteristics of High temperature Ceramics-Properties of Structural Ceramics- Mechanical properties of Structural Ceramics such as Elastic properties/Modulus of elasticity- Brittle Fracture- Fracture Toughness- Toughening Mechanism- Strength of ceramics- Hardness- Creep and its measurements- Fatigue of Ceramics- Thermal properties of New Ceramics such as Thermal stress-Thermal shock- Thermal Conductivity and Thermal expansion- Major Compaction Techniques used for Ceramic Fabrication- idea of flow sheet for fabrication by pressing- Uniaxial- Isostatic-Hot pressing-Hot Isostatic pressing of ceramic products- Tape casting/Doctor blade- Injection molding- High Temperature Ceramics: OXIDES - list of refractory Oxides having Melting Point above 1500^0 C-Alumina Ceramics - its Mineralogical properties and Applications, Electrical and Electronics applications of Alumina Ceramics- Chemical applications of Alumina Ceramics- Mechanical applications of Alumina ceramics- Properties and application of Zirconia, Alumina, Zirconia as high temperature parts-Magnesia- Berylia Ceramics- High Temperature Ceramics: NON-OXIDES- list of important non-oxide ceramic materials-manufacturing-applications and properties of Silicon Carbide- manufacturing-applications and properties of Silicon Nitride- manufacturing- applications and properties of SIALON-

manufacturing- applications and properties of Boron Nitride-Cermets and their types and applications.

3. **ELECTRICAL BEHAVIOR OF CERAMIC MATERILS:** Electrical properties of Ceramic materials- fundamentals and Definitions of Electricity- Electronic Conductivity- Ionic Conductivity- Mechanisms of Ionic Conductivity- different applications of Ironically conductive Ceramics- energy bands in a insulator- materials and applications of as an Electrical Insulators- Define the term Semiconductor- Mechanisms of Semiconductor- applications of Ceramic Semiconductors- definition of Superconductivity- Messiner effect – type I and Type II superconductors- Characteristics of Superconductor- Applications of Superconductors.

4. **DI-ELECTRIC BEHAVIOUR OF CRAMIC MATERIALS:**Dielectric properties of Ceramic Materials- Polarization- mechanisms of polarization- the Dielectric Constant- Dielectric Strength- Dielectrics Loss- Capacitance- functions of a Capacitor- History of capacitors-Mechanism of High Dielectric Constant- types of Capacitors- definition of Electrocermics- definitions of Electro ceramics such as Piezoelectric- Pyroelectricity and Ferroelectric- Piezoelectricity- Pyroelectricity- Ferro electricity- types of Ferroelectric Crystals- polycrystalline Ferroelectrics- Applications of Ferro electricity and Piezoelectricity.

5. **MAGNETIC AND OPTICAL BEHAVIOR OF CERAMICS:** Magnetic behavior Materials- source of Magnetism- terminology of magnetic ceramics- applications of Magnetic Ceramics- classification of Ferrites, process of Manufacture of Ferrites- Optical behavior of materials- properties such as Absorption and Transparency- Color- Phosphorescence and Index of refraction- Lasers-Electro-Optics/Fiber optics and Integrated Optics.

6. **BIOCERAMICS:** Bioceramics- Biomaterials and their fields of applications- Ceramic Bones- Relevance of Bioceramics- Ceramic devices and Industrials- ceramic coatings- ceramic composites- Bioglass- carbon and its composites.

7. **CERAMIC COMPOSITES**: Definition of Composites, Classification Composites- Fibers as composite material such as Glass fibers- Carbon fiber- Silicon Carbide Fiber and Alumina Fiber- comparison of Fiber properties-
Ceramic Matrices uses as high temperature composites- Ceramic Matrix materials-Glass-Ceramics as composite material-Carbon-Carbon as composite material- Nanocomposites- Joining of Ceramics- Sealing Glasses- Ceramic Adhesives- applications of composites.
Understand Nanomaterial and advantages and future prospects etc.

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1. Waye B.E. - Introduction Technical Ceramics Maclaren and sons Limited, London. 1967.
2. Norton F.H. - Fine Ceramics - Technology and Applications Mc Grow Hills, London, New York.1970
3. D W Richardson, Modern Ceramic Engineering, Marcel Dckker Inc., New York, 1992 (Page no. 204 for 3.0 objective and page no.251 for 4.0 objective and page no.286 for 5.0 objective)
4. S.Kumar, Hand Book of Ceramics Vol.IV, Kumar and Associate, Calcutta,1997
5. Advanced Ceramic Technology vol. I By.Dr.SK Banerjee. (for 6.0 and 7.0 objectives).
6. An introduction to High temperate Composite Materials by B.K. Sarkar (for 8.0 objective).
7. Michel W. Barsoum, Fundamentals of Ceramics, McGraw Hill Companies, Inc., New Delhi, 1997.
8. WD Kingery, H K Bowen and D R Uhlmanna, Introduction to Ceramics, John Wiley and sons, 1965.

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SPECIAL GLASSES & ENAMELS

SUBJECT TITLE : SPECIAL GLASSES & ENAMELS

SUBJECT CODE : CER-7402

PERIODS/WEEK : 5

PERIODS/SEMESTER : 75

TIME SCHEDULE

S. No	Major Topics	Periods	Weightage of marks	Short Answer Questions	Essay type Questions
	SPECIAL GLASSES:				
1	Heat resistant glasses	10	13	01	01
2	Fiber glass	10	13	01	01
3	Glass ceramics	07	13	01	01
4	Optical glasses	07	03	01	--
	ENAMELS				
5	Introduction	02	00	--	--
6	Raw materials	06	03	01	--
7	Pre treatment of metal and non-metal surface	08	13	01	01
8	Enamel-glass compositions	05	13	01	01
9	Frit making	05	03	01	--
10	Application and firings	05	13	01	01
11	Properties and Testing	06	13	01	01
12	Defects	04	10	--	01
TOTAL		**75**	**110**	**10**	**08**

OBJECTIVES:

On completion of the course, the student should be able to know the following:

1.0 HEAT RESISTANT GLASSES.

1.1 Introduction of Heat resistant Glasses.

1.2 Know the Boro-silicate Glasses.

1.3 Know the Chemical composition of Pyrex glasses.
1.4 Know the importance of Pyrex Glass and Jena Glass.
1.5 Know the Chemical composition of Sial glasses.
1.6 Know the importance of sial glass.
1.7 Know the Chemical composition of Vycor glass.
1.8 Know the importance of Vycor glass.
1.9 Know the importance of chemical composition of 96 percent silica glass.
1.10 Know the Chemical composition of Neutral glass.
1.11 Know the importance of Neutral glass.
1.12 Know the importance of Water glass.
1.13 Know the importance of sintered glass.
1.14 List the glasses for Electrical and electronic industries
1.15 Know the lampshells.
1.16 Know the Electrode tubes.
1.17 Know the T.V.Tubes.
1.18 Know the T.V. Shell Glasses.
1.19 Know the glasses used in microwave ovens
1.20 Know Bio-glasses
1.21 Know Gorilla glass

2.0 FIBRE GLASS:

2.1 Know the introduction.
2.2 know the chemical composition of different types fiberglass like S,H,E and C etc.
2.3 Know the manufacturing methods.
2.4 Explain Mechanical drawing operation.
2.5 Explain steam or Air blowing.
2.6 Explain Flame blowing.
2.7 Know the surface coating and finishes.
2.8 Know the preparation wool and matt products.
2.9 Explain various insulating methods of fiberglass.
2.10 Know the applications of Fibre glass-Reinforced plastics.
2.11 Explain the properties of Fiberglass.

3.0 GLASS-CERAMICS:

3.1 Know the introduction.
3.2 Know the Glass-Ceramic process.
3.3 Know the melting and forming.
3.4 Know the Nucleation and crystallization..
3.5 Know the commercial application.
3.6 Know the systems containg SiO_2 -Al_2O_3 - LiO_2. .
3.7 Know the systems of MgO-Al_2O_3-SiO_2
3.8 Know the functions of the Nucleating agents, like Au, Cu, TiO_2, ZrO_2 , Cr_2O_3, P_2O_5.Y_2O_3.

4.0 OPTICAL GLASSES:

4.1 Know the introduction.
4.2 Know the methods of manufacture of Crown, Flint and special compositions.
4.3 Know the optical glasses.
4.4 Know the preparation of Batch materials.

4.5 Know the stirring to obtain Homogeneity of optical glass.
4.6 Know the breaking up and molding the of optical glass.
4.7 Knows the annealing of optical glass.
4.8 Know the opthalmic glass.
4.9 Know the preparation of photosensitive glass.

ENAMELS:

5.0 INTRODUCTION.

5.1 Know the position of Enamel industry in India.
5.2 Draw the layout of Modern Enamel plant.

6.0 RAW MATERIALS.

6.1 Know the Enamels.
6.2 Know the Classification of raw materials used in enamels.
6.3 Know the fundamental consideration of enamels.
6.4 Know the types of metals used for enameling.
6.5 Know the cast Iron for enameling.
6.6 Know the sheet iron for enameling.
6.7 Know the enameling steels.
6.8 Know the cold rolled Rimmed and Killed steels.
6.9 Know the Enameling iron.
6.10 Know the Formation of Shapes of Sheet iron.
6.11 List the Aluminum alloys.

7.0 PRE TREATMENT OF METAL AND NON-METAL SURFACES.

7.1 Know the preparation ofsurface for Cast iron enameling.
7.2 Explain the blasting processes.
7.3 Write about Mechanical blasting processes.
7.4 Know the abrasives like sand, steel grit.
7.5 Explain the methods of cleaning of sheet iron for enameling.
7.6 Explain the theory of chemical cleaning.
7.7 Explain the theory of pickling.
7.8 Explain H_2SO_4 pickling.
7.9 Explain HCl pickling.
7.10 Explain phosphoric Acid pickling.
7.11 Know the Ferric sulphate pickling.
7.12 Know the preparation of metal surface for enamelling.
7.13 Know the equipment required for Pickling operation
7.14 Know about automatic cleaning
7.15 Know the finishing with water following Acid pickling.
7.16 Know the Neutralizing following water rinsing.
7.17 Write about special process like Nickel dips by Galvanic and reduction methods.
7.18 Know the Nicklous Oxide spray process.
7.19 Know the De-enamelling by sand blasting
7.20 Know the controlled test for pickling batches.
7.21 Know the control of neutralizing solutions.
7.22 Know the process of De-enameling by acidic alkaline and fused alkaline methods for cast iron.
7.23 Know the process of De-enameling by acidic alkaline and fused alkaline methods

for sheet iron.

8.0 ENAMEL - GLASS COMPOSITIONS:

8.1 Know the classification of Enamel composition.
8.2 Explain sheet iron ground coats.
8.3 Know the one frit ground coats.
8.4 Know the multiple frit Ground coats.
8.5 Explain white cover enamels for sheet iron.
8.6 Know the fluoride and low antimony white cover coat
8.7 Know the acid resistance antimony fluoride enamels for sheet iron.
8.8 Know the high opaque enamels like antimony, Zirconia, Titania, Phosphate, Molybdenum and Cerium enamels.
8.9 Explain the colored enamels for sheet iron.
8.10 Write the beading enamels for sheet iron.
8.11 Know the Dry, wet process for high lead, leadless, antimony, Titania, Zirconia, and colored enamels for cast iron.
8.12 Know the various types of Aluminium enamels like, lead bearing, and lead free, phosphate and Barium enamels.
8.13 Know the High temperature Ceramic coatings.
8.14 Know the Jewellery and copper enamels.
8.15 Know the various methods of decoration like screen-printing, decalcomania, printing, graining, marbleizing etc.
8.16 Know the study of the properties of Enamel Glasses.
8.17 Know the stress and strain.
8.18 Know the reflections.
8.19 Know the Gloss.
8.20 Know the Color.
8.21 Know the Opacity.

9.0 FRIT MAKING:

9.1 Know the receiving and storage of batch materials.
9.2 Know the smelting of batch materials.
9.3 Know the reactions taking place during smelting.
9.4 Know the smelter atmosphere and rate of Evaluation of CO_2, O_2, during smelting.
9.5 Know the quenching and drying operation.
9.6 Know the types of driers like, stationary, and rotary etc.
9.7 Know the magnetic separation of impurity of iron.
9.8 List the various types of smelters on detailed (i.e.) Crucible, Hearth, Rotary, Continuous furnace and Electric smelters.
8.9 Explain the milling and mill additions.
8.10 Explain the milling equipment.
8.11 Explain the milling operation and control.
8.12 Write the classification of mill additions like suspending agent, opacifiers, colors and electrolytes.

10.0 APPLICATION AND FIRINGS.

10.1 Know the control of enamel slips.
10.2 Know the suspending agents.
10.3 Know the methods of application like dipping, Slushing, spraying.

10.4 Know the spraying booth.
10.5 Know the enamel drying after application.
10.6 Know the enamel dries.
10.7 Know the stenciling and brushing.
10.8 Know the firing schedule.
10.9 Know the Gas evaluation.
10.10 Know the adherence.

10.11 Know the theory of adherence.
10.12 Know the wet process cast iron enamels.
10.13 Know the dry process cast iron enamels.
10.14 Know the effect of furnace atmosphere.
10.15 Know the behavior of enamel during firing.
10.16 Know the Box type, Intermittent and Modern muffle, continuous furnaces, Electrical muffle furnaces.
10.17 Know the Heat transfer and distribution methods of heat transfer and criteria of selection of design and materials for construction.

11.0 PROPERTIES AND TESTING :

11.1 List the thermal properties of Enamels.
11.2 Discuss the fusibility and fluidity.
11.3 Discuss the thermal expansion and contraction.
11.4 Discuss the Mechanical properties like adherence and fatigue strength.
11.5 Write the optical properties like reflections and color.
11.6 Discuss the chemical properties like acid resistance, alkali resistance, effect of soil, and resistance to water, condensates, gases and weathering.
11.7 Determination of PH value of a Pickle solution.
11.8 Determination of adherence of enamel on sheet iron
11.9 Determination of acid and alkali test
11.10 Determination of hot water test
11.11 Determination of bending test
11.12 Know the falling weight and impact test for enamel.

12.0 DEFECTS:

12.1 Know the Blistering.
12.2 Know the chipping.
12.3 Know the copper Heading.
12.4 Know the crazing.
12.5 Know the Fish Scaling.
12.6 Know the Eggshell.
12.7 Know the Hair lining.
12.8 Know the Jumping.
12.9 Know the Reboilling.
12.10 Know the Rusting.
12.11 Know the Specking.
12.12 Know the Tearing.
12.13 Know the Warping.
12.14 Know the wavy surface.
12.15 Know the peeling.

12.16 Know the pinholes.
12.17 Know the Casting cracks.
12.18 Know the pop off.

COURSE CONTENT:

1.0 HEAT RESISTANT GLASSES: Chemical composition and importance of Borosilicate glass- Pyrex-Jena glass- Sail glass- Vycor Glass- neutral glass- sintered glass- Silica Glass and 96% Silica glass, photosensitive glass. Glass for Electrical and Electronic Industries- Lampshells-electron tubes- T.V.tube- T.V. Shells- Glasses used in microwave oven- Bioglass- Gorilla glass.

2.0 FIBRE GLASS: Glass compositions: A.E.S. and special fiber glass composition- Manufacturing method of fiber glass- mechanical drawing operation- steam or air blowing- flame blowing- surface coating and finishing- preparation of wool and mat products-Various insulating methods of fiberglass- applications of fiber glass- reinforced plastics and properties of fiberglass.

3.0 GLASS CERAMICS: Introduction- Glass ceramic process- melting and forming- nucleation and nucleating agents- crystallization- commercial application of glass ceramics- systems containing SiO_2- Al_2O_3- Li_2O and MgO- Al_2O_3-SiO_2.

4.0 OPTICAL GLASSES: Introduction-methods of manufacture ofCrown- flint and special compositions- Optical glass- preparation of batch materials- stirring and homogeneity of glasses- studding the breaking up and molding of glasses- annealing-. Ophthalmic glass- Photo chromic glass.

II ENAMELS:

5.0 INTRODUCTION: Position of the Industry of Enamels in India- General Layout of Modern plants.

6.0 RAW MATERIALS: Enamels- classification of raw materials- fundamentals consideration of enamels-types of metals- Cast-iron- sheet iron- enameling Iron- rimmed and killed- special steels-selections- forming and design of sheet iron parts- Aluminium- Alloys- Design of shapes- Aluminized steel- Jewellery metals- High temperature alloys for ceramic coating.

7.0 PRE TREATMENT OF METAL AND NON-METAL SURFACES: Preparation of the surface of Cast Iron-blasting- abrasives- sand- steel grit- Cleaning methods for sheet iron- Theories and processes of Chemical Cleaning- pickling with acids- Equipment for continuous and Automatic cleaning- Sand blasting- Special processes – Neutralizing- Nickel Dip by Galvanic and Reduction methods- De-Enameling-Noble metals preparation-preparation of Aluminium Alloys.

8.0 ENAMEL GLASS COMPOSITION: Classification of composition: sheet Iron - ground coat- one frit and multiple frit ground coats-white cover enamels- fluoride and low Antimony- acid resistant- high opacity-Zirconia-Titania- phosphate- molybdenum

and cerium enamels-Colored enamels-beading enamels- Cost Iron - dry and wet process high lead- lead less- Antimony- Titania-Zirconia and colored Enamels- of Aluminium enamels like lead bearing- lead free- phosphate-Barium enamels-High temperature coatings-Jewellery and copper enamels- various methods of decoration-properties of enamels glasses-stress and strain- reflections- gloss- color-opacity etc.

9.0 FRIT MAKING: Receiving and storage of batch materials- Smelting- Quenching and Drying: Types of driers- stationary and rotary- magnetic separation of iron impurities. Smelting furnaces- Crucible-Health- rotary and continuous furnace- electric smelting. Milling and Mill additions- Mill rooms equipment- Milling operation and controls- mill additions- suspending agents-opacifiers-colors-electrolytes.

10.0 APPLICATIONS AND FIRING: Control of slips: Suspending agents- Application Methods and equipment: Dipping-Slushing- spraying- electrostatic spraying- spray booth-Drying- enamel dryers- stenciling and brushing- Firing operations: Firing schedule- gas evolution- adherence-wet process cast iron enamels-dry process cast iron enamels- properties of enamels during firing- Enameling Furnaces: Box type-Intermittent and modern muffle continuous furnaces-electrical muffle furnaces-Heat transfer and distribution methods of heat transfer-Selection of design and materials for construction.

11.0 PROPERTIES AND TESTING: Thermal Properties: Fusibility and fluidity- thermal expansion and contraction-Mechanical properties: Adherence- Fatigue strength- Optical properties: reflectance and color-Chemical properties: Acid resistance-Alkali resistance-effect on soil-resistance to water condensates gases and weathering- PH value-Adherence test – acid & alkali test- bending test.

12.0 DEFECTS, THEIR CAUSES AND REMEIDES: Blistering-Chipping-copper heading-crazing-eggshell-fishscale-Healing-Jumpingoff-reboilling-rusting-specking-tearing-warping- wavy surface- pealing-pinholes- casting crack- pop off etc.

REFERECE BOOKS:

1. Tooley Fay.V., Hand book of Glass manufacture Vol. I and II, Ogden publishing company, New York.,1960
2. Lewis M H, Glasses and Glass-Ceramics, Chappeman and Hall, London, 1989.
3. Andrew. I, Andrews Enamels, The Garrard Press publisher, Champaign Illinois, U.S.A., 1949.
4. R Charan Hand Book of Glass Technology,
5. Chappeman and Hall, Schott Guide to Glass, 2nd edition, Chappeman and Hall, London, 1996.
6. Samuel R Scholes, Moderns Glass Practice, industrial publications, Inc., Chicago, 1952
7. A Paul, Chemistry of Glasses, 2nd Edition, Chappeman and Hall, New York, 1990.
8. M Cable and J M Pasrker, High Performance Glasses, Blackie, London, 1992

9. E B Shand, Glass Engineering Hand Book,3rd Edition, McGraw Hill book company, New York, 1958.
10. K L Loewenstein, The manufacturing Technology of companies Glass Fibers, Elsevier Scientific publishing co., England, 1973.

C LANGUAGE LAB

SUBJECT TITLE	**:**	**C LANGUAGE LAB**
SUBJECT CODE	**:**	**CER-7215**
PERIODS / WEEK	**:**	**06**
PERIODS / SEMESTER	**:**	**90**

COURSE CONTENTS:

1. Exercise to demonstrate C programmed structure, use of printf and scanf Functions
2. Exercise on If, If—else, Nested If else
3. Exercise on Switch and Break Statement
4. Exercise on 1 D Arrays using loops
5. Exercise on functions to demonstrate prototyping parameter passing, function Returning values
6. Exercise on structures
7. Exercise to demonstrate to use of pointers, Pointers as function arguments, functions Returning pointers, pointers and structures.

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COMPUTER APPLICATION PRACTICE IN CERAMIC INDUSTRY

SUBJECT TITLE	**:**	**COMPUTER APPLICATION PRACTICE IN CERAMIC INDUSTRY**
SUBJECT CODE	**:**	**CER – 7216**
PERIODS/ WEEK	**:**	**6**
PERIODS / SEMESTER	**:**	**90**

List of Experiments:

1. CAD
   - 1.1 To study the basics of Auto CAD
   - 1.2 To draw 2D ceramic drawing of Block diagram, plant lay out, machine and line
   - 1.3 To draw simple 3D ceramic
     - Products- i. Porcelain insulator
     - ii. Refractory products
   - 1.4 To create realistic ceramic products
2. Furnace design by computer
3. Simple programming to calculate physical parameter density, porosity, CCS, MOR
4. Programming to converting chemical analysis to rational analysis and vice versa
5. Programming to calculate a batch
6. Calculate on batch white ware glazed and Refractories
7. Web page designing
   - 7.1 HTML
   - 7.2 Page designing containing images
   - 7.3 Form
   - 7.4 Frame
   - 7.5 Flow chart for preparation of Insulators, Refractories.

CERAMIC COATINGS LAB

SUBJECT TITLE **:CERAMIC COATINGS LAB**

SUBJECT CODE **:CER - 7403**

PERIODS/ WEEK **:05**

PERIODS / SEMESTER **:75**

SCOPE: Enamels and Glazes, their manufacture, application techniques are similar, only the Enamels are applied on metals and glazes are applied on clay ware articles. Here, their manufacture, applications are practiced.

ENAMELS:

1. Cutting, Filing, Punching and Finishing of Sheet Metal
2. Annealing and Scaling of Sheet Metal.
3. Chemical treatment of Sheet Iron.
4. Pickling with Sulphuric Acid and Pickling with Hydrochloric Acid.
5. Nickel Dips, Neutralizing and Water rinsing of Pickled Sheet Iron.
6. Frit making (Ground, white and cover coat) and sign Blue cover coat.
7. Milling of frit and Application of Enamel (including stencil preparation and brushing operation)
8. Firing of enamelware.
9. Decoration on enamelware.

GLAZES:

1. Preparation of various glaze batches suitable for Porcelain hard & soft, Earthenware Fine & medium, Stoneware, Terracotta bodies and produce articles
2. Application of glazes on the finished ware by spraying/ dipping/painting/pouring methods on the ware
3. Preparation of various Frit batches suitable for Porcelain, earthen ware..Etc
4. Preparation of various ceramic stains used for Inglaze and onglaze decorations
5. Liquid gold decoration & Luster decorations on glazed wares like cups & saucers
6. Application of transfer pictures on white and colored glazed wall and floor tiles
7. Firing of above glazed articles

Enamels:

S.NO	OBJECTIVE	COMPETENCY	KEYCOMPETENCY
1	Cutting, Filing, punching and Finishing Of Sheet Metal	• Enamel prepare sheet forming 2 methods • Cutting hand shearing or gearing cut the squire pieces • Filing is used for squire shape edges smoothening. • Punching is used for holding the sign boards at four corner • After punching some area having roughness that should be finished by grinder.	• Process of enamel techniques. • Handling of iron sheet and various metal sheets • Handling of machinery for sizing
2	annealing and scaling of sheet metal	• Annealing is heating operation to remove traced strain in metal. • Redness heat condition volatile the impure content. • Presence of acid or sulphur content removes the secondary annealing of scaling method.	• Existing of strain remove from the metal. • Untraced acids eliminate with the help of heating method.
3	Chemical treatment of sheet metal.	• Washing operation of residual oil and dirt from metal surface. • Alkali act as saponifiaction the soluble oils and soap aiding, dirt	• Verities of cleaner • Soap solution and detergent
4	Pickling with sulphuric acid pickling with hydrochloric acid	• Take 6% of H_2SO_4heated 150^0F immersed and soaked 10-20minutes of metal sheet. • HCl ionized into H^+ and Cl^- reaction of iron to form as • $FeCl_2$ and H_2 gas	• Ionization concentration of acid, by-products and influence of temperature.
5	Nickel dips, neutralizing and water rinsing of pickled sheet iron	• Double salt coated on metal surface $NiSO_4(NH_4)SO_4.6H_2O$ • Traced acid neutralizing by alkali neutralizer, cyanide neutralizer.	• Last trace acid in pore spaces extracted & improves the adherence of ground coat.
6	Frit making (ground, white and cover coat) and sign blue cover coat.	• Frit making steps to selection of raw material, mixing, grinding, slip, melting, pouring, quenching (frit). • Bond between metal and top coat of enamel named as ground coat • Opacifiers (give brilliant whiteness) used white coating	• In the name of known raw materials of ground, cover and over coat
7	Milling of frit and application of enamel (including stencil	• Material having grit particle to powder state made it and check the	• Cutting of pre-design for the coating of

	preparation and brushing operation)	parameters use as enamels. • Paper stencil or zinc sheet stencil are made(pre-cutting of design) • After first coating pre-designed paste and apply the second coating method of brushing or poring technique.	multilayer's.
8	Firing of enamel ware	• Selection of furnace shouldn't spoil the quality of ware. • Specified temperature should reach within the due time • Circulation heat throughout the furnace • Once upon the time muffle furnace is use now a day's electrical furnace are used for reduce the defects.	• Distinguish between the coal , oil and electrical firing schedule
9	Decoration on enamel ware	• Various types of decal techniques decal, printing, screen printing, glazes • Varnish transfer by rubber stamping design upon color powder sprinkle techniques call as decal • Machine having screen and color paste apply upon screen design enamel surface	• Differentiate the various painting techniques.

GLAZES:

S.NO	OBJECTIVE	COMPETENCY	KEYCOMPETENCY
1	Preparation of various glaze batches suitable for porcelain hard & soft, earthen ware, fine & medium, stone ware, terracotta bodies and produce articles	• Select the suitable glaze composition which was applied on the suitable body • Perform necessary grinding • Apply the glaze upon the body with suitable application technique • Fire the glaze articles in the suitable kiln	• Know the different glaze composition which was suitable for different bodies
2	Application of glazes on the finished ware by spraying/dipping/painting/pouring methods on the ware	• Take the suitable glaze for application upon the finished ware • Select the type of application according to the type of ware being glazed • The suitable methods of application are spraying, dipping, painting, pouring etc.,	• Find out the technological parameters to the glaze for application
3	Preparation of various frit batches suitable for porcelain, earthen ware etc.,	• Select the suitable frit batch composition for the preparation of the frit. • Which was melt in the suitable melter/smelter • Drain into the water • After passing on the sieve the residue should dry and pack	• Know the type of components used for making frit. • Type of mill additions is adding.

4	Preparation of various stains used for in-glaze and on-glaze decoration	• Take the composition of the ceramic stains and colorants for use in in-glaze and on-glaze decoration. • Calcine the raw-mix in the suitable kiln at suitable temperature. • The calcined mixture is properly ground in the mill	• Function of each ingredient in the stain composition • Differentiate the properties between coloring oxide and stain.
5	Liquid gold decoration & luster decoration on glaze ware like cups & saucers.	• Apply the gold luster/ luster decoration upon the glaze ware by suitable application technique i.e., painted or stenciled • A very thin metallic film is formed on the glaze surface. • Fire in muffle kiln	• Application of different luster upon the glaze ware • Composition used to preparation of luster
6	Application of transfer picture on white and colored glaze wall and floor tile	• Fit the required designed screen to the automatic/manually operated screen printing machine • Transfer the glaze paste onto the screen • The tile was passed under screen printing machine • While movement of the squeezer in machine the print was made upon the tile	• Know the making process of screens used for screen printing • Know the parameters maintained to the glaze paste.
7	Firing of above glaze articles.	• Set the glazed articles in the suitable kiln • Rise the temperature up to working point • Perform the cooling then take out the articles	• Maintain perfect working temperature • List out the defects arises in the firing • Measure the quality standards